Persistent traditions: a long-term perspective on communities in the process of Neolithisation in the Lower Rhine Area (5500-2500 cal BC)

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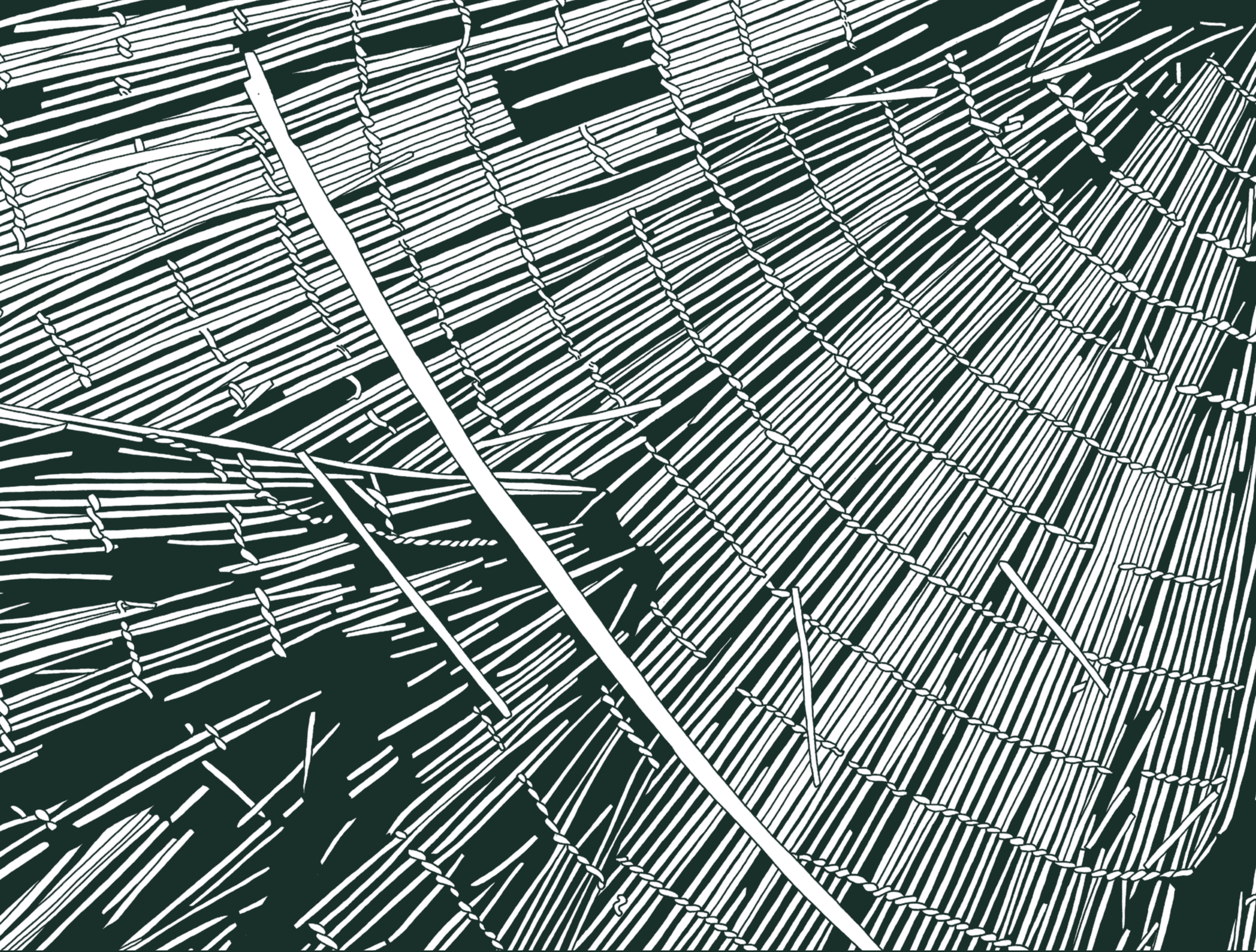
Title: Persistent traditions : a long-term perspective on communities in the process of Neolithisation in the Lower Rhine Area (5500-2500 cal BC)
Issue Date: 2013-12-19



L.W.S.W. Amkreutz

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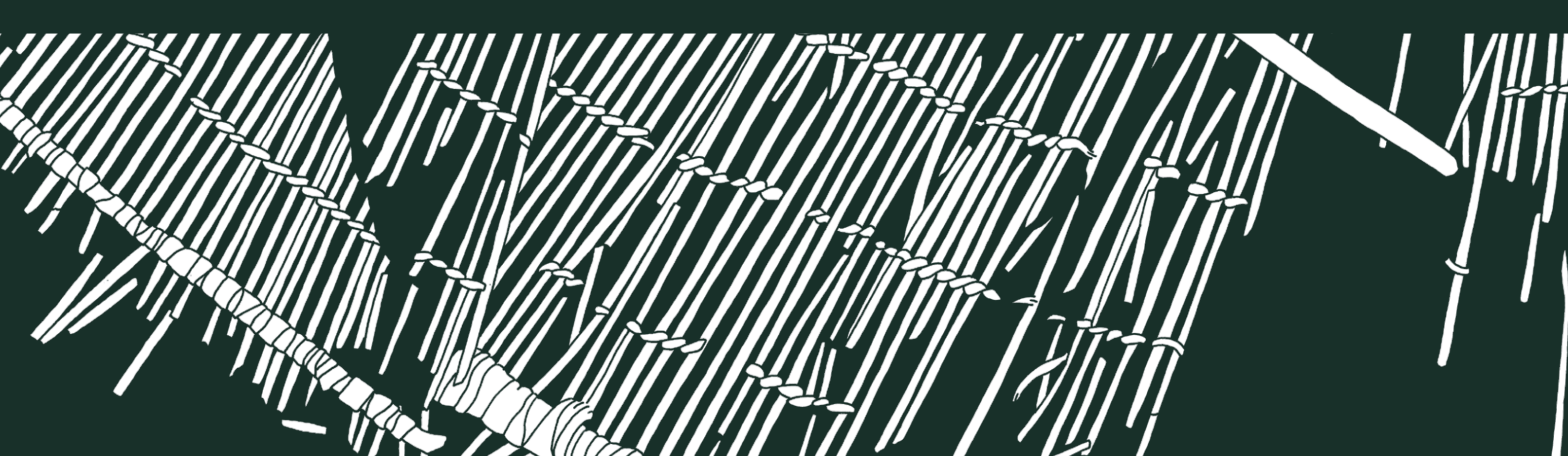

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Sidestone Press

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Proefschrift

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus Prof. mr. dr. C.J.J.M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op donderdag 19 december 2013
klokke 15.00 uur

door

Luc Winand Sophia Wilhelm Amkreutz

geboren te Heerlen, Nederland
In 1978

Promotiecommissie

Promotor:	Prof. dr. L.P. Louwe Kooijmans
Co-promotor:	Dr. D.R. Fontijn
Leden:	Prof. J.C. Barrett (the University of Sheffield)
	Prof. dr. A.L. van Gijn (Universiteit Leiden)
	Prof. dr. P. ter Keurs (Universiteit Leiden)

Published by Sidestone Press, Leiden
www.sidestone.com

ISBN 978-90-8890-203-1

Drawing cover: Bergschenhoek fish trap (Rijkmuseum van Oudheden/drawing Leo Verhart) and decoration bone awl Hardinxveld-Giessendam-De Bruin
Lay-out & Cover design: Sidestone Press

This book was sponsored by funding from:
Stichting Nederlands Museum voor Anthropologie en Praehistorie (SNMAP)
Stichting Rijksmuseum van Oudheden (RMO)

This research project was funded by the Dutch Organisation for Scientific Research (NWO)

‘So we beat on, boats against the current, borne back ceaselessly into the past.’

F. Scott Fitzgerald -The Great Gatsby- (1925)

‘Ah, but I was so much older then
I’m younger than that now’

Bob Dylan -My Back Pages- (1964)

Voor mijn (gravende) (voor)ouders

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Chapter 1

From Hardinxveld to Noordhoorn and beyond

1.1 Introduction

On the morning of November 7th 1997 the skeletal remains of an elderly woman were found at the waterlogged site of Hardinxveld-Giessendam Polderweg. The remains were dated to the Late Mesolithic (5738-5588 cal BC), making her the oldest known inhumation burial in the Netherlands at the time. The woman, affectionately named 'Trijntje', was buried on her back and had no burial gifts except for a few specks of ochre. At some distance from the elderly woman was a second, severely disturbed interment of an adult person and three dog burials, two of which were disturbed, as well as some 80 isolated finds of human bone. The evidence provided by the skeletal material indicated the former presence of men, women and children (Louwe Kooijmans 2001[a]; Smits/Louwe Kooijmans 2001).

The woman was likely a member of a small community inhabiting a Late Glacial dune or 'donk'. The donk must have been a focal point, a dry home for this community in a vast wetland consisting of lakes, watercourses and swamps. The faunal material at the site provides evidence of an extensive range of (subsistence) activities such as hunting, fishing, fowling and trapping, while botanical remains attested to gathering. This picture was complemented not only through lithic evidence, but especially through the recovery of artefacts of bone, antler and wood like axes, adzes, awls, chisels, sleeves, bows, paddle blades, and, at the nearby twin site of De Bruin, a fish-weir and a complete dug-out canoe. The unparalleled artefactual, faunal and botanical evidence as well as the formal burials and the considerable number of features, including the remains of sunken dwellings, argue for an interpretation of the site as a winter base camp for a group of hunter-gatherers. The artefacts also showed that the community was not an isolated band in a temperate wilderness, but was part of a larger community, with material contacts stretching to South-Limburg and the Ardennes and maintaining relations, either directly or indirectly, with the first farmers of the Bandkeramik culture (Louwe Kooijmans 2003).

Both Polderweg and nearby De Bruin yielded a wealth of information concerning these sites' use, the spectrum of activities carried out there and their wider social and cultural networks, thanks to the unique preservation conditions and the rich artefactual, structural and ecological remains. This enabled researchers in the Lower Rhine Area (LRA) to transcend for the first time the rather restricted record of this period predominantly made up of numerous flint scatters (see Deeben/Van Gijn 2005; Louwe Kooijmans 1993[b]; 2001[a]; Verhart 2000), and gain greater insight into the variety of Late Mesolithic life, allowing us to appreciate its distinct identity more fully. In a way, one could say these sites are the region's answer to such renowned sites as Starr Carr (Clark 1954) and Friesack 4 (Gramsch/Kloss 1989), as well as the rich Danish Mesolithic as a whole, which has been regularly held up as a role model for this region (Louwe Kooijmans 1999; 2001[a]; Verhart 2000).

From Hardinxveld to Noordhoorn

Of equal importance to the perspective both Hardinxveld sites offer regarding the Mesolithic communities in the LRA is their position in the process of Neolithisation. At Polderweg the intriguing discovery was made of an LBK-type arrowhead dating from phase 1, synchronous with, or predating, the earliest LBK occupation in southern Limburg and indicative of contacts with these early farming communities. Several centuries later, around 5000 cal BC, the first locally made pottery appears at the site, marking the start of the Swifterbant culture. Finally, the locality of De Bruin yielded the first evidence of animal husbandry by these communities, in the form of a limited number of bones of domestic animals – cattle, pig, sheep and goat – that were brought to the site (Louwe Kooijmans 2007[a], 296-297). These discoveries form important material and economic markers in the process of Neolithisation that allow the documentation of the early phase of the transition to agriculture in this area. Another such discovery was made nearby.

Almost six years later and 50 km to the west another skeleton was discovered, this time of an adult man. He was lying in a contracted position. In his right hand he held a grave gift: a piece of pyrite and three strike-a-lights. The grave was discovered during the excavation of the Middle Neolithic wetland site of Schipluiden-Noordhoorn and was part of a small burial ground, consisting of three graves and four individuals. The site was located on a slight elevation formed by a low dune and must have been one of the higher places in the surrounding vast salt marsh landscape. Due to comparable favourable find circumstances as at Hardinxveld, Schipluiden also yielded a lot of information about its habitation dated to approximately 3700 cal BC, and attributed to the Neolithic Hazendonk group. Some 4600 features were uncovered at the site, including postholes of numerous residential structures, wells, pits, hearthpits and an enclosing fence.

The people at Schipluiden, unlike their predecessors at Hardinxveld, herded cattle on the surrounding salt marsh as attested by the faunal remains. Botanical evidence also indicates the presence of locally grown cereals. The lithic material yielded many axe fragments and illustrates the wide range of existing contacts needed to acquire the variety of raw materials documented. Although hunting, fishing and gathering still constituted an important share of daily practice, as is attested by various artefacts such as bows and paddles as well as faunal remains and stable isotope analysis (Louwe Kooijmans 2006[a]; Smits/Van der Plicht 2009; Smits *et al.* 2010), these new practices formed distinct additions to the spectrum of activities. Because of the vast quantities of material unearthed at Schipluiden, it is a key site for understanding the development of the Neolithic in this region, as the evidence in its entirety indicates not only a distinct agricultural component, but also that the site was occupied permanently. Both agriculture and sedentism are perceived as important and oft-associated characteristics of Neolithic communities (*e.g.* Bogucki 1999; Rowley-Conwy 2004).

A paradox of change?

The introduction of these sites illustrates a development and accentuates a seeming contrast between both time frames and the communities involved, regarding the transition from hunter-gatherer societies to farmers in LRA.[1] In this respect the sites of Hardinxveld-Giessendam and Schipluiden-Noordhoorn belong to apparently very different stages in this process. The community at Hardinxveld formed a small band that seasonally inhabited a dune in a vast wetland area. These people were the heirs of communities that had been characterized by mobility and a hunter-gatherer mode of subsistence for millennia, eventually dating back to the reindeer hunters of the Magdalenian and Hamburgian age (Clark 1977; Deeben/Arts 2005; Gamble 1986[a,b]; Louwe Kooijmans 1993[a]). The members of the Schipluiden community, on the other hand, appear to have been part of something new; they tended herds of cattle, grew domesticated plants and their home was permanent and distinctly marked by a surrounding fence. This points to new cultural facets such as production, ownership, territory and the shaping of the land, that can be considered 'alien' to temperate post-glacial Europe. They ultimately largely derive from the by then roughly 6000-year-old Near-Eastern development of agriculture (Bogucki 1988, Louwe Kooijmans 1993[b]; 1998[b]; Thorpe 1996; Whittle 1999).[2]

However, as much as they belong to very different periods in time, both Hardinxveld and Noordhoorn are also essentially part of one and the same: a cultural succession of related indigenous communities caught up in a regional process of Neolithisation. As such the Hardinxveld band, as well as forming the last embers of a hunter-gatherer way of life, also stood on the threshold of something new, while Schipluiden-Noordhoorn in many ways forms a testimony to the way these new elements became incorporated.

1.2 Research aims: point of departure

The two key sites introduced above serve to indicate the position of this study in the wider debate on the Mesolithic and Neolithic and illustrate its main objective:

To better understand the process of Neolithisation in the Lower Rhine Area through a specification of the long-term socio-ideological characteristics of the indigenous communities involved.

The emphasis is on the continuity of the traditions of originally hunter-gatherer communities in the trajectory of introduction and incorporation of 'Neolithic' elements. It stresses the notion that the study of their relations with the very special and dynamic landscape they lived in may result in an increased understanding of their role in the period and process investigated. The position of this study in the debate on Neolithisation is, as such, in essence a native view on the offer of the new farming communities.

At the same time the importance of the developments taking place cannot be studied in isolation from the larger issue of the transition to agriculture, which ultimately classifies as one of the important steps in the history of mankind (see Chapter 2). For the studied area and period the most influential models of the past decades has been the in essence descriptive 'availability model' originally developed by Zvelebil and Rowley-Conwy (1984; also see Zvelebil 1986[a]; 1998[a]).

While the heuristic aspects of this model will be discussed in detail in Chapter 3, it serves as a point of departure here.

The availability model subdivides the transition to agriculture into three stages, termed availability, substitution and consolidation based on the relative contribution of domesticates and cultigens to the diet. This means that the economic shift from hunting and gathering to food production takes centre stage in the discussion on the transition to agriculture and is seen as the prime marker for the process of Neolithisation (see Zvelebil/Lillie 2000). However, a Neolithic way of life in essence comprises much more than an economic development. It potentially includes fundamental social changes and an altogether different world view.

Without denying the importance of this economic aspect, this study aims to demonstrate that an increased understanding of the process of Neolithisation in the LRA may ultimately derive from altogether different aspects of the communities involved, in particular those of a socio-ideological nature. These provide an additional, perspective to current models on the transition to agriculture in the LRA.

This study embraces archaeological as well as anthropological and theoretical approaches to underline the importance of non-economic aspects and to demonstrate the importance of the socio-ideological identity and associated practices of the communities involved in shaping the process of Neolithisation in this area. At the end of this thesis a number of general notions resulting from this approach will be presented in a reconsideration of the availability model.

Research context and perspective

The scope of this research covers the successive communities caught up in the indigenous process of Neolithisation in the Lower Rhine Area. Chronologically this involves the cultural succession of Late Mesolithic, Swifterbant culture, Hazendonk group and Vlaardingen culture between *c.* 5500 and 2500 cal BC. Geographically this roughly concerns the wetlands and wetland margin areas between the rivers Scheldt and Elbe.

The process of Neolithisation in this area can be characterized as a long-term and gradual incorporation of material elements, domesticates and cultigens, and at last the adoption of sedentism (*e.g.* Louwe Kooijmans 1998[a]; 2007[a]). Although interpretations regarding the time span of this transition differ (see Raemaekers 2003), its gradual nature remains undisputed and contrasts with contemporaneous developments in Scandinavia and Great Britain (see Hartz *et al.* 2007; Larsson 2007[c]; Rowley-Conwy 2004; see also Sørensen/Karg 2012). It also implies a different involvement of the indigenous communities living in the LRA (*e.g.* Raemaekers 1999, 191).

The general outline of the trajectory of Neolithisation in the LRA has, over the past two decades, developed into a robust framework, both through regular synthetic overviews and empirically based interpretations, as well as through the publication of new highly informative sites (*e.g.* Ten Anscher 2012; Koot *et al.* 2008; Louwe Kooijmans 1993[a,b]; 1998[a,b]; 2003; 2006[a]; 2007[a]; Out 2009; ; Peeters 2007; Raemaekers 1999; 2003; De Roever 2004; Vanmontfort 2007; Verhart 2000; 2012; also see below). At the same time much is still unknown regarding the introduction and adoption of these new Neolithic elements. This involves questions such as the actual economic contribution of domesticates and cultigens, the role of the communities on the coversand landscapes in between the wetlands and the (earlier) loess-based LBK occupation, and our limited information on some time trajectories, such as those between Hardinxveld and Swifterbant (4700-4400 cal BC) and before the Hazendonk group (4000-3700 cal BC; see also Vanmontfort 2007).

Despite these challenges, the goal of this thesis is not primarily to expand our documentation of these or similar characteristics of the transition to agriculture - at least not directly. Instead the aim of this study is to resolve our understanding of Neolithisation through a study of its regional repercussions. In other words the focus is on the indigenous communities involved, rather than the transition taking place and following from that; the emphasis is on persistency of tradition, rather than change and development; on people, rather than process.

An additional aspect of this study is that it is a literature-based synthesis, offering a limited potential for adding new data, but favouring compiling and reviewing. Primarily and essentially, however, it is a matter of perspective. It is precisely the focus on the characteristics, identity and role of the indigenous communities by which this study hopes to offer an alternative perspective to approaches focussing on trajectories of change and to contribute to a more balanced understanding of Neolithisation in this area.

Research questions

In adopting this approach a number of central research themes can be formulated. The main question focuses on the indigenous communities involved in the transition to agriculture in the study area. It concerns seeking a better understanding of how the characteristics of the successive groups between the Late Mesolithic and Vlaardingen culture may be defined over time and in relation to their landscape and environmental context. The research will then examine how the formulation of long-term common values, or in effect group identity or *mentalité*, may help define the role and position of these communities in the process of Neolithisation and, as such, their influence on the 'dimensions' of the transition to agriculture in this area. In relation to this three related central themes were defined.

- Mesolithic roots. The first theme deals with the Mesolithic roots of the communities involved. This is meant both in a chronological and a relational sense. The Late Mesolithic period comprises the communities preceding and experiencing the initial interaction with farming communities. Their diversity across the LRA meant an equally diverse 'substrate' for the Neolithisation process. The relational aspect focuses on the persistence of values and associated behaviour derived from the hunter-gatherer roots of these communities and the extent to which they influence the various processes of acculturation taking place (see Barnard 2007).

- Landscape and environment. The second theme examines the recursive interaction between communities and their (physical) environment. This includes both the landscape as substrate and its associated environmental dynamics as well as, in this case in particular, the relationship between the Late Mesolithic to Vlaardingen culture groups, present in the wetland and wetland margin landscape to these. From an interpretative perspective, this not only involves aspects of a measurable physical-ecological relationship, but essentially constitutes an attempt to define landscape perception (*cf.* Ingold 2000). It is therefore also a phenomenological approach.

- Neolithic axioms. The third theme questions and reinterprets the position of Neolithic markers and the contribution and role of material and economic aspects of the transition to agriculture in relation to the data available in the study area. This involves the extent to which current models of Neolithisation are supported by the archaeological record, how the incorporation of new Neolithic elements may be understood from an emic perspective and to what extent processes of change and incorporation of aspects of an agricultural existence altered the characteristics of the studied communities. This, importantly, is a theoretical discussion regarding stresses and emphases placed in discussing the broad topic of Neolithisation.

The three themes are not treated separately but recur repeatedly throughout this thesis. The underlying thrust of this study (see also Chapter 6), emphasises the relational qualities of community behaviour (and perception) and environment over time and in relation to both issues of identity and Neolithisation.

1.3 Research area and dataset

The study operates on two geographical levels. It deals with the process of Neolithisation in the Lower Rhine Area. This area may be defined as the western part of the North European plain bordered by the Belgian and German mountain ranges of the Ardennes and the Eifel respectively, and by the North Sea (see Chapter 3). It encompasses the loess soils in the southern part of the Netherlands and adjacent territory, characterized by the occupation of Neolithic Bandkeramik (LBK) farmers from 5300 cal BC, the coversand areas north of that and the wetland areas north and west of these. The emphasis in this study is on this latter part, in particular the wetland and wetland margin areas of the Western and Central Netherlands (the coastal, intracoastal and fluviatile region) which form a rough triangle with its apex in the eastern riverine area. Chronologically the study centres on the period between 6000 and 2500 cal BC, including the Late Mesolithic up to and including the Late Neolithic A period (*cf.* Van den Broeke *et al.* 2005).[3] The emphasis within the scope of this work, however, distinctly lies on the Late Mesolithic, Swifterbant culture, Hazendonk group and Vlaardingen culture communities. The contextualisation and implications of this must take shape within the wider framework of developments taking place during the transition to agriculture in the LRA and northwestern Europe in general.

Site-based perspective

A dataset has been created (Appendix I) with site descriptions with respect to the time frame and studied area. It comprises some 58 sites with relevant information, as well as 93 sites that provide some additional information. These sites form the backbone of the analysed data. As such, this study does not primarily take a landscape approach in the classical sense of a regional occupation history established through the reconstruction of detailed settlement systems, including sites and off-site phenomena (see Darvill 1997; Donahue 2006; Topping 1997). The available informative sites simply do not allow such a reconstruction in most areas. Instead the research perspective is primarily that of a comparative study of the long-term characteristics of sites in relation to the dynamics of landscape and environment, with the purpose of increasing our understanding of the characteristics of the communities involved. As such, an important part of this study aims to yield a perspective on the integrated and recursive relationship between communities and their surroundings. Such a people-place-perception perspective ties in with the theoretical relational approach of an archaeology of inhabitation mentioned above (also see Brück/Goodman 1999[a,b]; Casey 1996; Geertz 1996; Pollard 1999; Thomas 2000; 2001). This scope also entails that the range of archaeological proxies is wide, including material, economic and behavioural information.

The study is largely based on an analysis of the available literature. This self-evidently gives rise to shortcomings that mainly relate to the quality of the available publications and the associated excavations and importantly, different systems of recording. In particular 'old' research based on different standards, many preliminary publications and the standardised reports generated by recent commercial archaeology quantitatively form one end of the spectrum, while a limited number of other, site-based publications, also mostly deriving from CRM archaeology, form the opposite, highly qualitative, end. In spite of the difficulties in a comparative analysis, all evidence is needed for an understanding of the studied communities.

1.4 Structure and methodology: a road map

This research covers a long time period and a large area. A number of archaeological as well as theoretical elements contribute to the main research aim as discussed above and structure the argument along the way. Four different parts may be distinguished. In order to elucidate their role and position in this text a brief 'road map' is provided.

Part I: context and background

The first part situates this study in the context of the recent debate on the transition to agriculture and introduces the strengths and weaknesses of the Lower Rhine Area dataset for the period studied.

- Chapter 2 starts with an historical perspective of the wider Neolithisation debate and the position of this study.
- This is followed in Chapter 3 by a more detailed introduction regarding Neolithisation in the Lower Rhine Area, a qualification of several interpretative biases and a definition of the theoretical and analytical scope of this study
- Chapter 4 deals with the quantitative and qualitative aspects of the dataset in relation to geographical, taphonomic and methodological factors, including a reflection on the values of the qualitatively highly informative wetland dataset.

Part II: the Late Mesolithic prelude

The second part provides a context for the process of Neolithisation in the LRA and the role of the indigenous communities.

- Chapter 5 is directed at detecting differences and similarities in the occupation practices of the communities of the hunter-gatherer substrate, as the basis of hypotheses on their influences on the process of Neolithisation. For this purpose a varied set of topics, including settlement location choice and site structure as well as technological, typological and raw material characteristics of the lithic assemblages is examined in a comparative study of excavated Late Mesolithic sites from different geographical contexts.

Part III: the Neolithisation of the wetland communities

The third part focuses on the special case of the transformation of the indigenous wetland communities during the process of Neolithisation.

- As a first step Chapter 6 provides a theoretical basis for the relationship of these communities with and their perception of the environment.
- This phenomenological perspective is applied in Chapter 7 to the archaeological evidence. The focus is on the long-term characteristics of occupation and the choices made by the communities involved in relation to Neolithisation. This allows a reinterpretation of the way in which communities negotiated Neolithisation, an agricultural existence included.
- On that basis Chapter 8 at last offers a new view on the developments of the settlement system over time and a further specification of the very extended and gradual nature of the Neolithisation process among these communities with their - as is argued – specific wetland identity and *mentalité*.

Part IV: synthesis and concluding thoughts

The different elements studied in this thesis are combined in the final part.

- A synthesis is presented in Chapter 9. It recapitulates the main ideas presented and draws out aspects of long-term continuity in the community-environment relationship in light of the process of Neolithisation.
- Chapter 10 forms an epilogue and advances a reconsideration of the availability model from the perspective advocated in this study.

1.5 Background

This study is part of the research project 'The Malta Harvest: From Hardinxveld to Noordhoorn- from forager to farmer'. The project was funded by the Netherlands Organisation for Scientific Research (NWO) and situated at the Faculty of Archaeology, Leiden University. While this study focuses on the questions and implications of 'from forager to farmer', it importantly draws on 'from Hardinxveld to Noordhoorn' and the wider set of sites attributed to the Malta harvest. This finds its origins in the Malta Convention (1992), aimed at protecting European archaeological heritage and regulating excavation and research.[4] The preliminary implementation of the treaty in the Netherlands and its ratification (2011) eventuated in a partially commercial heritage and excavation framework and led to an increase in commercially tendered projects, both of small to moderate scale as well as a small number of high-quality, large-scale infrastructural projects.[5] As a result of this growing corpus of 'Malta sites', new data regarding the process of Neolithisation has come to light in a relatively brief period. The aim of this project is to synthesize these new results in relation to data yielded by sites excavated earlier and provide a new context for studying the period of the transition to agriculture in the Lower Rhine Area.

Notes

1 The terms hunter-gatherer and forager will be used indiscriminately in this study. However, the term forager probably does more justice to the societies in question because it is a more economic expression and does not suggest a prevailing importance of hunting (Lee 1968, 44). For a discussion on this subject, see *e.g.* Shott 1992, 864, note 1.

2 Most scholars agree that domesticates, crops as well as animals, must have been introduced to these communities by the successors of the Linear Bandkeramik Culture that arrived in the Lower Rhine Basin around 5350 BC and effectively established the first or 'primary' Neolithic in the region (Bogucki 1988; 2000; Louwe Kooijmans 2001[a]; Van de Velde/Bakels 2002) The 'primacy' of the Linear Bandkeramik Culture, *i.e.* being the first Neolithic culture in the region, is the topic of much debate. The role of the rather elusive La Hoguette and Limburg pottery is especially important in this respect. La Hoguette pottery might even predate the Bandkeramik occupation in the Lower Rhine Basin since it is not often found in association with it (Brounen/De Jong 1988; Van Berg 1990; Constantin 2002; Jeunesse 2001; Louwe Kooijmans 1993[a]; Modderman 1987; Raemaekers 1999, however, also see Brounen/Vromen 1990 and Brounen/Hauzeur 2010). Nevertheless the impact of the LBK arrival and the impetus it gave to setting in motion the process of Neolithisation can hardly be underestimated.

3 This involves the Late Mesolithic communities as well as contemporary and subsequent Neolithic cultures and groups. It includes both the LBK and its successors on the loess and coversands and the indigenous development of the Late Mesolithic in the wetland and wetland margin area north and west of these.

4 At the Malta Convention (1992) several European nations, including the Netherlands, signed the treaty of Valetta. This treaty regulates European archaeological heritage management and is based on the concept of *in-situ* preservation. If this is not possible the disturbing party in principle has to pay for excavation. Another spearhead of the treaty is to make archaeology a priority within town and country planning. The Dutch law-bill for implementing Malta was approved by the house of parliament in 2006) and was ratified in 2011.

5 Examples of large-scale projects are the Betuweroute and HSL-projects (railroad connections), the Maaswerken (flood-control and environment), several highways (for example the A27) as well as numerous smaller projects. For the period under consideration here several medium to large-scale excavations have taken place, such as A27-Hoge Vaart (Hogestijn/Peeters, 2001), Hardinxveld-Giessendam-Polderweg and De Bruin (Louwe Kooijmans 2001[a,b]), Wateringen IV (Raemaekers *et al.* 1997), Ypenburg (Koot *et al.* 2008), Urk-E4 (Peters/Peeters 2001) and Schipluiden-Harnaschpolder (Louwe Kooijmans 2006[a]). While the quantitative addition of new discoveries is tantalizing there are at least two fundamental qualitative aspects that should be mentioned. First of all Malta-inspired contractual archaeology mostly funds excavation and documentation of sites yet rarely any subsequent research. This means excavated sites end up in so-called 'standard-reports' mainly focusing on the documentary aspects of the excavation itself. In addition, these reports are often of variable quality, not in the least since their initial conception was not born out of research-questions. Secondly, in times when the market finds itself economically distressed, as it is presently, competition between the different commercial parties may lead to pricing in the tendering project that seriously undermines the quality of the work and consequently the safeguarding of our cultural heritage. As of yet the governmental and regulatory aspects of the commercial system lack the means to properly act upon this.

Chapter 2

Thoughts in transition – A European perspective

'…that revolution whereby man ceased to be purely parasitic and, with the adoption of agriculture and stock-raising, became a creator emancipated from the whims of his environment…' (Childe 1952 (1935), 1-2).

2.1 Introduction

As somewhat dramatically stated by V.G. Childe above, the transition to farming is regarded by most prehistorians as one of the pivotal events in the history and development of humanity worldwide (*e.g.* Binford 2002 (1983); Bar-Yosef 2004; Childe 1976 (1957); Hayden 1995; Louwe Kooijmans 1998[a]; Price 2000[a]; Whittle/Cummings 2007). This almost unanimous concordance, however, contrasts strikingly with the multitude of opinions voiced concerning the processes that govern this transition, its spread and its implications. Although much of the debate has focused on the actual centres of domestication, there now also exists a vast body of literature on the transition to agriculture and the spread of farming *ex situ*. Europe generally is not regarded as an original centre of domestication, as most of the wild predecessors characterising the European Neolithic originated in the Near East. There is both ample evidence and chronological control as well as a constellation of circumstances (Uerpmann 1996, 232) pointing to an early local development (*e.g.* Ammerman 2003; Bar-Yosef/Belfer-Cohen 1989; 1992; Garrard *et al.* 1996; Thomas 1996[a]; Watson 1995).[1,2] Independent domestication in Europe can be largely ruled out and that leaves us with two main options for explaining the spread of agriculture: migration or local adoption. This study aims to contribute to an understanding of the transition to agriculture in the Lower Rhine Area (LRA), but should do so within the interpretative context of the process of Neolithisation on a European scale. Therefore, this chapter presents the main theoretical aspects and developments of this debate in order to create a European context for discussion. The following chapter will subsequently narrow the scope to the LRA.

2.2 The mechanics of spread

The academic debate concerning whether the dispersal of agriculture over Europe was mainly brought about by the migration of colonist-farmers originating from the Near East or through the adoption of (elements of) a 'Neolithic package' by an indigenous Mesolithic population is far from settled, yet there seems to be consensus concerning some aspects.[3] It is evident that both processes occurred and operating simultaneously more often than separately (*e.g.* Price 2000[c]; Louwe Kooijmans 1998[b]). The relevance or dominance of either mode within a certain region, however, remains subject to debate.

Mediterranean perspectives

There are a few strong cases for colonization in Southern and Southeastern Europe such as the Aegean islands (Price 2000[c]) and Thessaly (Halstead 1996), which boast substantial evidence such as archaeobotanical (Colledge *et al.* 2004) and craniometric data (Pinhasi/Pluciennik 2004). Yet even there the situation is far more complex than previously assumed. A good example is Franchti cave in Greece, one of the few positively identified Mesolithic sites, where the transition to agriculture around 7000 BC was very rapid, while at the same time yielding convincing evidence for indigenous adoption (Halstead 1996, 299-300; Thorpe 1996, 23). Later in time and further west, another example is formed by the Cardial or Impressed Ware culture indicative of the westward spread of the Neolithic along the various coasts of the Mediterranean. Long deemed a classical example of colonization (Childe 1958, 47-49; *cf.* Price 2000[a]), there has been increasing evidence over the years that the picture is much more complex (*e.g.* Rowley-Conwy 1995, 346-347). Some of the evidence points to colonist bridgeheads, sedentism and farmer enclaves in Italy, Southern France and the Iberian peninsula (*e.g.* Barker 1985, 71; Binder 2000, 117; Harris 1996, 560; Zilhão 2000, 171). On the other hand there is evidence for internal adoption, or acculturation, as was proposed by Lewthwaite (1986) and Donahue (1992) (*e.g.* Geddes 1985). Whittle (1999, 291) even speaks of 'the sea-borne transmission of contacts, ideas and resources' as the 'primary means of change'. This is backed up by sites bearing evidence of a gradual change, such as the 7th millennium BC Grotta dell' Uzzo in Sicily or the Aude valley sites in Southern France.[4] There seem to be ample indications that both processes were operating in the region, perhaps even contemporaneously. Most scholars agree however that the untangling of these processes is severely hampered by differential preservation of sites. The submersion of presumed coastal sites with indications for contact and change, for example, places too much emphasis on the evidence from caves and rockshelters, spectacular dates often lack a good context, the allocation of finds and features to certain periods is questionable and there is limited knowledge on the Mesolithic occupation (Barnett 2000; Binder 2000; Lewthwaite 1986; Price 2000[a]; Tarrus *et al.* 1994; Whittle 1999; Zilhão 2000). Tringham (2000[a], 33) notes that the awareness of these kinds of problems and the general ambiguity of the data, have led to a reduction in speed, distance of movement and scale in modeling colonization, emphasizing social pressures and the social complexity of fissioning settlements.

Into Central Europe

This reduction also affects one of the other strongholds of colonization, the LBK-culture. The apparent homogeneity in material culture and settlement system of the LBK combined with a rapid spread over vast expanses of land still convinces many scholars of its migratory nature. Yet most agree that it was not as unilinear and evident as previously thought (*e.g.* Gronenborn 1998; Kind 1998; Louwe Kooijmans 1998[b]; Lüning (ed.) 1972; Modderman 1988; Price *et al.* 1995; Zvelebil 2004[a]). The origins of the LBK-culture lie in the northwestern part of the Hungarian plain, where there are strong affiliations with the Starčevo-Körös complex (Bogucki/Grygiel 1993). It is, however, very unlikely that population growth of the pioneering groups and an open settlement system alone could have been responsible for the subsequent swift spread of the *Älteste* LBK up to Niedersachsen and Hessen (Louwe Kooijmans 1998[b]; Whittle 1999).[5] These doubts are confirmed by the heterogeneous appearance of assemblages and exchange patterns, implying intensive Mesolithic contact and already existent networks (Gronenborn 1994, 146; 1998; 1999; 2003[a]; Zvelebil 2004[a]) or, according to Tillman (1993), even possible Late Mesolithic origins. Mesolithic influence further north is suggested by the appearance of LBK-like arrowheads in Late Mesolithic assemblages (see Gronenborn 1998; Huyge/ Vermeersch 1982; Louwe Kooijmans 1998[b])[6] and the conspicuous lateralisation of both trapezes and LBK points as demonstrated by Löhr (1994; also see Gehlen 2006; Robinson 2008; 2010). Increasing regionalisation, visible for example in pottery decoration, (*e.g.* Modderman 1988) could also be ascribed to increasing indigenous influence. Metrical (Modderman 1988) and strontium-isotope analysis (Bentley 2007; Price *et al.* 2001; 2006) of Bandkeramik skeletal material indicate both strong regional differences and a very plausible Mesolithic influx within LBK-society. The occurrence of Limburg pottery and La Hoguette and *Begleitkeramik*-ware add to the existing complexity and the academic debate concerning both phenomena and their relationship to the LBK remains far from settled (*e.g.* Van Berg 1990; Brounen/Hauzeur 2010; Constantin 2002; Gronenborn 1994; Jeunesse 2001; Lüning *et al.* 1989; Manen/Mazurié de Keroualin 2003; Modderman 1981). One might, however, conclude that they at least represent, in either pure or acculturated form, the material legacy of a Late Mesolithic or, in the case of La Hoguette, early Neolithic substratum (Gronenborn 2004, 15; Jeunesse 2003, 102).[7] Their appearance at LBK sites at least indicates contact and interaction going on. The various strands of evidence taken together convincingly attest to a difficult to determine, yet distinct role for the Late Mesolithic population in the spread and settlement of LBK communities (also see Vanmontfort 2008[a]). In this light it is understandable that Whittle (1999) opts for an indigenous origin and mobile settlement system for the entire Bandkeramik, effectively reviving the debate on '*Wandernbauerntum*' (see for instance Childe 1958; Soudsky 1962; Modderman 1970; Bakels 1982). Yet although the evidence for (partial) indigenous acculturation is substantial, the indications arguing in favour of colonization are at least equally convincing; the absence of a fully Neolithic substrate with local domesticates, the differences in stone tools, pottery and house forms, as well as the rapidity and simultaneity of the numerous changes (Bogucki/Grygiel 1993; Jochim 2000), cannot but signal the significant 'intrusive' character of the LBK, especially from the *Ältere* LBK onwards (*e.g.* Gronenborn 1999).

On the North European Plain

Further north the Neolithic dispersal came to a more or less complete stop along the southern margin of the North European Plain (Bogucki 1999, 179). North of this imaginary frontier there is tangible evidence of a rather substantial Late Mesolithic population that held off agriculture for a considerable timespan. They only gradually incorporated various Neolithic elements, while to a great extent holding on to a foraging way of life, effectively turning into 'hybrid' communities (*e.g.* Louwe Kooijmans 1987; Price 2000[b,c]; Price/Gebauer 1992; Raemaekers 1999; Zvelebil/Rowley-Conwy 1984). Theoretically, peaceful coexistence, hostility or avoidance are the possible options in these contact situations (*e.g.* Golitko/ Keeley 2007; Jochim 2000; Price *et al.* 1995; Keeley 1992) and often there is a difference between the initial contact (first stage) and subsequent (second stage) relations (Verhart 2000). Although these stages in contact situations are hard to detect archaeologically, the North European Plain (including the LRA), and to some extent Scandinavia and the British Isles, remain an ideal 'stage' to study the process of Neolithisation and the different 'frontier-situations' (see Dennell 1985; Zvelebil 1996; 2000; 2001). This is both because of the long time-span involved, due to the static frontier, and the availability of high-quality (often wetland) sites (see Chapters 3 and 4).[8] As such the emphasis is much less on whether colonization or adoption was the dominant process involved, but more on the character and temporalities of the incorporation of Neolithic elements. This does not mean that colonization or demic diffusion should be entirely absent from the debate (*contra* Whittle 1999). People did not always stay in one place and the simultaneous occurrence of various Neolithic and transitional societies leaves room for intrusive or demic arguments, be it on a somewhat smaller scale.[9]

The transition to agriculture in Europe was differentiated according to region and time frame (*cf.* Tringham 2000[a]). This realization and the fact that even the cases of colonization previously deemed clear-cut are hardly uncontested, has put an end to the polarization of the debate on the mechanics behind dispersal and the search for a monolithic process (see Gkiasta *et al.* 2003). The presence of a Late-Mesolithic hunter-gatherer population indicates that there will always have been an interplay between external and indigenous processes. Unfortunately the uneven distribution and archaeological 'invisibility' of this indigenous population is a major deficit in our current knowledge. Both colonization and internal adoption retain value as conceptual frameworks but future research must look for arguments to better distinguish between the movement of people, objects and ideas.[10]

2.3 In search of causality

The discussion above mainly deals with questions of where, how and when agriculture spread. The answer to the question *why* it spread, the search for causality, remains elusive. The past century has seen different important paradigmatic approaches to the problem accentuating the debate and shaping our knowledge. In order to understand the current situation, its deficiencies and the perspective of this study, a brief historic outline will be sketched.

Early models

The earliest explanations for the transition to agriculture were evolutionistic. Agriculture was a self-evident superior lifestyle that would be unhesitatingly picked up by hunter-gatherers confronted with it. This notion sprang from Darwin's ideas on the matter (1875) advocating knowledge as the crucial factor. Ecologically favourable circumstances in combination with knowledge, or culturally 'ready' communities (Thorpe 1996; Zvelebil 1986[a]), would inevitably lead to agriculture. Several models adopting this point of view were established for the Near East (*e.g.* Pumpelly 1908; Childe 1928; Braidwood 1960; Watson 1995). Farming populations would subsequently colonize new territories, assimilating or driving away the hunter-gatherers present. These ideas neatly echoed the existing culture-historical views on prehistory in Europe (see for example Childe 1958; Clark

1936), corroborating the supposed evolutionary gap between the Mesolithic and the Neolithic and making the latter a logical choice (Childe 1928; Daniel 1975; Dennell 1985; Pluciennik 1998). The spread of the LBK across Europe must have seemed illustrative in this respect.

Man the Hunter and New Archaeology

Anthropological opinion changed in the 1960s (Bender/Morris 1991; David/Kramer 2001; Shott 1992), with archaeology following suit. Fundamental in this regard was the publication of the 'Man the Hunter' conference proceedings (Lee/DeVore 1968). Foraging was no longer envisaged as an inferior unattractive subsistence strategy (see Dennell 1985). Hunter-gatherers had a good standard of living, expending remarkably little time and energy on subsistence compared to farmers (*e.g.* Lee 1968, 43; Woodburn 1968, 52-55).[11] Although hardly objective in itself (Price 1991), this new view effectively changed the perspective of the search for causality. Superiority no longer sufficed as an explanation and other motivations had to be found.[12]

With the onset of the 'New Archaeology', archaeological thinking in general changed. The approach to archaeology became more 'scientific', processual models were used and these had to be tested against verifiable data. Clarke, in his influential work 'Analytical Archaeology' (1978 (1968)), presented human society or culture as a system with subsystems. These sociocultural subsystems were themselves operating in an environmental system and striving to maintain a certain equilibrium in reaction to negative and positive feedback (1978 (1968), 47-52). Since homeostasis is the crucial element of these systems (Madsen 1986, 230), theories concerning the transition to agriculture now focused on univocal causes, such as population growth, resource imbalance and climatic change (feedback), emphasizing stress, rather than deliberate choice, as a motivation for the shift to farming (new equilibrium; *e.g.* Ammerman/Cavalli-Sforza 1971; Bar-Yosef/Belfer-Cohen 1992; Binford 1968; Harris 1990; Rowley-Conwy 1984).[13] An archetypical example of these 'push and pull' models (Bogucki 1999, 187-188; Harris 2003, 48) is Ammerman and Cavalli-Sforza's 'wave of advance model', based upon population biology (1971, 1973, 2003).[14] They explained the spread of agriculture, indicated by numerous ^{14}C dates, as the result of demic diffusion through the combination of an increase in population combined with a modest migratory activity. This would have set off a 'wave of advance' spreading out at a constant radial rate of 1 km per year from the Near East across Europe. In a later article (1973) the spread was also linked to the genetic variation in European populations.[15] Another example is Binford's 'packing model' (1968; 2002(1983)) whereby population growth acts as a trigger, restricting hunter-gatherer mobility and forcing them to focus on smaller animals and plants, eventually leading to a demand for an intensive production system. Climatic change and aquatic resources are important in the patterning of these processes (Binford 1999, 29-31).

During the 1980s dissatisfaction with single-causal stress models grew, mainly because of the difficulties in correlating population growth and climate change, or stress, to cultural change (see Bogucki 1999; Price 2000[c]). Attention now focused on the interplay of several factors in multi-causal models. At the same time the academic pendulum swung away from external factors altogether (*e.g.* Halstead 1996; Price 2000[c]; Thorpe 1996). Price, for example, (2000[c], 310) argues that it seems that forces such as climate, environment and population growth were not primary causes of the transition to agriculture. Main arguments are that in many areas of Mesolithic habitation food resources were abundant and productive, especially in coastal and riverine zones. This abundance was not significantly reduced by environmental changes (because agriculture spread over long distances despite diverse environments within the short span of 3000 years) and thus could not form an incentive for the transition. Furthermore population numbers never seem to have been substantial (Price 1987).

Postprocessualism and indigenist perspectives

In the light of postprocessualism, the search for causality focused inward, regarding the processes, decisions and relations of hunter-gatherers as crucial in bringing about the transition to agriculture as well as in understanding the process of Neolithisation. The emphasis of the so-called internalist or indigenist approach (*e.g.* Ammerman 2003; Raemaekers 1999) is on the social and/or ideological structures of past societies and the way these instigate, shape and enshrine the process of Neolithisation (*e.g.* Edmonds 1999; Hodder 1990; Ingold 1996; Jennbert 1988, Price 2003; Thomas 1999; Tilley 1996).[16] One of the first to propose a social perspective was Bender (1978). According to her the commitment to agriculture was brought about by changing social relations, therefore we should question what brought about increased production and why these demands were made on the economy (1978, 204-206). Bender (1978, 214) further points out that social competition provides the major incentive for surplus production, ultimately leading to development in the productive forces and often involving technological change. Hayden (1990; 1995) explicitly draws these ideas into the arena of 'Big Men' and competitive feasting. He argues that the first domesticates exclusively appear in societies of resource abundant complex hunter-gatherers. Competitive individuals accumulating wealth could have stimulated the domestication of plants and animals in order to enhance their quest for power. These social and socio-competitive models have also been proposed in relation to the spread of agriculture across Europe (*e.g.* Dennell 1985; Price/Gebauer 1992; Verhart 2000; Zvelebil 1998[a,b]). Raemaekers (1999, 14 and 188-190) states that these models approach the transition to farming out of a state of 'social disequilibrium', where competition acts as a trigger for the adoption of domesticates. Echoing Madsen (1986) and Tilley (1996) and their interpretation of the social structure of Ertebølle communities, Raemaekers argues for a rather conservative subpopulation (of in this case Swifterbant-communities) preventing the full-scale adoption of agriculture. These opposing views of the competition models, requiring group consensus for societal change, are termed 'primitive communism' (*cf.* Tilley 1996, 68-69).[17]

Ideological approaches

Another postprocessual approach to the transition to agriculture is of an ideological nature, focusing on the symbolic and structural aspects of societies (*e.g.* Hodder 1990;1998; Tilley 1996; Thomas 1999; Whittle 1999). In his 'The domestication of Europe', Hodder (1990) clearly argues that the economic domestication of both plants and animals was secondary to the social domestication of the communities involved. According to Hodder the impact of the transition to agriculture implied a restructuring of worldview or *mentalité* in order to be able to cope with the consequences of Neolithisation. The taming of the wild (*agrios*), took place within the concept of the *domus* (meaning as much as home in its broadest sense), which provided a way of thinking about this control and about the greater oppositions between culture and nature, social and unsocial.[18] Through the *domus* the origins of agriculture were conceived of and symbolic control of the wild took place. This means that the *domus* was a conceptual and practical mechanism for social as well as economic transformation (Hodder 1990, 28-43; also see Chapter 6).[19] Thomas (1997;1999) elaborates on the ideological approach by suggesting that for Atlantic Europe the actual economic transition was preceded by the adoption of cultural traits and accompanying beliefs such as pottery and monumentalism, transforming society and creating new worlds of meaning (*ibid.*, 14-17, 223, 229). Whittle (1999) argues that the in his eyes mainly indigenous transition from Mesolithic to Neolithic in Europe was less about technological-economic factors, but much more about the ideas and values guiding and framing peoples activities within the world (Whittle 1999, 370-371).

The postprocessual approach has emphasized the fact that there are more aspects to the process of Neolithisation than a mere change in subsistence. The prerogative of the 'walking stomach' has therefore rightly made way for social and ideological approaches emphasizing both the importance of the context of our data as well as the importance of the agencies structuring it. In the current postmodernist era these theories now often prevail in interpreting archaeological data, yet it is questionable whether they are as suited to enhancing our knowledge and understanding of the transition to agriculture, as they are to enhancing our scope on it. There is need for a more integrated approach incorporating data from a regional perspective.

2.4 Back to Basics?

In assessing several contributions to the debate on the transition to farming Madsen stated: *'It is symptomatic for many of the newer contributions that they base themselves to a wide extent on theoretical considerations, and make little or no reference to the archaeological record…Ideally a concern with the transition from Mesolithic to Neolithic, and an attempt to explain this transition, should base itself on both the Late Mesolithic and the Early Neolithic record, and these should be carefully compared in the light of what we know of the nature of the transition itself'* (1986, 231). Apparently not much heed has been payed to Madsen's statement, for in the following two decades the archaeological debate surrounding the process of Neolithisation in Northwestern Europe has, in the wake of the shifting Anglo-Saxon frontline of theory, succeeded in placing ever more emphasis on the social and ideological aspects of the transition (*cf. supra*). This has led to a steady drift away from archaeological data and as such, inevitably, from reality. Rowley-Conwy's 2004 article 'How the West Was Lost' is a critical appraisal of current archaeological discourse on the subject and a reconsideration of the agricultural origins of Britain, Ireland and Southern Scandinavia. Although geographically limited, Rowley-Conwy's plea for a new understanding of Northwestern Europe's Neolithic has definite repercussions that also affect the continental parts of the region, including the LRA. His main argument is built around the decoupling of ideology and subsistence that has taken place within postprocessual archaeology. Subsistence is no longer seen as fundamental in effecting change and, unlike material culture, is portrayed as only evolving at a slow pace. This subsequently led to the notion that the rapid change in material culture and the beginnings of monument building marking both the advent of the 4th millennium as well as the Neolithic in Britain and Scandinavia must have sprung from a change in ideology (see Thomas 1999, fig. 2.1).

From this consensus three axioms have arisen (Rowley-Conwy 2004, 84). The first supposes an intensifying Mesolithic predisposed to agriculture. The second suggests the existence of a 'foraging' Neolithic after the change in ideology and the third as a result envisages a supposedly slow economic transformation, implying a rather seamless and gradual transition to agriculture. It is, however, demonstrated by Rowley-Conwy that there is no solid ethnographic or archaeological proof for either an intensifying Mesolithic, or a Neolithic subsistence economy based mainly on foraging (also see Rowley-Conwy 2001). The scarcity of domesticated plants for example has led to their contextualisation as ritual instead of relating this to biases in preservation. Houses have generally been missed during excavations because they were not searched for due to unfamiliarity with the concept and domestic faunal remains at settlements have been underemphasized compared to assemblages from monuments.[20,21] The origin of these thought-constructs lies mainly in taphonomical and preservation biases influencing both research tradition as well as theoretical development. This means that the supposedly slow, gradual and seamless transition to agriculture did not exist in Great Britain and Scandinavia. The process of Neolithisation there was rather disruptive and sudden involving sedentism, domesticated grains, livestock and agricultural fields in small clearings (Rowley-Conwy 2004, 93-96). A rapid transition to agriculture early in the Neolithic is further backed up by stable isotope analysis, which indicates an abrupt shift to a predominantly terrestrial diet even on the coast (*cf.* Richards/Schulting 2006[a,b]; Richards *et al.* 2003[c], 366; Schulting/Richards 2002[a,b]).[22] The deconstruction of the three axioms thus forms an argumented reply to the current consensus of decoupling ideology and subsistence economy and represents a plea for the reintroduction of domesticity to the debate.

Towards a combined approach

The above-mentioned discussion has certain implications for research on the process of Neolithisation in the LRA and as such forms an incentive for this study. One of the first issues raised is the current focus on social and ideological motivations for adopting agriculture within a particularly postprocessual and indigenist framework (*cf. supra*). Apart from Rowley-Conwy (2004) other authors have also warned against the various pitfalls surrounding social and ideological explanations since as early as the 1980s (see Binford 2002(1983), 17; Bintliff 1993, 92-95; Madsen 1986, 231; Shanks/Tilley 1989, 1-6; Shennan 1987, 378; Schulting 1996, 347). Yet current research more often than not is characterized by a remarkable aversion to so-called external factors such as climate, population growth and environmental changes. According to Price (2000[c], 311), causality should even be sought elsewhere. This has led to the awkward situation whereby the transition to agriculture, which is still importantly a change in subsistence-mode, has increasingly been explained as predominantly a social and ideological transformation initiated by the susceptibility of the present hunter-gatherers. Recently there has been a move away from this internalist premise (*e.g.* Ammerman 2003; Binford 1999; 2001; Bogucki 2003[a,b]; Bonsall *et al.* 2002; Gkiasta *et al.* 2003; Gronenborn 2004, Kalis *et al.* 2003; Layton 1999; McDermott *et al.* 2002;

Stager/Mayewski 1997;Strien/Gronenborn 2005; Richards 2003) and Rowley-Conwy's reappraisal of domesticity and subsistence-economy is an attempt to redress the balance in the search for causality.

There is however a danger of overstretching the argument. For instance, recent climatic arguments have (again) rather easily been adopted and endowed with complete explanatory value. It should be acknowledged that the past 20 years of contextual archaeology have provided a valuable contribution to understanding the various aspects of the process of Neolithisation (see Jones 2004, in reply to Rowley-Conwy 2004). It has demonstrated that while the transition to agriculture may be characterized by a change in subsistence mode, the process of Neolithisation is a much more diffuse process, incorporating many aspects of society in spatio-temporally different constellations. To ignore this draws the academic debate on the adoption of agriculture back into a polemic between the classical (Cartesian) opposites of nature and culture.[23] There is thus a need for studies seeking to combine internalist and externalist explications or at least address their applicability to certain situations without ruling them out beforehand (see Arias 2004, in reply to Rowley-Conwy 2004, 100; Barrett 2005; Gkiasta *et al.* 2003; Gronenborn 2004, 24; Harris 2003, 52; Pinhasi/Pluciennik 2004, 74). However, and this brings us to another issue, research concerning the transition to agriculture also needs to re-establish a firm foundation rooted in reliable archaeological data.

Rowley-Conwy's article gives clear examples of the deficiencies of so-called *post hoc* accommodative argumentation (*cf.* Binford 2002(1983), 17). Archaeological data is interpreted in the light of preconceived notions of past motivations for adopting (parts of) the agricultural package. This has led to an increasing detachment from the archaeological record, sometimes resulting in rather narrative accounts (*e.g.* Edmonds 1999). To bridge this inferential gap there is a need for bottom-up research within a geographically coherent context, incorporating new theory without ignoring the limitations and patterning in the data.

2.5 Defining scope

The process of Neolithisation has been aptly described as a mosaic (Tringham 2000[a], 53-54). There is no singular explanation or motivation for either the spread of farming or its adoption, certainly not on a European scale. Thomas (1996[a], 311-312) stresses the different temporalities of various aspects of 'the Neolithic', indicating that its appearance was anything but a homogeneous and synchronous event. This is further elaborated upon by Price (2000[c], 306), echoing Gould and Eldredge's model of punctuated equilibrium (1993) when he states that the spread of agriculture is marked by series of rapid expansions followed by long periods of stasis, fits and starts. Various authors (*e.g.* Gould 1999; Layton 1999; Sherratt 1996; Simmons 1999) have also introduced the concept of contingency to the debate, questioning whether the constellation of circumstances leading to the adoption of agriculture is really that logical and structural. It may therefore be concluded that the process of Neolithisation is heterogeneous, discontinuous and to a significant extent dependent on specific spatially and temporally defined conditions. From this two implications arise, fundamental to this study. Firstly, research should take place within a geographically and culturally meaningful region.[24] This implies an abstinence from nomothetic explanations and a cautious use of archaeological data from outside the regional framework in order to be able to appreciate the unique historiography within the area of research.[25] Following this, theoretical modelling regarding these developments in Neolithisation within these regions should take into account both the position and background of the population living there as well as incorporate the natural and dynamic characteristics of the region itself and seek out the relationship between the two. Second, it demands a 'test-of-mettle' of the inferential power and constraints of the archaeological record within the area of research in order to provide a useful database to study the transition to agriculture. While the former implication forms the main theme in Chapters 5-8, the latter brings us back to Rowley-Conwy's plea (2004, 88-90) for the re-introduction of 'middle-range theory' (*cf.* Binford 1977; 2002(1983)) to the debate. To arrive at an empirically sound database for studying the transition to agriculture, there is a need for a taphonomical reconsideration of the archaeological record, especially of its most informative component, the site. This topic will be investigated in Chapter 4. First though, the following chapter will provide a more detailed archaeological background for these issues, focusing on the LRA itself.

Notes

1 Most scholars agree upon external cultivation of emmer wheat, oats, einkorn and barley and the introduction of sheep and goat (Thorpe 1996, 22). Cattle and pigs were already present in Europe but most claims for local domestication can be refuted (see Bogucki 1999, 177; Rowley-Conwy 2003).

2 There have been some studies claiming that a local domestication could have taken place within Europe (*e.g.* Barker 1985; Dennell 1983). Barker (1985, 252) argues, although he admits the uncertain context of some of his data, that the natural distributions of the wild prototype-domesticates could have been present in Southern Europe, implying internal domestication. Apart from the fact that this fails to explain the spread of farming further north, few of the early dates for local domesticates appeared to remain tenable after AMS-dating (Ammerman 2003, 5). Recent investigations of cattle DNA also indicate a non-local origin (Bollongino/Burger 2007). Less controversial in this respect is the evidence for the intensive relationship between hunter-gatherers and wild resources, even to the level of manipulation and control (Bogucki 1999; Price/ Brown 1985; Zvelebil 1994).

3 The concept of the 'Neolithic package' is a rather problematic one since, first and foremost, there is an ongoing debate concerning what traits can be regarded as unambiguously Neolithic. Second, the existence and spread of a coherent and integrated set of traits, 'a package deal', remains far from undisputed (*e.g.* Bogucki 1987; Czerniak 1998; Price 2000[a]; Thomas 1996[a]).

4 The early dates claimed for several Southern French and Spanish sites such as Chateauneuf-les-Martiques, Grotte Gazel, l'Abri Jean Cros or Dehesilla are untenable in the light of their problematic dating (see Barnett 2000; Donahue 1992; Whittle 1999). The start of the Impressed Ware complex in Southern France and Spain shortly after 6000 BC is now agreed upon by most scholars (Whittle 1999, 301).

5 The oldest phase of LBK spread is termed *Älteste* or Krumlov LBK. It correlates with Modderman's phase Ia and can be dated to 5500-5300 BC. Around 5300 BC the LBK, now termed *Ältere* LBK or Flomborn, spread into Northwestern Europe (Modderman's phase Ib-d). This was followed by a spread of the *Jüngere* LBK (Modderman's phase IIa-d) into Hainault and the Paris Basin ending in the *Rubané Récent du Bassin Parisien* (RRBP) (Bogucki 1988; Louwe Kooijmans 1976[b]; Lüning *et al.* 1989; Modderman 1970).

6 Newell (1970[a,b]) tried to assess the affinities existing between Bandkeramik and Late Mesolithic (Younger Oldesloe) flint assemblages. He concluded that the latter influenced the former up to the level of cultural re-orientation. Louwe Kooijmans (1976[b], 235-236) convincingly argued that any existing influence would have been far more subtle.

7 The assertion that La Hoguette or Limburg ware could be special-purpose pottery made by LBK potters can largely be refuted on account of stylistic links, occurrence independently of LBK sites and geographical distribution (*e.g.* Constantin 1985; Lüning *et al.*1989; Raemaekers 1999).

8 The contribution of wetland sites is especially relevant with respect to the LRA and adjacent North European Plain wetlands as well as Mesolithic Southern Scandinavia. For the British Isles wetlands seem more of a localized phenomenon (*e.g.* the Fenlands, Starr Carr and surroundings etc.).

9 Subsequent post-LBK cultures such as the Michelsberg culture (MK), and the TRB culture (Trichterbecherkultur or Funnel Beaker) partially appear to have been the result of prolonged meso-neo interaction (*e.g.* Bogucki 1987; Louwe Kooijmans 1993[b]; Midgley 1992; Raemaekers 1999; Vanmontfort 2004; Verhart 2000; Thomas 1999; Wansleeben/Verhart 1990; Zvelebil 1998[b]). Thomas, reflecting on the differences between LBK and MK, even speaks of a Mesolithisation of Central Europe (1996[a], 320). Both interaction as well as population mobility seem to have been factors in their development.

10 Recent research focusing on strontium isotope evidence as well as DNA patterns is providing new data with respect to these questions (*e.g.* Bentley 2007; Bentley *et al.* 2003; Haak *et al.* 2005; Price *et al.* 2001; 2006; Smits *et al.* 2010). However, difficulties regarding provenance, contamination, limited availability of good sampling material and multiple interpretations still limit the power of these new methods.

11 The different perspective on hunter-gatherer societies entailed a new bias, namely that of the Original Affluent Society (OAS), a term first coined by Sahlins (1968, 83). The groups of hunter-gatherers and their way of life were now idealized, characterising the transition to farming as a 'forced' reaction to stress (Raemaekers 1999, 13; Thorpe 1996, 5). Later on another bias sprang from the apparent hunter-gatherer variability. OAS foragers were contrasted with complex foragers, suggesting an evolutionistic trend. Complex hunter-gatherers would be more inclined towards farming (Hayden 1990; Rowley-Conwy 2001). This bias will be discussed more elaborately in Chapter 5.

12 Although outdated there might be some validity in the superiority argument, in that people worldwide independently adopted agriculture within the short span of a few millennia. Apparently there is something of an irresistible quality to agriculture (Louwe Kooijmans 1998[b], 15).

13 Sedentism and the diversification of resource use are other elements in such models (Bogucki 1999, 188),

14 Both Thorpe (1996, 2) and Zvelebil (1986[a], 9) classify the 'wave of advance' model as belonging within the superiority paradigm, because of the rather passive role set aside for the Mesolithic population.

15 The 'wave of advance' model justly received a lot of criticism (*e.g.* Dennell 1985; Price 2000[a,c], Raemaekers 1999; Thomas 1996[a]; Whittle 1999; Zvelebil 1986[a];1996;1998[a], Zvelebil/Zvelebil 1988). This mainly focused on the dubious nature of some of the ^{14}C dates, the arguments for the classification of sites as Neolithic, the problematic aspect of genetic correlation and the speed and gradual aspects of the process. However, Ammerman (2003, 13-18) stresses that the 'wave of advance' was only meant to be a model. He holds much of the critique to be related to the currently popular 'indigenist' point of view and argues to move beyond it.

16 Sahlins' publication 'Culture and Practical Reason' (1976) can be seen as one of the fundamental works for the social approach. Sahlins argues that Man is not just a biological organism, but also a cultural organism striving to attain a meaningful life based on its own decisions instead of upon living in a material world.

17 Tilley's (1996) description of 'primitive communism', however, may suffer from some, often general, presumptions. Contrary to these, Late Mesolithic life was probably less egalitarian, tranquil and peaceful than is often suggested. This is for example attested to by numerous violent deaths in Late Mesolithic cemeteries such as Téviec in France, Vedbaek in Denmark and Voloshskoe and Vasilévka in the Ukraine (Schulting, 1996; Orschiedt 2004).

18 Hodder (1998, 91) states that the concept of *domus* stands for the economic, social and cultural emphasis on the house and its continuity through time.

19 Exemplary in this respect is Whittle (1996, 25). He suggests that the LBK longhouse figured in a mobile system and in this way facilitated integration, interchange and cohesion. In case of an indigenous development of longhouses Whittle considers the busyness of the interior with wood as linked to possible animistic forager beliefs, enculturating the surrounding forest of trees.

20 The dearth of domesticated plant remains in excavations and the abundance of wild species such as hazel, apple, pear and weeds for example had led to a ritualization of the cultigens that were present at sites (see Thomas 1999). However, hazelnut shells are robust and survive charring relatively well, as opposed to cereal grains that were not intended to be discarded in the first place. Apart from this the common occurrence of wild apple and pear at sites might be due to the appearance of mantle vegetation induced by forest clearings. Weed seeds can stem from the processing of crops (Rowley Conwy 2004, 90; also see Bakels 1978, 58-71). Another example is the fact that the unfamiliarity with the concept of Neolithic houses has prevented them from being discovered in excavations, supporting the theory of a mobile and foraging Neolithic. This idea however stands in striking contrast to the actual number of identified house plans for Ireland, Britain and Southern Scandinavia (175) (Rowley-Conwy 2004, 87-93)

21 The failure to find or recognize Neolithic houses is common in Northwest Europe in general. Examples are post-LBK cultures in the LRA such as the MK culture or the Stein group. These are mainly known from pits and scatters (*e.g.* Louwe Kooijmans/Verhart 1990; Vanmontfort 2004; Verhart 2000) as house plans are few and sparsely distributed (for a recent example see Van Kampen/Van den Brink 2013). Rowley-Conwy's methodological critique (2004) therefore also applies to these situations.

22 Stable isotope analysis does suffer from several biases. It only indicates dietary habits of individuals and cannot distinguish between wild or domesticated resources (Milner *et al.* 2004). Liden *et al.* (2004) argue for Southern Sweden that the distinction between terrestrial and marine diet probably stems from geographical rather than chronological variation.

23 This debate is strongly linked to both the conceptual appreciation of and earlier approaches in research taken towards the Mesolithic and the Neolithic.

24 Often, literature discussing the transition to agriculture in Northwestern Europe is exclusively based on data stemming from Denmark, Southern Sweden and the UK (*e.g.* Rowley-Conwy 2004; Price *et al.* 1995). Another emblematic example of this is the fact that Price's (2000) substantive compendium on Europe's 'First Farmers' conspicuously lacks a chapter on the Netherlands and Belgium. Also questionable are vaguely defined regions such as Bogucki's 'riverine interior Central Europe' (2003[a,b]). The definition of archaeologically relevant regions should first and foremost be based on archaeological arguments instead of research intensity, favourable preservation conditions, political borders etc. If not, arguments for extrapolation should be well-considered (also see Chapter 3).

25 This is definitely not an argument for a return to the parochialism that has hampered both Meso- and Neolithic research in Northwest Europe for a long time, but instead for a considered approach in defining meaningful regions for investigation.

Chapter 3

Thoughts on transition - The Lower Rhine Area

3.1 Introduction

Against the background of the transition to agriculture on a pan-European scale (as presented in the previous chapter), the focus now shifts to the process of Neolithisation in the study region of the LRA. Apart from a discussion of several of the main geographical and archaeological aspects that create a spatio-temporal context for this study, a number of factors distorting our perspective on the archaeological information available as well as the developments in the past will be discussed. Geomorphologically, the LRA constitutes the western part of the North European Plain. To the south it is bordered by the Belgian and German mountain ranges of the Ardennes and the Eifel and to the west and north by the North Sea. The eastern border runs through the German *Bundesländer* Niedersachsen and Rheinland-Westfalen, skimming the German mountain ranges (*Mittelgebirge*) and ending in the North Sea west of Hamburg.

The process of Neolithisation in this region can be characterised as both long-term and complex. It can, however, be conceptually divided into two separate phenomena, both with a distinctly different background yet both intricately interlinked. The first can be seen as the 'classic' Neolithic succession of Danubian origin, involving the first LBK settlers and their successors, arriving in the LRA around 5250 cal BC. Associated, and potentially pre-dating these developments, are groups producing La Hoguette pottery and *Begleitkeramik* (*e.g.* Louwe Kooijmans 2007[a], 295). It is unknown to what extent they should be positioned in a process of Neolithisation. Since these groups are beyond the main scope of this thesis they will only be dealt with cursorily (however, see Vanmontfort *et al.*(eds) 2010[a]).The other phenomenon concerns the development and transition of the local Late Mesolithic hunter-gatherers into farmers, involving the Swifterbant culture and its successors. This process is geographically defined, focusing mainly on the wetlands and wet margins between the Scheldt and Elbe, and can be placed roughly between 5500 and 2500 cal BC. The reader is referred to figs. 3.1-3.6 for a spatiotemporal and geographical background and to Louwe Kooijmans 1998[a]; 2005[a]; 2007[a]; Raemaekers 1999; 2005[a] for a general overview).

3.2 Neolithic successions: a brief overview

The earliest clear evidence for Neolithic communities in the study area (*Vollneolithikum*) comes with the arrival of the Linearbandkeramik culture (LBK), settling mainly on the fertile patches of loess at the southern and eastern margins.[1] The LBK entered the LRA during its second phase of spread, termed

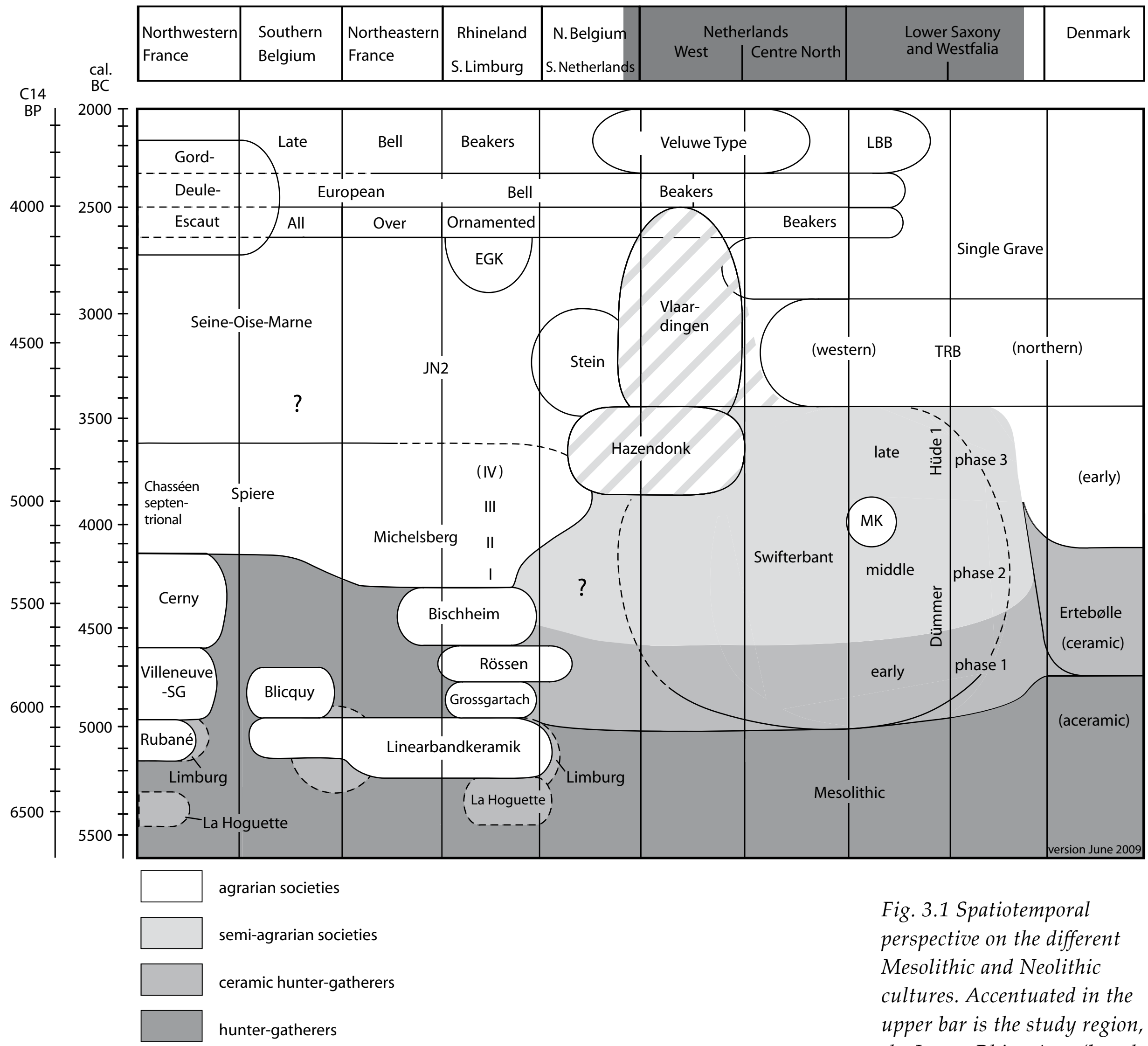


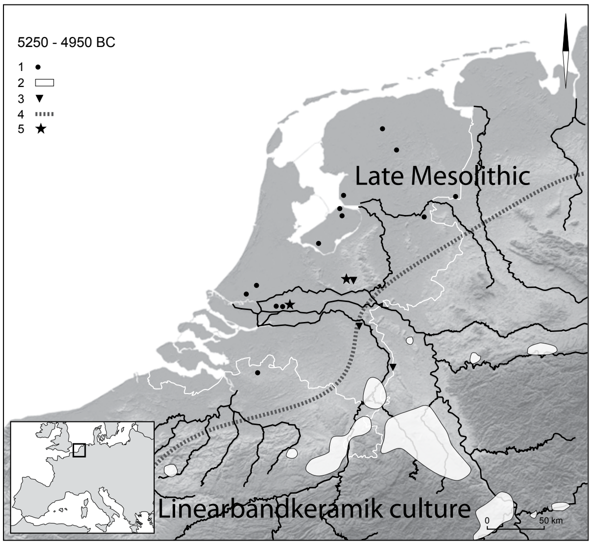
Fig. 3.1 Spatiotemporal perspective on the different Mesolithic and Neolithic cultures. Accentuated in the upper bar is the study region, the Lower Rhine Area (based on Louwe Kooijmans 2007[a], fig. 2, version June 2009).

Flomborn (see Gronenborn 2007; Louwe Kooijmans 2007[a]) and usually dated around 5300 cal BC (Modderman 1970, phase 1b).[2] Its main areas of settlement or *Siedlungskammer* can be pinpointed to the German Aldenhovener Platte, the Dutch Graetheideplateau, and the adjacent Belgian loess area (see Bakels 1982; Kuper *et al.* 1977; Lüning 1982[a]; 2000; Modderman 1985). Some smaller locations appear further west in Belgium (*e.g.* Hainaut; Van Berg and Hauzeur 2001).

By 4900 cal BC, the rather uniform tradition of the LBK is largely continued in the east of the study area in the subsequent Rössen culture (4900-4300 cal BC), preceded by the Grossgartach-horizon. Most settlements are known from the German *Niederrheinische Bucht* and, until now, apart from some isolated finds, the site of Maastricht-Randwijck (Louwe Kooijmans 1988; Oude Rengerink 1991) forms the only Dutch counterpart. Although clearly the Danubian 'inheritors' of the LBK (Constantin 1985, 326; Jeunesse 1998; Lüning 1982[b]), there are some important differences. The Rössen settlement system appears to be more flexible, abandoning the strict adherence to the loess. Settlements are now also located in less fertile areas. They tend to be less numerous and more nucleated and short-lived, featuring trapezoidal multi-family buildings and palisading (Dohrn-Ihmig 1983; Lüning 1982[b]). Bread wheat and barley are both new cultivated wheats (Bakels 1990, 83-87) and wild and domestic animals were consumed in differing proportions (Raemaekers 1999, 140). Also, new flint sources are acquired. Exemplary of the intensified northern and western contacts with the Late Mesolithic and Swifterbant communities is the spread of the Rössen *Breitkeile* and (occasionally some) pottery over an extensive area (see Louwe Kooijmans 1998[a]; Lüning 1982[b]; Sherratt 1990; Verhart 2000, fig. 5.1; Van der Waals 1972). Further west, the LBK is succeeded by the Blicquy Group, concentrated in the LBK territories in Hainault and western Hesbaye.[3] The group can be defined as a regional variety of the Groupe Villeneuve-Saint-Germain (*e.g.* Constantin/Illett 1998) that originated out of the latest LBK phases in the Paris Basin (*RRBP, Rubané récent du Bassin Parisien*). Its material repertoire is therefore clearly derived from the LBK. Its temporal affiliations are subject of a heated debate concerning the contemporaneity of the latest Bandkeramik phases with the Blicquy Group in Belgium. Since the resolution of the available ^{14}C dates is inadequate, arguments are based on stylistic disparities, (non-)association of finds and possible re-use of material (Caspar/Burnez-Lanotte 1998). Some authors such as Constantin (1985, 325; Constantin/Illett 1998) argue for a diachronic relation based on the apparent lack of sufficient contact finds. Others, such as Jadin (2003, 479-486) are convinced of the coexistence of both, whether aware or unaware of each other, even proposing the 'scavenging' of each other's sites.

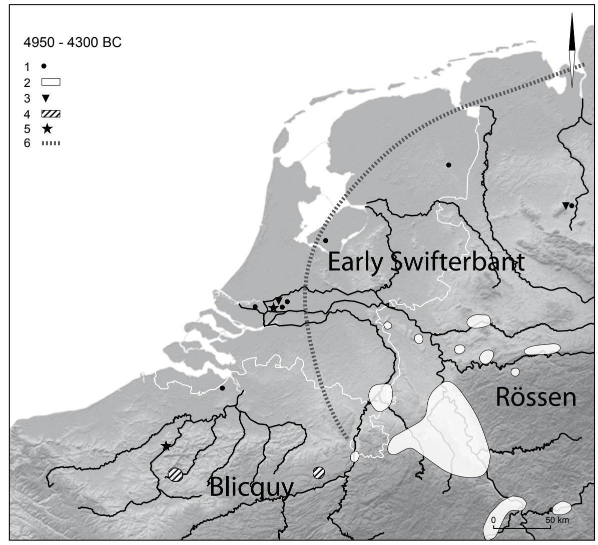
Both cultures in the research area are succeeded by the Michelsberg culture around 4300 cal BC.[4] (Louwe Kooijmans 1998[a], 412; Vanmontfort 2004, 299-300). The Michelsberg culture (MK) has a very distinctive 'cultural repertoire' as attested by deep shaft mining, almost industrial characteristics of flint production, the construction of *Erdwerke* and the resemblances in pottery morphology (*e.g.* De Grooth 1994; Louwe Kooijmans 2005[a]; Whittle 1999, 203). However, despite its uniform appearance there is also clear evidence for regional variation, for example regarding pottery production and lithic technology. This may reflect former cultural traditions as well as chronological, geographical and economic variation (Louwe Kooijmans 2005[a], 253, 256; Vanmontfort 2004, 323). The MK settlement system remains elusive, as only few house plans have been uncovered (see Bakels 2009). Apart from taphonomical considerations this might be explained by a less robust architecture or possibly a higher degree of mobility (Schreurs 1992, 163; Vanmontfort 2004, 329; Verhart 2000, 218-221). In Limburg and adjacent Belgium the MK also settles on the less fertile sandy or loessic sandy soils and the Northwest group turns up as far north as the Münster basin and the riverine area in the north (Louwe Kooijmans 2005[a], 258; Lüning 1968; Vanmontfort 2004). Although the palimpsest character of many settlements is not very informative the apparent shifts in settlement location attest to an important adaptation of the agricultural system. This may relate to more emphasis on husbandry, but also to the appearance of new crops such as Durum wheat (see Bakels 2003; Louwe Kooijmans 2005[a], 260).

Around 3400 cal BC, the northern and eastern parts of the research area witness the inception of the Neolithic TRB West Group (Van Gijn/Bakker 2005). Its origins may partially lie within the indigenous Swifterbant communities (see Ten Anscher 2012). It represents the western regional variant of the Funnel Beaker complex covering a large part of the North European Plain and Southern



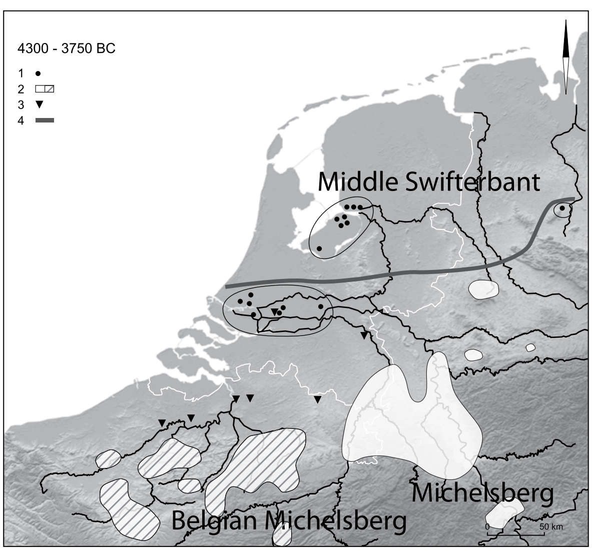
1. Late Mesolithic sites with a ^{14}C range overlapping with this phase
2. LBK settlement areas
3. non-Swifterbant pottery (*Begleitkeramik/La Hoguette*)
4. northern limited distribution isolated LBK adzes
5. earliest Swifterbant pottery

Fig. 3.2



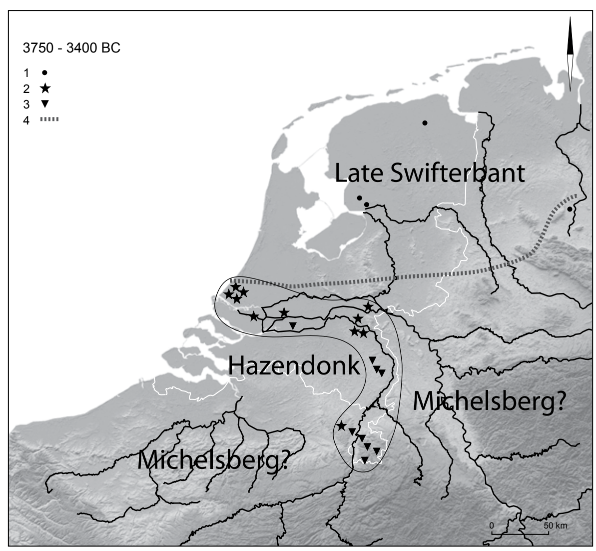
1. Early Swifterbant sites
2. Rössen settlement area
3. Rössen pottery
4. Blicquy settlement area
5. Blicquy pottery
6. northwestern distribution limit of Rössen *Breitkeile*

Fig. 3.3



1. Middle Swifterbant sites
2. Michelsberg settlement area
3. Michelsberg pottery
4. northern distribution of mined lithic artefacts

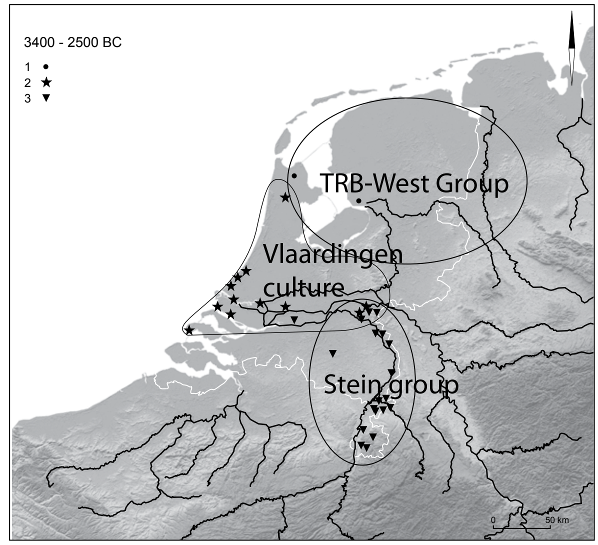
Fig. 3.4



1. Late Swifterbant sites
2. Hazendonk sites
3. Hazendonk(-like) pottery sherds
4. northern distribution of mined lithic artefacts

Fig. 3.5

Scandinavia (Midgley 1992; 2008). Well known for its megalithic burial monuments, the *hunebedden*, the domestic aspects of the TRB West Group are less well-known. It is probable that some form of shifting cultivation agriculture was practised (Van Gijn/Bakker 2005, 288). House plans, such as the one from Slootdorp-Bouwlust (Hogestijn/Drenth 2000/2001, 44-55) and several German examples, indicate rather small, two-aisled, rectangular structures (Van Gijn/Bakker 2005, 287; Midgley 1992). Bakker (1992) argues that this period also sees the introduction of the ard and wheeled transport.



1. TRB West Group wetland sites
2. Vlaardingen sites
3. Stein sites

Fig. 3.6

Figs. 3.2-3.6 Cultures and contact finds c. 5500-2500 cal BC. (Adapted from Out 2009, fig. 1.2-1.4; based on data from the research project 'From Hardinxveld to Noordhoorn' and a map by W. Laan, Archol).

In the south the MK is succeeded by the Stein Group (*cf.* Louwe Kooijmans/Verhart 1990). Apart from the chambered tomb discovered near Stein (South Limburg; Modderman 1964) the material legacy of the Stein Group is mostly known from a few pits as found at Linden-Kraaijenberg (Louwe Kooijmans/Verhart 1990), Sittard-Hof van Limburg and Ittervoort (Drenth *et al.* 2003) as well as surface sites. Recently very long (up to 30 m) rectangular house plans have been documented near Veldhoven (Van Kampen/Van den Brink in prep./2013). Culturally the Stein Group belongs to the Wartberg-Stein-Vlaardingen complex (WSV), which finds itself in-between the TRB West Group in the north and the Seine-Oise-Marne complex (SOM) further south (see Louwe Kooijmans 1976[a,b]; Louwe Kooijmans/Verhart 1990).

From 2900 cal BC onwards (Lanting/Van der Plicht 1999/2000, 35), both the TRB culture and the WSV complex merge into the Single Grave Culture. This Late Neolithic cultural complex, encompassing the later All Over Ornamented phase and the subsequent Bell Beaker pottery tradition, bridges the gap to the Early Bronze Age. In many ways the Single Grave Culture can be seen as a pan-European phenomenon (Van Gijn /Bakker 2005, 305), forming a cultural break with the past.

3.3 On the fringe…

The description above does not do justice to the complexity and variability of the Neolithic cultures involved or the mechanisms and details of their succession and relations. Yet generally the development and chronological outline of these cultures is understood. What is also accepted is their economic status and character: apart from several exceptions or regional adaptations the subsistence mode was essentially agricultural. This means that they can be seen as the main influence on or source of the second phenomenon, the transition of originally hunter-gatherer societies into farmers.

In the following an overview shall be given of the developments in the wetlands and wet margins of the LRA, since these communities, often pictured as being 'on the receiving end' form the main focus of this thesis. Apart from providing a general background, the different elements presented below form a framework for the study of the specific character and nature of the transition to agriculture in the LRA, presented in Chapters 5-9.

3.3.1 Cultural developments

Sites of the Swifterbant Culture, the Hazendonk group and the Vlaardingen culture, communities combining both a farming and a hunter-gatherer existence, are mainly known from the Holocene sedimentation basin, although they are geographically not absolutely restricted to this wetland area. This basin is situated to the west and north of the loess and sandy Pleistocene uplands where most of the sites of the above-mentioned Neolithic cultures can be found (*cf.* Louwe Kooijmans 1998[a], 421). Late Mesolithic sites (see Chapter 5) have been documented in a wider area, but distinct wetland sites that are the direct fore-runners of the sites of the Swifterbant communities have been found in these wetland areas (*e.g.* Louwe Kooijmans 2003; Peeters 2007).

These societies only gradually adopted elements of the Neolithic package from the subsequent cultures on the uplands. Louwe Kooijmans (1993[b], 131) introduced the term 'extended broad spectrum' to define their mode of subsistence consisting of a (continued) Mesolithic economy, combined with aspects of animal husbandry and crop cultivation (also see Chapter 7) Of these intermediate societies, the Swifterbant culture can be roughly dated between 5000 and 3400 cal BC (Louwe Kooijmans 2003; Raemaekers 1999, 108-112). It distinguishes itself from previous and contemporary Late Mesolithic communities by the use of pottery and later on by the piecemeal introduction and use of domesticates (Louwe Kooijmans 2001[b], 523; 2007[a]) and between *c.* 4300 and 4100 cal BC possible crop cultivation (Out 2009, 444-445). The presence of small-scale cultivation has recently been further attested by the find of what may be small fields at Swifterbant-S4 (Huisman/ Raemaekers 2008; Huisman *et al.* 2009). The Hazendonk Group emerges out of the southern Swifterbant communities around 3700 cal BC. There are indications in material culture for both an origin in the Swifterbant culture as well as distinct affiliations with the Michelsberg Northwest Group (Louwe Kooijmans, 2006[d], 150-155; 2009; Raemaekers 1999, 156-157). Apart from convincing indications for animal husbandry as well as crop cultivation at several sites (Louwe Kooijmans 2007[a]; 2005[a]), there is also clear evidence for the construction of houses as attested at Wateringen IV (Raemaekers *et al.* 1997, 146-149). The excavations at Schipluiden have yielded evidence for the first sedentary occupation, based on evidence relating to subsistence, seasonality and settlement structure (Louwe Kooijmans 2006[a]). At Ypenburg the (organic) evidence is less convincing, but a sedentary occupation is the most likely option (see Koot *et al.* 2008). From about 3400 cal BC the relatively short cultural phenomenon of the Hazendonk group evolves into the Vlaardingen culture or Vlaardingen group (Raemaekers 1999, 178; Verhart 2010[a]). In the north the relationship and transition between the last Swifterbant communities and the West group of the TRB remains poorly understood (see, however, Ten Anscher 2012). The Vlaardingen group left some convincing evidence of house construction, (*e.g.* Verhart 1992), but other sites yield a much more diffuse picture (Hogestijn/Drenth 2000; also see Chapters 7 and 8). Furthermore, there is a remarkable variation in both geographical location choice as well as subsistence mode, incorporating, for instance, locations with ard marks as well as sites with a relatively significant contribution of wild resources (Amkreutz 2010[b]; Van Gijn/Bakker 2005, 10-12). Culturally related to the Stein Group, both end with the dominance of the Beaker cultures around 2500 cal BC. These appear with the onset the Single Grave Culture around 2850 cal BC (Lanting/Van der Plicht 1999/2000, 35).

3.3.2 Material developments and contact

The Neolithisation process of the Delta communities studied here is geographically and chronologically 'flanked' by developments taking place in adjacent Neolithic communities. From 5300 cal BC onwards the LBK and subsequent Neolithic groups such as the Rössen and Michelsberg culture can be found to the south and east, while later on the north and the northeast saw the development of the TRB Neolithic and the Single Grave Culture (SGC). It is evident that these groups over time formed the major source of inspiration, either through direct contact and exchange, or through the transmission of ideas, for the Neolithic developments in the wetlands and wet margins. The most characteristic steps will be briefly discussed below. A more elaborate discussion may be found in Chapter 7.

Contacts in stone

A first step involves evidence of contact between the Danubian Neolithic and Late Mesolithic or Swifterbant communities further north and west. This is best demonstrated by the dispersal of Bandkeramik adzes and, later on, the even wider distribution of Rössen *Breitkeile*. Although the exact interpretation of these finds is hampered by various difficulties (Amkreutz *et al.* 2009), it is most likely that their occurrence is the result of exchange between foragers and farmers (see Verhart 2000; 2012; Raemaekers *et al.* 2011).[5] Due to the absence of contextual information it is difficult to date this exchange and interaction, but it is likely that it continued well into the 5th millennium cal BC. Next to *Breitkeile* southern contacts are also reflected in the presence of raw materials such as Rijckholt flint or flint of Lightgrey Belgian type. Specifically compelling and early were the finds of at least one LBK point made from a blade of Rijckholt flint and a pre-core of Rijckholt flint at the site of Hardinxveld-Giessendam Polderweg (Louwe Kooijmans 2003).

Contacts in ceramics

The first evidence of local indigenous pottery production, marking the start of the Swifterbant culture, has been documented for the last phase of occupation at Hardinxveld-Giessendam Polderweg and dates around 5000 cal BC (*ibid.*; Louwe Kooijmans 2011; Raemaekers 2011, 452).[6] Other early Swifterbant pottery was found at Hoge Vaart-A27, Bronneger and Hüde I (see Appendix I). The earliest SWB pottery predates the Ertebølle ceramics by some 300 years. Comparable early pottery has been found in the German Baltic area, most notably at Schlamersdorf. This pottery was ^{14}C dated to *c.* 5300 cal BC, but this date is probably a couple of hundred years too old due to the reservoir effect (Hartz *et al.* 2002, 330). This and, for example, the absence of lamps, eliminates the Ertebølle culture as a source for the origins of Swifterbant pottery (see Raemaekers 1997; 2011), yet does not provide further evidence for its inspiration or development.[7] In general two theories are presented. The first of these interprets the Swifterbant and Ertebølle pottery as (partially) belonging to a broader and widespread tradition of point-based pottery stretching across the whole of the Northern European plain and into the lake areas of northern Poland and Russia (*e.g.* Crombé 2009; Ilkiewicz 1989; Van Hoof 2005; Raemaekers/De Roever 2010; De Roever 2004; Timofeev 1998). This interpretation specifically stresses the cultural contact between indigenous groups of hunter-gatherers and the transmission of knowledge of pottery production between these groups (see Louwe Kooijmans 1998[a], fig. 5). The other theory argues that the origins of the indigenous pottery are to be found in the Danubian Neolithic (Crombé *et al.* 2011[a]; Louwe Kooijmans 2010[a]; 2011). While certain authors have attempted to pinpoint a source ranging from La Hoguette and the LBK to the Rössen culture (see Hogestijn/Peeters 1996; Ten Anscher 2012; Raemaekers 1999, 141; De Roever 2004, 151-152) this remains difficult to ascertain with any certainty. Recently a plausible hypothesis has been forwarded that separates execution from inspiration. It is argued here that while the southern (LBK) sphere is likely to have formed a source of inspiration for the origins of Swifterbant pottery, the execution is distinctly local. For instance, the coiling technique used in some ways resembles the manner in which baskets were woven (*e.g.* Louwe Kooijmans 2010[a]; Raemaekers/De Roever 2010). Louwe Kooijmans (2010[a]) argues that it was probably the men within hunter-gatherer communities that became acquainted with these new techniques and materials on their expeditions. Despite these arguments the actual rationale behind the question *why* communities started producing pottery, its effects and the changes it brought about, unfortunately remains poorly understood (however, see Barnett 2009; Budja 2009), but most likely (also) relates to new consumption methods.

3.3.3 Introducing domesticates and cultigens

Another hallmark of the process of Neolithisation is the introduction of domestic animals. The first bones of domesticated animals in Swifterbant context have been documented for phase 3 at Hardinxveld-Giessendam De Bruin. They date between 4700 and 4450 cal BC and comprise cattle, pig, sheep and goat (Louwe Kooijmans 2003; 2007[a], 297). Further north, in Schleswig-Holstein, a limited number of bones of cattle were also dated to *c.* 4600 cal BC at the site of Rosenhof (Hartz *et al.* 2002, 327; 2007), but their context and date are questionable (Noe-Nygaard 2005). It should be noted that the first appearance of domesticated animals does not necessarily imply a drastic economic change. Based on the information available the number of bones of domestic animals in the earliest phase of the Swifterbant culture appears to be rather limited, as is demonstrated at Hardinxveld-De Bruin (Louwe Kooijmans 2007[a]), or even absent, as at Hoge Vaart (see Appendix I). At many later Swifterbant sites the economical contribution of livestock distinctly forms part of a wider choice (*e.g.* Louwe Kooijmans 2007[a]; Zeiler 1997). Domesticated animals seem rather to contribute to what has been termed an 'extended broad spectrum economy' (Louwe Kooijmans 1993[a]; 1998[a]), whereby domesticates (next to crops) are one of many food sources exploited.

Only in the subsequent Hazendonk and Vlaardingen groups do domestic animals, especially cattle, form a more prominent contribution to the faunal spectrum at certain sites (*e.g.* Schipluiden, Louwe Kooijmans 2006[a,b]).

The earliest indications for cereal consumption and potential cultivation are found in the middle phase of the Swifterbant culture between *c.*4300 and 4100 cal BC (Out 2009; Raemaekers 1999).[8] At Swifterbant-S3 grains and chaff of naked barley and emmer were found, while a substantial concentration or dump of charred cereals, chaff and internodes was found in Hazendonk phase 1 (Louwe Kooijmans 1987, 232). These finds can be dated between 4300 and 4000 cal BC. Over the years much discussion has focused on the question of whether or not the presence of these cereals is indeed an indication for local crop cultivation or whether they were either obtained through exchange with fully Neolithic (Michelsberg) farmers further south and east, or grown by the Swifterbant communities themselves on the surrounding uplands and brought to the site seasonally. This especially raised the question of the feasibility of crop cultivation on the dunes and levees in the wetland parts of the LRA (*e.g.* Bakels 1986; 1988; 2000; Louwe Kooijmans 1993[a]; Out 2009; Raemaekers 1999; Weijdema *et al.* 2011). Both import and local production remain viable options (see Out 2009, Chapter 11) based on both older data as well as recent excavations (*e.g.* Huisman/Raemaekers 2008; Huisman *et al.* 2009). This will be discussed in more detail in Chapters 7 and 8. It is, however, safe to assume that crop cultivation as well as animal husbandry at many sites in the study area formed part of this extended broad spectrum of choices, instead of becoming the staple resource for these communities.

3.3.4 Settling down?

In relation to stock herding and crop farming, sedentism has often been seen as a further indication for a Neolithic existence. An important argument is formed by the evidence on seasonality. Unfortunately this evidence is strongly influenced by taphonomical conditions (see Chapter 4), limiting the number of sites with sufficient seasonal information. This topic will be further discussed in Chapter 7. At many sites most evidence indicates an occupation during part of the year, probably with occasional short-term visits during other seasons. The first convincing seasonal evidence for year-round occupation dates to the Hazendonk group at the site of Schipluiden (Louwe Kooijmans 2006[a], 486). Sedentism at this location was supported by other arguments, most notably the continued construction and maintenance of houses and a rather fixed settlement layout with yards (*ibid.*). While it was not possible to identify individual house plans, this did prove possible at the contemporaneous sites of Wateringen IV (Raemaekers *et al.* 1997) and Ypenburg (Koot *et al.* 2008). Unfortunately further evidence for sedentism remains limited, and little is known from contemporaneous Neolithic groups. At later sites such as the TRB site of Slootdorp-Bouwlust (Hogestijn/Drenth 2000/2001) and the Vlaardingen site of Hekelingen III there is, however, evidence for a continued seasonal exploitation of certain locations.

3.4 Factors of perception

The discovery several decades ago of communities with Neolithic elements in a dynamic and unstable environment away from 'safe' Pleistocene uplands or coastal dunes was quite unexpected (*cf.* Louwe Kooijmans 1997, 11; 1999, 113).

Since then a number of excavations, site reports and synthetic overviews have expanded our knowledge, both of these communities and of their way of life as well as their position and role in shaping the process of Neolithisation within the LRA (*e.g.* Glasbergen *et al.* 1961; Kampffmeyer 1991, Louwe Kooijmans 1993[a,b], 1998[a,b]; 2009; Raemaekers 1999; De Roever 2004). The apparent cultural and geographical disparity of the above-mentioned phenomena can, in the light of the long time span involved, be considered as an ideal set of conditions for studying the transition to agriculture. Although we are not dealing with isolated developments the process of Neolithisation can, as it were, be studied in slow-motion here, focusing on elements of contact, adoption and integration. This makes the LRA a meaningful and very valuable region for research.

The brief characterization sketched in this chapter provides a general framework for most characteristic developments within the process of Neolithisation in the LRA, both regarding the fully Neolithic communities as well as the groups situated in the wetlands and their margins that are of the most interest of this study. In general and summarizing, it can be stated that there is a very gradual adoption of pottery (production) initially, and then domesticates and cultigens, into Late Mesolithic and subsequent Swifterbant communities. Most of the material and stylistic evidence points to interaction with Neolithic communities in the south. By the time of the Hazendonk group most elements of a farming economy, including sedentism, were present, although a considerable variation between sites remains (Amkreutz 2010[b]; Louwe Kooijmans/Verbruggen 2011). The Vlaardingen culture forms a final stage in this development, yet remains characterized by diversity.

While such a general outline may be given, it should be noted that much still remains unresolved concerning the exact temporality and character of the individual developments. This thesis mainly aims to contribute to this problem by furthering our understanding of the transition from the perspective and disposition of the indigenous communities involved in the Late Mesolithic to Vlaardingen culture sequence. In order to do so, however, a number of complicating factors should be defined that impair our understanding of these communities, our analysis of their economic adaptations, settlement system and social structure as well as our interpretation of these and other aspects in terms of a transition towards an agricultural way of life.

3.4.1 Bias I: the upland-wetland dichotomy

'At any rate the wetland-upland distinction is ours, based on our geological erudition, separating the Holocene from the Pleistocene geology' (Louwe Kooijmans 1999, 111). The first bias is of an essentially physical nature, although its appreciation and interpretation are less unequivocal. The amelioration of the climate at the transition from the Pleistocene to the Holocene (*c.* 8800 cal BC) led to the melting of the ice caps and a rise in sea-level.[9] This had rather drastic consequences for the subsequent geological development of large parts of the LRA, dictating the distribution of wet and dry land, natural resources and inhabitable places, but also for archaeological insight. The transgression of the North Sea and the related rise of the groundwater table further inland mainly affected the lower lying areas such as the central river district, the IJsselmeer Basin and the northern parts of the provinces of Friesland and Groningen. These areas functioned as sedimentation basins under the influence of both the sea and hinterland river systems (De

Mulder *et al.* 2003, 16; Zagwijn 1986, 27). A range of typical coastal and fluvial wetland landscapes came into existence that were buried or removed again as the influence of the sea expanded, shifting the entire system further west (Berendsen 2005(1997), 153-180; Louwe Kooijmans 1985, 25-28). These gradients became more or less transfixed as sea levels decreased at the onset of the Subboreal (*c.* 4050 cal BC; Gehasse 1995, 194). The stabilization of the coastal belt enabled the growth of saltmarshes and peat over what were previously tidal flats and the influence of fresh water (fluvial or through precipitation) caused desalination of the soil. Further inland, separated by a zone of estuarine creek systems, lake and peat formation was followed by that of both extensive oligotrophic and eutrophic fens interspersed with riverine sediments (*e.g.* Gehasse 1995, 194; Van Gijn/ Louwe Kooijmans 2005[a], 208; De Mulder *et al.* 2003, 223-230). These processes contrast with the Holocene impact on the uplands, both on the loess and on the coversand. Apart from local peat growth, erosion or local fluvial and colluvial processes, these areas remained relatively unaltered.

The dichotomy between the upland and wetland has led to biases on several levels. The first level is taphonomical. The different geological background has led to a marked difference in preservation. Quantitatively, sites in the wetlands are far less numerous. The main reason for this is that thick layers of sediment covered them, preventing easy discovery and making excavation a rare and costly exercise. Besides, many former outlying coastal areas were lost during the transgression of the sea until *c.* 4000 cal BC (see De Mulder *et al.* 2003, 223-224).[10] On the Pleistocene upland, sites are often still located on or at the surface and can be discovered by survey. Qualitatively, however, the few wetland sites yield a wealth of unique information. Usually the organic preservation of perishable objects or the palaeoecological potential as reflected in faunal and botanical remains are stressed in this respect (*e.g.* Coles/Coles 1989). Of equal importance, however, is the preservation of distinct spatial patterning and chronological resolution through sedimentation. Stratigraphy and microstratigraphy enables the discovery and localization of episodes or phases of habitation and site-use (Louwe Kooijmans 1997; 1999). This contrasts dramatically with most upland sites. Non-carbonized organic remains often are not preserved due to the natural acidity of the soil (*e.g.* Bakels 2005; Bakels/Zeiler 2005, 311; Price 1978, 81; Verhart 2000, 47, Vermeersch 1989, 284-286). Apart from this the stability of the surface minimalized spatial as well as chronological information while re-use and site-formative processes completed the development of palimpsests (see Chapter 4). This unbalanced distribution of archaeological data quite evidently raises the question of representativeness.

On the dynamic level of past societies the same distinction is of importance. Clearly there are differences between wetland and upland environments concerning the distribution and quantity of resources, inhabitable places or availability of farmland, but the important question here is whether this is a difference of kind, or degree. Were the different wetland landscapes part of a broad range of used environments, or did they represent something different, requiring certain skills or adaptations? Did communities specifically focus on their exploitation or always as part of 'something else'? How wet were the uplands in comparison (Bakels/Zeiler 2005; Louwe Kooijmans 1986; 1997)? The answer to these questions and the interpretation of the wetland environments is not only complicated by the above-mentioned taphonomic bias, but also by our own etic bias. Many wetlands are still perceived as wastelands, marginal areas, unsuitable for year-round occupation, let alone agriculture. This perception need not have been analogous with the prehistoric perception (*ibid.*), which dictates that we try to answer the question of representativeness principally on the basis of our archaeological data-set, however unbalanced it may be. These topics will be touched upon in Chapters 4 and 7-8.

3.4.2 Bias II: the Scandinavian paragon

The second bias is of a more historical nature, but is related to that described above. For a long time the supposed limited potential of our archaeological record forced researchers to look abroad for parallels. Price (2003, 274), reflecting on his career stated: '*My research here* [the Netherlands] *solidified my interest in the Mesolithic but, at the same time, made me aware that better preservation was essential for understanding prehistoric hunter-gatherers*.' For the Late Mesolithic in general and the Early and Middle Neolithic on the Northwestern fringe this often meant a comparison with high-quality South-Scandinavian sites (see Louwe Kooijmans 2001[a]; 2005[b]). Post-war research mainly focused on typological and typo-chronological aspects (*e.g.* Bohmers/Wouters 1956) and the association with either northern (Maglemose/Kongemose) or western (Sauveterre/Tardenoisien) traditions. For the end of the Late Mesolithic Newell distinguished the De Leien-Wartena complex, also related to the Nordic traditions (Newell 1973, 407). Later on parallels for other aspects such as subsistence, housing, burial customs and settlement system were often found in Denmark or Southern Sweden (*e.g.* Gehasse 1995, 211-216; Hamburg/Louwe Kooijmans 2001, 97; Newell 1973, 410-415; Smits/Louwe Kooijmans 2001, 431-432; Verhart 2000, 123). Apart from these parallels, the Swifterbant culture, specifically, is often linked more directly to the Danish Ertebølle culture because of (supposed) material similarities, especially in the pottery (De Roever 1979; 2004). This sometimes led to the assumption that Swifterbant was a southwestern variant of Ertebølle. Thorpe (1996, 55): '*We should not, however, underestimate the importance of the links visible at the Swifterbant sites with gatherer-hunter practices to the north in the pottery…*' Another example is Thomas (1996[a], 316): '*An interconnected group of later Mesolithic communities on the North European Plain, of which the Ertebølle are merely the most archaeologically visible…*' (*e.g.* Zvelebil and Rowley-Conwy 1986). Stapel (1991) and especially Raemaekers (1997) have recognized and commented on this problem. Raemaekers clearly states that the similarities between both cultures are mainly restricted to the occasional occurrence of point-based pottery in Swifterbant context, arguing for a rather divergent character of both groups (1997, 229).

Another result of the more informative Scandinavian data-base is the fact that certain models used to describe and explain the transition to agriculture in Northwestern Europe are based upon Scandinavian evidence or research. The most influential is without a doubt the 'availability model' designed by Zvelebil and Rowley-Conwy in 1984. This descriptive model has been mentioned and used in many studies on the transition to farming in the LRA (*e.g.* Van Gijn/Louwe Kooijmans 2005[b]; Gehasse 1995; Out 2009; Raemaekers 1999; Louwe Kooijmans 1998[a,b]; Louwe Kooijmans 2001[a,b], Vanmontfort 2004). The 'availability model' in general describes three phases within the transition to agriculture (see fig. 3.7). The first phase, or the 'availability phase', is marked by some exchange of materials or information between foragers and farmers, but domesticates and cultigens do not

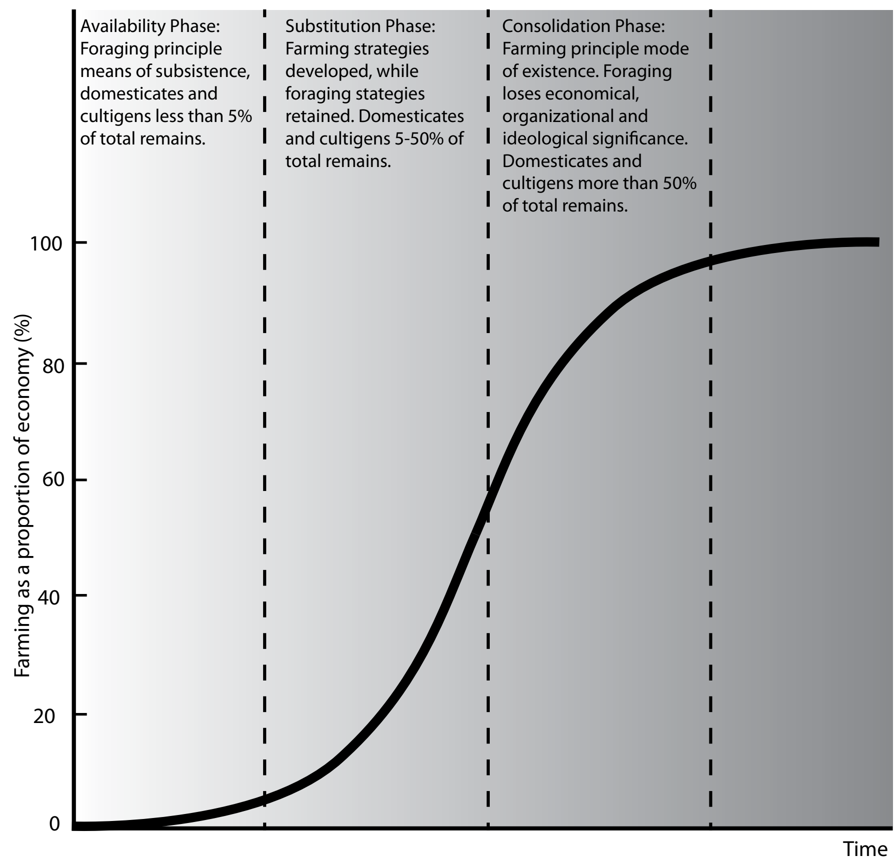


Fig. 3.7 The availability model (adapted from Zvelebil 1986[a]; 1998[a]).

make up more than 5% of the total remains within the assemblages of the hunter-gatherer economies. Both remain culturally and economically independent. In the subsequent substitution phase there is some form of competition between the farming and foraging way of life, which is eventually responsible for an increasing decline of the latter. Domesticates and cultigens make up 5-50% in this transitional phase. The process ends with the consolidation phase when cultigens and domesticates make up more than 50%. Farming is the principal mode of subsistence (Zvelebil/Rowley-Conwy 1984; Zvelebil 1986[a,b]). Although the model cannot be denied a certain elegance, it was originally conceived with reference to the Scandinavian situation. This is most markedly demonstrated by the substitution phase, which is presumed to have been short, mainly because of the difficulties in maintaining a subsistence strategy comprising both a considerable amount of hunting and gathering as well as farming (Zvelebil/Rowley-Conwy 1984, 112; Zvelebil 1996, 326; 1998[a], 11). This seems to be inspired by the rather abrupt shift to agriculture marking the start of the Neolithic in both Scandinavia and Great Britain around 4000 cal BC. Louwe Kooijmans (1998[a], 422-425) and Raemaekers (1999, 187) have therefore both questioned the applicability of the model for the LRA, arguing that the region, by contrast, experienced a rather long substitution phase (also see Chapter 7 as well as Pluciennik 1998, 68; Thomas 1988). Associated with this is the detailed analysis of the transition to agriculture and forager-farmer interactions in the circum-Baltic region (Zvelebil 1996; 1998[a]), which seems quite unrealistic for the LRA.

Using Scandinavian data to patch up the deficiencies of the archaeological record of the LRA and elsewhere (*e.g.* Armit/Finlayson 1992, 665) is not an erroneous practice in itself. In the LRA there are more or less evident cultural similarities on several levels (Louwe Kooijmans 2003, 621). Most Scandinavian data, however, stems from either the Boreal Maglemose culture or the later Ertebølle culture (Louwe Kooijmans 2001[a], 464). The intermittent Kongemose culture, ending around 5400 cal BC, currently is far less informative, thus providing a skewed parallel case-study. Another danger lies in the recurring association of the Scandinavian Late Mesolithic with the concept of complexity (*e.g.* Zvelebil 1996, 1998[a]) and the applicability of this to the situation in the LRA. Complex hunter-gatherers are often associated with certain traits setting them apart from other foragers.[11] Price and Brown (1985, 10-12) name: intensification of production, technological innovations, specialization, reduction in mobility, increased territoriality, extensive and differentiated settlements, complex burial traditions, storage etc. (*cf.* Testart 1982). Elements of these characteristics of complex hunter-gatherers can be found in the archaeological record of the Late Mesolithic communities of Southern Scandinavia (*e.g.* Andersen 1994; 2004; Grøn 1987; Larsson 1990; Müller *et al.* 2002 (1900)). This does not justify their applicability to the situation in the LRA (*e.g.* Verhart 2003), yet some aspects of complexity, such as an increasing population density, smaller territories, more sedentism and associated cemeteries have also been suggested for the Late Mesolithic of this region (*e.g.* Deeben/Van Gijn 2005, 192-197; Neeley/Clark 1990; Newell 1970[a,b]).

The problem of using the notion of complexity will also be touched upon in Chapter 5. Here it suffices to mention that complex hunter-gatherers are often seen as the apogee of foraging communities, suggesting the existence of a logical evolutionary development from simple to complex (Hodder 1990, Price/Brown 1985). This often leads to the assumption that these communities were the ones predisposed to agriculture, exhibiting a higher degree of sedentism, social stratification etc. (*ibid.*; Bogucki 1999; Price 1996). The concept of complex hunter-gatherers as well as its neo-evolutionist connotations have received criticism mainly because of many of these associated assumptions (Rowley-Conwy 1998; 2001). Despite it remaining a contentious term, it generates many questions regarding site-function, settlement system and social structure, rendering it a valuable concept for testing, also in the LRA. Both the concept of complex hunter-gatherers as well as the use of Scandinavian parallels may therefore aid in our understanding of the transition to agriculture, but their use should be conditional in order to avoid careless extrapolation (also see Armit/Finlayson 1992, 665). Research should primarily be based on our own archaeological record. Only by taking into account the regional context of the communities studied is one able to ascertain to what extent defined characteristics are of a general or more specific nature, related to living in and dealing with a certain environment.

3.4.3 Bias III: the constructs of Mesolithic and Neolithic

The last bias to be analysed here is of a conceptual nature and concerns the meaning and implications of the terms Mesolithic and Neolithic. After Thomsen divided prehistory according to his Three Age System, Lubbock (1865) subdivided the Stone Age into a Palaeolithic and a Neolithic era. The main criterion for the latter period was the presence of polished stone tools as opposed to chipped tools.

Later, other elements were added such as pottery, which is still one of the main characteristics of the Neolithic in Russia (*e.g.* Gronenborn 2003[a]). In '*The Dawn of European Civilisation*' (1976 (1925)), Childe advanced food-production as the main distinguishing criterion for the Neolithic, an idea adopted from Elliot Smith (*e.g.* Pluciennik 1998; Raemaekers 1999), which became applied widely as the primary determinant. Apart from economical or material correlates however, the concept of the Neolithic in time also became imbued with technological, social and ideological meaning (*e.g.* Hodder 1990, Thomas 1999). Especially in the light of demic diffusion these different traits were often seen as a package deal of which the identification of one (or more) element(s) signalled the presence of the rest (*cf.* Price 2000[a], 5).

The acceptance of the Mesolithic was not undisputed. Westropp conceived the term Mesolithic in 1872 to accommodate for the hiatus existing between Lubbocks' Old Stone Age and the Neolithic. For historical reasons the term did not catch on, mainly because its usage was internally inconsistent (Rowley-Conwy 1996, 940-944). Eventually it did but it was seen as a period of stagnation, degeneration and decline between the artefactually rich and more imaginative Palaeolithic and Neolithic periods (Childe 1976 (1925); Clark 1978). Later the rich results of excavations at Starr Carr (Clark 1954) and the general reappraisal of hunter-gatherers initiated by the 'Man the Hunter' conference (Lee/DeVore 1968; Sahlins 1968), led to a revision of the Mesolithic period. From the 1980s the concept of complexity and the shifting emphasis in favour of a significant indigenous contribution to the process of Neolithisation (*cf. supra*), further consolidated its chronological and historical position (*e.g.* Pluciennik 1998; Price 2000[a]; Zvelebil 1986[a,b]).

Both the concepts of Meso- and Neolithic have become universally accepted. Their meaning or connotations, however, have remained subject to frequent alterations and additions, but these have failed to accommodate for the existing variability both of the Mesolithic and the Neolithic (*e.g.* Zvelebil 1986[a], 6). This is germane to the LRA as well, since this region is characterized by 'hybrid' communities. These groups combine classical Neolithic elements such as pottery, polished stone tools, a certain level of sedentism and use of cultigens in varying proportions and compositions within an essentially hunter-gatherer way of life. From this it follows that at least the adoption, if not the existence, of a 'Neolithic package' can be refuted for these communities. Since the existing terminology has proved to be inadequate, various subcategories like Subneolithic or Forest Neolithic have been introduced (*e.g.* Werbart 1998; Zvelebil 1986[a,b]). It may, however, be argued as well that the categories defined are perhaps superfluous. Czerniak argues: '*…it can be concluded that there are no true definitions of such concepts as the Neolithic. The answers to what occurred in the Neolithic transition are based on a complex set of assumptions, only a few of which can be, and have been, subjected to empirical investigation*' (1998, 30).

This loss of meaning of the constructs of Mesolithic and Neolithic, the limits of generalization within the process of Neolithisation, poses problems in defining an overarching conceptual framework in the study of the transition to agriculture. One answer has been to abandon existing terminology altogether (*e.g.* Gamble 1986b, 33-34, 40; Zvelebil 1986[a], 6-7), yet this transforms archaeologists into researchers of specific historic particularities, failing to detect interconnectedness as well as understanding what Neolithisation is about (see Czerniak 1998, 29;

Raemaekers 1999, 12). A more popular approach has been the definition of subsistence and the dependence of communities on domesticates and cultigens to be the *'prime marker'* of the Neolithic (*e.g.* Louwe Kooijmans 1998[a,b]; Raemaekers 1999; Zvelebil 1986[a]; Zvelebil/Rowley-Conwy 1984). However one may wonder whether *'the hegemony of subsistence as the defining feature of the Neolithic'* (Pluciennik 1998, 77) is justified. Pluciennik (2008, 27) argues that a sole focus on the transition in subsistence could also lead to a conceptually homogenous Neolithic, in the same way that hunter-gatherers were often characterized in ecological terms. Especially in the light of the criticism over the decoupling of ideology and subsistence (*cf. supra*; Rowley-Conwy 2004), this also applies to the economic side of the debate.

Over the past decade several scholars have attempted to bridge this theoretical and conceptual gap by offering hypothetical solutions as well as suggestions for further research (*e.g.* Czerniak 1998, Pluciennik 1998, Zvelebil 1989). More often than not these have remained on a supra-regional and abstract theoretical level. In order to address the above-mentioned problems archaeologically, it is necessary to (re)define the conceptual parameters within which we study the transition to agriculture in the LRA.

Dealing with Neolithic premises

As already noted above, the main emphasis in characterizing the Neolithic and Neolithisation has shifted from material innovation to economic change marked by the transition from 'living off the land' to actual food production (*e.g.* Zvelebil/Lillie 2000). Ever since Childe (*e.g.* 1958; 1976(1925)), the agricultural premise, in combination with other traits such as house construction, sedentism and pottery, has formed the primary constituent of what has been conceived of as 'the Neolithic package' (see Price 2000[a], 4-5). In this way the Neolithic is interpreted as a unified phenomenon, the individual elements of which signal the presence of the whole. Over the years various scholars have rightly addressed the temporal and spatial incongruities involved with this point of view and questioned the existence of a coherent, integrated set of cultural and economic traits altogether (*e.g.* Bogucki 1987; Czerniak 1998; Thomas 1996[a], 310; Edmonds 1999, 6).[12] This formed the basis for our awareness of the diversity and spatiotemporal variety existing in the many transitions to agriculture, of the mosaic as it were (*cf.* Robb/Miracle 2007; Tringham 2000[a]) of regionally specific situations.

Nevertheless it should be acknowledged that identifying a set of characteristic 'benchmarks' for the Neolithic has remained important. 'Unpacking' the Neolithic will continually lead to the identification of certain elements or traits which from a general perspective remain 'typically Neolithic'. Whittle (1999, 6) therefore argues that the existence of some form of 'agricultural package' is still widely accepted, but it is argued here that the identification and composition of such a set of traits can and should only function as an idealized template against which actual data may be tested. As such, these traits or characteristics act as general points of reference. From this perspective a 'classic' outline of the Neolithic of Northwestern Europe can be drawn. To what extent this outline applies to regions and areas of study should remain to be determined. For the LRA it may be added that much of our perception on what the Neolithic is about is coloured by the Danubian LBK Neolithic and perhaps to a lesser extent by the later TRB groups. As for example argued by Louwe Kooijmans (1998[b], 41, 49), the LBK should be seen as a rather unique Neolithic phenomenon. Its rigid characteristics differed not only from the existing indigenous communities, but also from ensuing Neolithic groups. The more mobile existence and different exploitation of the landscape of this evolved Neolithic, such as the MK, may have been more in line with and perhaps even partially rooted in the lifeways of previous indigenous groups (*e.g.* Crombé/Vanmontfort 2007; Thomas 1996[a]; Vanmontfort 2007). Defining typically 'Neolithic premises' therefore may sometimes become a dangerously subjective endeavour (see also Chapter 6).

3.5 Perspectives on Neolithisation

As demonstrated above a number of factors influence the debate on the transition to agriculture. These range from the regional landscape and geomorphological situation to general theoretical issues. It is important to be aware of these aspects as well as the manner in which they influence our perspective on the situation in the LRA. In the following, therefore, a general outline will be given as to how this study will negotiate these issues as well as a definition of the perspectives from which it intends to approach the process of Neolithisation.

1. The constructs of both the Mesolithic and the Neolithic are retained as conceptual tools. Chronologically both are linked with partially concurrent cultural phenomena; the Late Mesolithic ending with either the start of the LBK (5300 cal BC) or Swifterbant Culture (4900 cal BC) (*cf.* Lanting/Van der Plicht 1997/1998, Raemaekers 1999), or at least before the start of the MK-culture around 4400 cal BC (see Verhart 2000; Vanmontfort 2004).[13] Qualitatively the Mesolithic and Neolithic are envisaged as less rigid categories representing either end of a continuous spectrum. Both therefore are subject to constant redefinition.[14] Research should thus include an active search for the constituent elements of Neolithic society as well as its archaeological correlates (Zvelebil 1989, 382).[15] This should primarily be done within a coherent regional framework and from a bottom-up perspective.

2. The 'primacy of (domesticated) subsistence' is not regarded as the only defining criterion of the Neolithic (*contra* Zvelebil 1998[a], 9; Zvelebil/Lillie 2000). Subsistence should be correlated with or linked to other elements, be they social, ideological or material (see also Pluciennik 1998; Rowley-Conwy 2004). This could be termed a relational or contextual approach in that the specific composition of archaeological data at a site within its geographical, ecological and social context is indicative for the 'level of Neolithisation'. It is realized that within this approach subsistence remains a crucial category since it is a less ambiguous and more direct indication of the dependence on domesticates. Its importance however clearly hinges upon its use. Zvelebil (1998[a], 11) and Raemaekers (1999, 13) argue that the presence of domesticates should be correlated or calibrated for a regional scale or cultural unit to compensate for taphonomically induced variability as well as existing site variability. This is understandable yet problematic, since it assumes that what is defined by pottery and associated artefacts are in fact also economically and socially homogeneous communities. Furthermore, it also suggests that the transition to agriculture was a unidirectional event. To avoid these culture-historical connotations in this study, subsistence will primarily

be established and calibrated per site. Extrapolation should then take place on the basis of contextual and archaeological arguments (see Chapters 7 and 8). Furthermore, Raemaekers (1999, 13) argues that classification of sites should be based on absence/presence rather than proportional data, '*…because the main concern is the incorporation of domesticates in the subsistence base rather than the proportion of people's diet provided by domestic animals…*'. This, however, is questionable, since it approaches Neolithisation as something rather static, an either/or situation. According to this study communities should, when possible, be appreciated on a qualitative basis. For domesticates and cultigens this specifically relates to quantity and proportion. Keeping a goat is altogether different from having to rely on and tending a substantial herd of cows.

3. It is time to inject the debate on the transition to agriculture in the LRA with an appropriate dose of historicity. Studying the process of Neolithisation can be regarded as studying a mosaic of different situations and particularities (*cf.* Tringham 2000[a], 53). There is a certain risk in trying to define general nomothetic laws or aspects of Neolithisation even within a region like the LRA. Czerniak in this respect refers to pitfalls of universalism, rationalism and progress (1998, 30-31). However one cannot deny the fact that eventually, after several millennia, the hunter-gatherers of the LRA did become farmers (Louwe Kooijmans 1998[b], 15, 39, 50). The introduction of historicity therefore is not intended as a justification to stop searching for structure or specific characteristics. Rather it is a potential tool for investigating the variability existing within the period of transition and shifts the focus from the concepts of Meso- and Neolithic to the period of transition as such (*cf.* Pluciennik 1998, 79).

4. A final perspective is formed by the necessity to study the process of Neolithisation from a meaningful regional perspective that incorporates aspects of landscape and environment and relates these to the communities living there. This is based on the notion that the inhabitation of a certain region and the connection between people and their land, significantly shaped by their perception of it, may form an important factor in the overall disposition of these groups and contribute to their *mentalité* or even identity (*e.g.* De Coppet 1985; Ingold 2000). This in turn also potentially influences how they approach, use and incorporate new resources. This will be further elaborated upon in Chapters 6-9. The LRA as a research area is too large to answer these questions, simply because of the various and contemporaneous regional developments taking place, in different cultural as well as physical settings. The emphasis will therefore be placed on defining the existence of regionally distinct traditions for the Late Mesolithic (Chapter 5). For the subsequent communities in transition to agriculture, attention will shift to the characteristics of inhabiting the wetlands and their margins (Chapters 6-8). Since most of the sites in the cultural sequence from Swifterbant to Vlaardingen are situated in or near the wetlands these and their landscape and environmental qualities will be argued to be meaningful in relation to both the communities living there as well as the development of Neolithisation.

3.6 Concluding remarks

The previous two chapters have provided a general outline regarding the archaeology and theoretical debate of the process of Neolithisation, from a European perspective as well as focusing on the LRA study area. The main points that arose from this exercise concerned the necessity to analyse and interpret the situation in the LRA within a regionally coherent context and without rigid ideas concerning the meaning and connotations of Mesolithic, Neolithic and the transition between them. The aim in the following chapters is to arrive at an analysis of the transition to agriculture in the LRA that is, importantly, rooted in both the communities and region itself and that approaches the process of Neolithisation less from its general implications and more from indigenous perception. The potential of different regional characteristics will be examined through an analysis of Late Mesolithic sites within the LRA as well as for the Late Mesolithic-Vlaardingen continuum in the wetlands (*cf. supra*). Different aspects of these topics will be addressed. However, the following chapter will first deal with the characteristics, deficiencies and potential of the available dataset, addressing both methodological and taphonomic issues as well as the upland-wetland dichotomy.

Notes

1 Another Neolithic culture is the La Hoguette group. Within the area of research it is mainly known from concentrations of flint and mostly bone- or shell-tempered sherds as attested by sites such as Sweikhuizen, Gassel, Ede-Frankeneng and Langweiler (Brounen/De Jong 1988; Brounen *et al.* 2010; Lüning *et al.* 1989; Modderman 1987; Schut 1988). According to Raemaekers (1999, 136-138) it predates LBK within the LRA, because, as opposed to the *Älteste* LBK further south, it is absent from its assemblages. However it is found in a LBK context on the Aldenhovener Platte in Germany (Lüning *et al.* 1989, 383) and at the Graetheide-cluster (Brounen/Vromen 1990) suggesting this is probably due to a lack of research further complicated by difficulties of identification.

2 Recently Lanting and Van der Plicht (1999/2000, 42-46) put forward arguments indicating that the LBK in these parts might have started later (around 5230 cal BC) and ended earlier, lasting no more than 230 years for Southern Limburg.

3 Although geographically hardly separable, Blicquy and Rössen are often interpreted as possibly two culturally distinctive groups (*cf.* Louwe Kooijmans 2005[a], 250). On the basis of artefactual and architectural evidence however Blicquy and the Rössen-linked cultural phenomena of Grossgartach and Hinkelstein seem to be clearly related (see Costantin/Illett 1998, 209-214).

4 In the east the Bisscheim-phase forms the bridge between the Rössen and Michelsberg culture. In the west there seems to be a chronological hiatus between the Blicquy group and the Michelsberg culture (*cf.* Lanting and Van der Plicht 1999/2000, 18; Vanmontfort 2004, 300). This is probably linked to a research bias.

5 It is important to note that the dispersal of *Breitkeile* involves large parts of the North European Plain. This indicates that in spite of a lack of sites on the upland coversand, the area was frequented and possibly also inhabited by people of the Swifterbant culture or contemporaneous groups. It also underscores the intensity of contacts between these groups and those of the southern Neolithic between 4900 and 4400 cal BC. In contrast not many *Breitkeile* have been found in a settlement context. Two fragments were found at Swifterbant-S3 (Raemaekers 1999), and several other pieces at Hüde I (Stapel 1991). Furthermore one complete *Breitkeil* was found in open association at the Late Mesolithic sites of Helmond-Stiphoutsbroek (Arts 1994), as well as an adze in a similar open context at Gassel-Over de Voort (Brounen/De Jong 1988).

6 For recent overviews of Swifterbant pottery in the LRA see Crombé *et al.* 2011[a]; Louwe Kooijmans 2011; Raemaekers 2011.

7 Raemaekers (1997) provides further arguments against a cultural 'assimilation' of the Ertebølle and Swifterbant cultures. Apart from similarities there are various marked differences between the two.

8 The presence of cereals and pollen of cereals at Schokland-P14 is not discussed here because of problems involving the stratigraphy and dating of the individual layers at this site. This specifically involves the long time spans represented by layers A, B and C. The supposed ard marks found at Urk-E4 are also excluded because of problems of identification and interpretation (see Appendix I).

9 Around 10.000 BP the sea-level was still 40-50 meters below NAP. Great Britain was still part of the continent and a large part of the North Sea basin was dry. At the start of the Atlantic, a mere 2000 years later, the present coastline was reached as the sea encroached even further inland (*cf.* De Mulder *et al.* 2003, 216-217).

10 This severely hampers the interpretation of and relative importance attached to marine resources, coastal settlement and suitability for agriculture (Price 1987, 242; Raemaekers 2003, 746). According to Van Gijsel and Van der Valk (2005, 68) and Vos and Kiden (2005, 31), this stagnation took place somewhere between 4500 and 4000 cal BC.

11 The construct of complex hunter-gatherers was partly a reaction to Sahlins' 'Original Affluent Forager' (1968) (Zvelebil 1986, 8). Publications by Binford (1980) and Woodburn (1980) were instrumental in creating an awareness of a different kind of hunter-gatherers: less prone to opportunistic foraging, but employing a logistic mobility, delayed return systems, aspects of sedentism etc. (Rowley-Conwy 2001).

12 This has led some to try and identify a specific order as to what traits came first in a certain area or region. Thomas (1999), for example, argues for material (monumental) change and accompanying changes in society in large parts of Britain, prior to major economic transitions. Similar approaches are adopted by Whittle (1999) and Edmonds (1999), while Hodder (1990; 1998), stresses the socio-symbolic and ideological aspects of Neolithisation as crucial in enabling economic change on an even larger scale. Criticism of these approaches correctly addressed the methodological and taphonomic shortcomings of the data involved (Madsen 1986; Rowley-Conwy 2004).

13 Another possibly earlier representative of the primary Neolithic in the LRA is the La Hoguette group. However, many issues concerning chronology, subsistence and relations to the LBK remain to be solved (see Louwe Kooijmans 1998[a], 410, Lanting/Van der Plicht 1999/2000, 14-15).

14 Thomas (1988, 59) clearly points out that the transition from the Mesolithic to the Neolithic is also a point at which our perception of the past changes. The former is linked to a Palaeolithic tradition concerned with human behaviour in terms of adaptive responses to environmental pressures; the latter considers human beings as purposive subjects, acting in pursuit of socially defined goals (Bailey/Milner 2003). It goes without saying that these models are obsolete even for the most classical cultural exponents of either the Mesolithic or the Neolithic but they are of course especially defunct when communities harbouring aspects of both are studied, such as those in the LRA.

15 From this perspective it may be argued that the 'transition to agriculture' is not synonymous with the 'process of Neolithisation'. While both terms will be used in this study the former stresses the importance of agriculture as the distinguishing criterion, while the latter potentially incorporates many other developments and aspects. Use of the former therefore best fits the chronological period studied, while the latter more aptly defines the process and changes at hand.

Chapter 4

Lower Rhine Area sites: a qualitative review

4.1 Introduction

This chapter provides a reflective overview of the qualitative aspects of sites and their datasets in the study area. The aim is to present the main formative factors and methodological approaches and demonstrate how sites in different regional settings vary according to the sources of information available. In this respect it particularly focuses on aspects of taphonomy and site formation and deals with the contrast between upland and wetland sites. It therefore also represents an outline of the quality and limitations of the available dataset, presented in Appendix I, for the period under investigation. The aim is to develop a framework of site formative inference for the LRA, roughly between 6000-2500 cal BC and as such an estimate for evaluating the character, nature and distribution of the data available. Assessing the strengths and weaknesses of the sites we use in our research into the transition to agriculture in this region might lead to a more accurate appraisalof the quality of our data as well as provide useful incentives for future research. This chapter has been divided into three main parts. The first provides a regional background to aspects of site and assemblage formation. The second part deals with a number of formative and methodological issues and traditions pertaining to how sites develop and how this influences research. The final part presents an archaeological site typology of a number of characteristic sites and deals with the issues of wetland representativeness.

4.2 A regional distinction

An important factor in the nature and impact of postdepositional processes on the archaeological record is the regional geomorphological and pedological situation, often in combination with the specific circumstances existing at the location of the site. Groenewoudt (1994, 50-51) distinguished thirteen different 'archaeoregions' for the Netherlands, that demonstrate a specific relation between the archaeology and the landscape both in terms of the character of the material record as well as in formative respect. For the LRA a similar, more general subdivision can be made, into five taphonomic regions (see fig. 4.1). These are the mountainous zone, loess, sandy uplands, wetlands and river valley floors.

Uniting or 'lumping' the many different local situations into five overall categories is of course an oversimplified rendering of the diversity of taphonomic and site-formative factors. For the LRA, however, it demonstrates the general framework into which most sites can be fitted and addresses the main actors

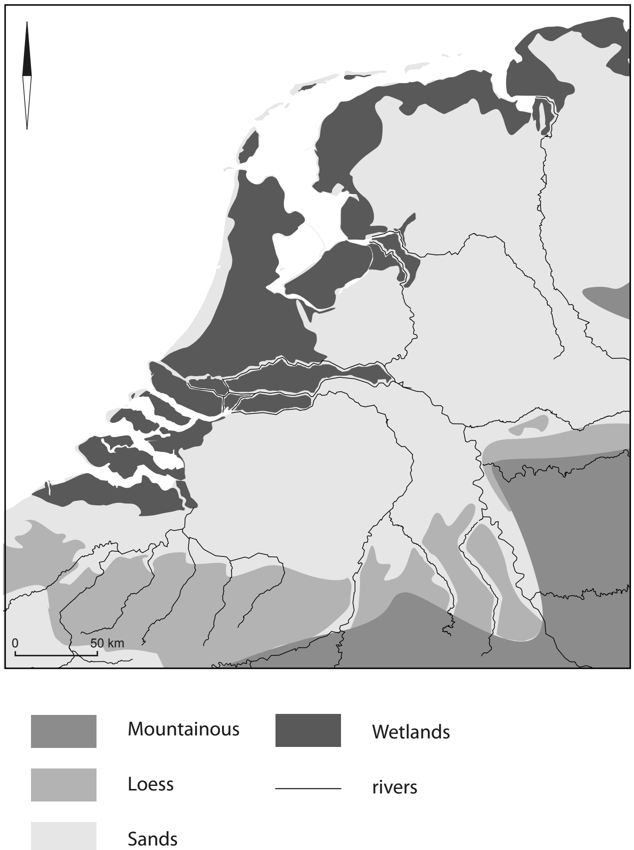


Fig. 4.1 General subdivision of the LRA study area into formative landscapes.

working at the different sites. A short characterization of the five different regions is given below (see also Berendsen 2005; De Mulder *et al.* 2003; Zagwijn 1986; 1989).

4.2.1 Mountainous zone

Location:

In the LRA only a limited part can be defined as a (low) mountainous area. This not only forms a geological separation but also archaeologically accentuates the LRA as a culturally integrated area for studying the transition to agriculture, as the development of the process of Neolithisation further south and southeast was of a different character. The mountainous areas in the LRA are formed by the lower reaches and foothills of both the Ardennes and the Eifel in the south and southeast. These include the Belgian regions of the Condroz and the Famenne consisting of a substratum of loam and rock as well as the rocky cliffs in the southern valley of the Meuse around Liège. The German *Mittelgebirge* (100-600 m) forms another mountainous zone located near the eastern limits of the Basin (see also Louwe Kooijmans 1998[a], fig. 1).

Processes:

Mountainous areas are subject to distinct formative and taphonomic processes. Intensive and high-energy erosion and weathering create limited areas where archaeological remains and features are embedded and sealed. Well-known examples are caves, rock shelters and small patches of mineral soil. The rocky substrate often does not provide ideal conditions for the preservation of organic remains. Furthermore the relative inaccessibility of mountainous areas may hamper the discovery of sites, while the specific environment may have limited the number of tasks executed there in prehistory.

4.2.2 Loess region

Location:

The loess area is situated in the southern and southeastern part of the LRA, wedged in between the mountainous zone and the Pleistocene sandy uplands. The area is often depicted as a continuous belt stretching from east to west (see for example Bogucki 2000, fig. 8.1), whereas in fact it represents an archipelago of loess patches or islands (actually upland basins) (see for example Bogaard 2004, fig. 1.1). These can subsequently be broken down into locally specific varieties such as the limestone area in Southern Limburg or the sandy-loamy soils of the Belgian Hageland. Despite their internal variation these fertile soils were a popular settlement location for the initial LBK farmers and subsequent Neolithic groups, thus forming the earliest region in the study area where agriculture was practised. Remarkable is the apparent absence of Late Mesolithic sites. This is often related to the development of the lush homogeneous Atlantic forest vegetation, which was probably unattractive for many species of wildlife, resulting in low overall quantities of and variety in biomass (but see Vanmontfort 2008[a]). On the other hand it cannot be ruled out that their invisibility is in part due to site formation processes.

Processes:

Several processes characterize the loess region. On the positive side, features of past settlements have often been preserved within developed soils such as brown podzolic soils (*Parabraunerden*), especially in level areas (*e.g.* Bakels 1978, 19-20). On the other hand soil processes often led to a certain degree of dissipation of features. Moreover, the (often undulating) relief in combination with surface runoff in many areas has led to considerable and ongoing erosion and colluviation. This has had a significant detrimental effect on the preservation of sites (See for example Modderman 1976 as well as Berendsen 2005) and may lead to a considerable distortion in the perceived distribution of sites, since especially those located on top and at the foot of slopes would have been affected. Furthermore, large stretches of the extensive loess cover within the LRA are no longer calcareous resulting in virtually no preservation of uncalcined faunal remains (*e.g.* Bakels 1978, 72). Although a 'Neolithic' subsistence base is assumed for most sites, this is partly based on external evidence and presumed analogies.

4.2.3 Sandy uplands

Location:

Located roughly north and west of the loess and mountainous zone and bordering on the eastern margin of the wetlands, the sandy uplands form the most substantial geological region within the LRA. Instead of one homogeneous zone this area actually harbours several different landscapes. In the northern and eastern limits of the study area, the subsoil of the sandy uplands is formed by glacial deposits of moraine on top of which coversand was deposited. Some relief in the form of dunes or ridges is present. Furthermore, substantial areas have been covered by oligotrophous peat, such as the Bourtanger swamp. In the Netherlands the moraine area is bordered by the palaeo-channels of the Vecht and the Hunze (Berendsen 2005, 74-75). Further south the sandy uplands are characterised by extensive coversand areas, low relief in the form of dunes and ridges as well as more conspicuous ice-pushed ridges, for example near the Veluwe. Several brooks regulate the discharge (*ibid.*; Groenewoudt 1994, 50, note 10). Yet another type of landscape can be found still further south and comprises the sandy uplands of Dutch Limburg and Brabant as well as the Belgian Campine area. The subsoil in large parts of this area is formed by ancient fluvial and marine deposits (Berendsen 2005; Bubel 2002/2003), on top of which Pleistocene coversand has been deposited. The relief consists of elaborate dunesand belts or ridges which to a large extent determine the direction of the drainage pattern. Apart from river valleys such as the Meuse, the Demer or the Scheldt and their tributaries, fens formed an important and attractive wet element in the landscape (see for instance Weelde-Paardsdrank; Opglabbeek-Ruiterskuil or Meeuwen in den Damp I in Appendix I). The Peel bog on the border of Dutch Limburg and Brabant forms an extensive oligotrophic peat area.

Processes:

In contrast to the diversity of the sandy uplands the formative processes affecting archaeological sites are rather similar across the area. An important feature is the relative stability of the surface preventing archaeological remains from becoming embedded (and as it were stabilized). This leads both to palimpsests of static and mobile archaeological remains as well as to exposure to various postdepositional processes such as bioturbation (see Bubel 2002/2003). Furthermore features have often (partially) disappeared due to a combination of limited depth and soil formation (*e.g.* Groenewoudt 1994, 113; Rensink *et al.* 2006). Unfortunately, the initial potential of this elaborate area has turned out to be very limited. It should furthermore be mentioned that certain parts of the coastal barriers and low dunes also classify as sandy uplands, at least with respect to formation processes.

4.2.4 Wetlands

Location:

The main body of wetlands is located in the central and western part of the Netherlands and might be defined as the Dutch delta. It consists of a variety of dynamic landscapes which, over time, have been subject to intensive alterations caused by changes in sea-level and related changes in groundwater level. In general several zones can be defined related to the transition from salt to fresh water and influenced by tidal and riverine regimes (see De Mulder *et al.* 2003; Louwe Kooijmans 1985; 1993[a]; Vos/Kiden 2005; Zagwijn 1986; 1989; Zeiler 1997).

- In the east the river clay area of the Meuse and the Rhine forms a dynamic environment of deposition and erosion. Within this environment river dunes and later on levees form dry elements.

- West of this, extensive wetlands with energetic riverine elements as well as lacustrine or swamp areas with stagnant or almost stagnant water and further characterised by development of eutrophic peat are located. Dry elements are formed by river dunes that have become embedded in Holocene deposits, the so-called 'donken'.
- To the west of these an area of saltmarshes can be found dissected by estuarine creek systems which formed important east-west corridors between the hinterland and the coast
- Finally, separated by an area of tidal flats, several coastal barriers with low dunes and interspersed with wide tidal inlets form the westernmost element. The sandy coastal barriers formed ideal locations for settlement from the second half of the fourth millennium BC onwards.

Several other wetland areas might also be defined:

- An important region is the IJsselmeer basin which was connected to the coast by extensive estuaries. A landscape of tidal flats (initially), creeks and backswamps developed (Ente 1976; Gehasse 1995; Hacquebord 1976; De Roever 2004; Zagwijn 1986; 1989) in which river dunes, levees and Pleistocene boulder clay outcrops formed dry, inhabitable elements. The tidal flats soon disappeared, especially when the area became connected to the coast (Louwe Kooijmans pers. comm. 2012).
- An area that has only recently been adequately archaeologically investigated is the Scheldt Basin. Here the former valley of the Scheldt as well as the adjacent sandy lowland have been covered by peat and (peri)marine clayey deposits. Dunes and elaborate coversand ridges form local dry elements (see Crombé 2005[b]).
- Finally isolated patches of wetlands can be included in this region. A good example is the creek-dissected marshland on the banks of lake Dümmer in Niedersachsen (Germany) (Deichmüller 1965; Stapel 1991).

Processes:

Many formative processes characterize wetland environments. Of major importance are the marine transgression and landward coastal formation. This process only came to a halt at the start of the Subboreal (± 4050 cal BC; Vos/Kiden 2005). As a result, most of the coastal occupation of the Mesolithic up to the Swifterbant period will have been lost (see also Raemaekers 2003). The absence of these data makes for a serious coastal hiatus in the reconstruction of settlement systems etc. Other negative processes are more localized and mainly relate to events of erosion destroying (parts of) sites as well as (temporary) drops in groundwater level leading to weathering and disintegration of organic finds. Yet another aspect is the fact that sites in specific areas such as the freshwater peat area are often buried beneath many meters of sediment and therefore often 'beyond the reach' of archaeological investigations. Of course on the other hand, because of their waterlogged and sealed conditions wetlands form ideal preservation contexts. Wetland sites are thus important, not only with respect to the preservation of organic remains and data on subsistence, but also because of the preservation of spatial information pertaining to a limited chronological timespan (see Louwe Kooijmans 1997; 1999).

4.2.5 River valleys

Location:

Although they might be classified together with wetlands, river valleys form a category of their own (*e.g.* Brown 1997). From a geographical perspective they differ from the extensive wetland areas because they consist of one or multiple channels located within an, often limited, valley. Conditions may also be more dynamic compared to many other wetland areas. From an archaeological perspective rivers, like wetlands, formed special habitats with distinct species of plant- and wildlife, raw materials etc. Furthermore they might have acted as important conduits for transport and communication in the past. Rivers and their tributaries can be found throughout the entire LRA and have continuously formed an attractive and sought after element in any type of environment. The most important rivers in the LRA are the Rhine, the Meuse, the IJssel, the Vecht and the Scheldt. Furthermore there are smaller streams such as the Hunze, the Dommel, the Hunte, the Geul and the Demer. Apart from terraces and valley margins the drier elements within river valleys are formed by covered palaeoridges, river dunes, crevasse splays and levees.

Processes:

River valleys are highly dynamic environments that are the subject of their own subdiscipline of archaeology (Brown 1997, 219-253 and 279-303; 2003). Their dynamic qualities make for a changing environment that hinges upon erosion and destruction of sites by channel activity and preservation of sites by deposition of sediment. In this respect river valleys are ambiguous entities since it is often unknown what part of the settlement system has been destroyed, or might still be preserved underneath thick layers of sediment (see also Groenewoudt 1994, 147; Schiffer 1987, 249-255). This has often led to a certain level of neglect for river valleys and smaller stream valleys in the archaeological field (see also Rensink 2004). Nevertheless, the locations that have been preserved often form important interpretative counterparts to the less informative upland parts of the settlement system. Furthermore organic remains and spatiotemporal patterning are sometimes preserved there (see for instance Liège-Place St.-Lambert, Jardinga, or Bronneger in Appendix I).

4.3 Uplands and wetlands: contrasting contexts

All the sites in the above-mentioned regions are to some extent affected by the same postdepositional processes. Artefacts weather and deteriorate by chemical, physical or biological agents. Sites and internal patterning are affected by bioturbation and related pedological processes. Local slope and gradient lead to processes such as colluviation. On a regional level, events such as shifts in groundwater level and coastal regression and transgression phases have a large impact (see Bubel 2002/2003; Schiffer 1987).

The general subdivision in physiographic regions above serves to show that most of the processes described in the foregoing are unevenly distributed. We are therefore dealing with environments which each harbour a characteristic set of taphonomic agents which, in combination with local conditions, are responsible for different levels of archaeological information. This has meant that the composition of the archaeological record in these environments is largely mutually incomparable, leading to certain problems when trying to correlate for differences, or similarities, in the use of sites, or for behaviour in these specific environments.

To further approach the specifics of this problem a basic subdivision can be made between upland sites and wetland sites. This distinction between wetland and upland is mainly based on regional landscape and environmental aspects. The terminology is of limited intrinsic value since both wetlands and uplands of course harbour a wide diversity of landscapes. The uplands category furthermore has different connotations in other areas where it stands for highland or mountainous regions. Another term would be drylands, but that also brings with it certain arid connotations. The term uplands will therefore be used here as a category for the non-wetland regions of predominantly Pleistocene origin in the LRA. This is a further simplification of the existing situation which is generally valid and functional with respect to taphonomic and site formative processes. To what extent it may also apply to a past perception will be discussed later on (see Chapters 6-9; see also Louwe Kooijmans 1997, 15, 19; Raemaekers 1999, 123). This abstract upland-wetland representation of the situation is generally applicable to many of the sites studied here and leads to a division with an overall positive or negative connotation (see table 4.1).

Upland sites	**Wetland sites**
ARCHAEOLOGICAL ASPECTS	
many	few
relatively easy to locate/excavate	hard to locate/excavate
regional perspective	limited site perspective
CHRONOLOGICAL CONTROL	
no clear temporal resolution	temporal resolution
continuous palimpsest	temporally limited palimpsest
low quantity/quality ^{14}C dates	high quantity/quality ^{14}C dates
SPATIOTEMPORAL INFORMATION	
continuous exposure to bioturbation	limited exposure to bioturbation
blurred intrasite spatial patterning	preserved intrasite spatial patterning
SUBSISTENCE AND SEASONALITY	
no preservation of uncharred organic remains	preservation of organic remains
no detailed information on subsistence	detailed information on subsistence
no information on seasonality	information on seasonality
LANDSCAPE AND ENVIRONMENT	
rel. unaltered regional palaeogeographical situation	changed regional palaeogeographical situation
few sources for ecological reconstruction	many sources for ecological reconstruction

Table 4.1 Juxtaposition of upland versus wetland qualities for a number of archaeological and systemic contexts. Note that positive upland qualities relate to the site in regional context. Positive wetland qualities are informative as to the site and site function itself.

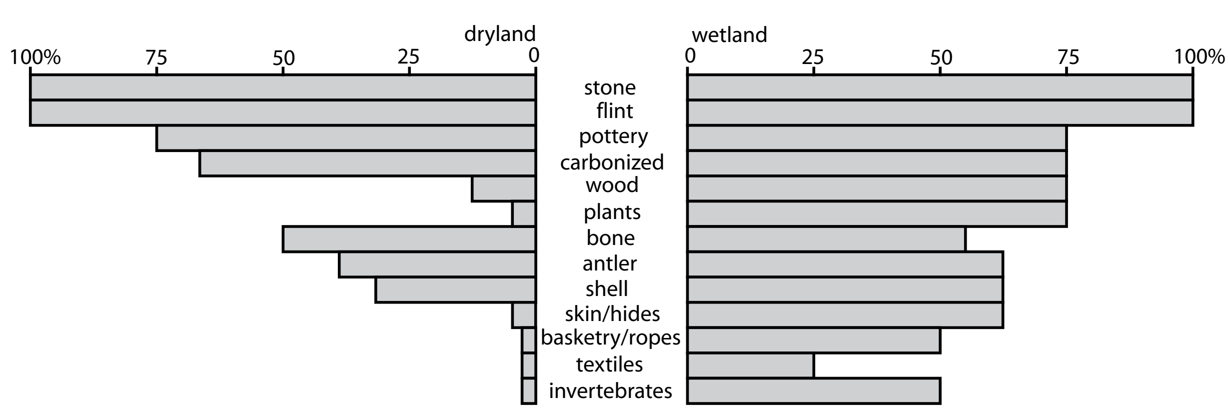
In the following, the contrast between the upland and wetland situation and its consequences for the archaeological record of the LRA in the Mesolithic and Neolithic will be further elaborated upon. The distinction between uplands and wetlands carries with it many different implicit repercussions for both the interpretation of sites and the degree to which they may be compared. A number of these aspects will now be discussed in more detail.

4.3.1 Preservation of artefacts

One of the most emblematic aspects when comparing wetland and upland archaeology is the qualitative and quantitative difference in preservation of artefacts (*e.g.* Coles/Coles 1989). The anaerobic waterlogged conditions of wetlands in combination with covering layers of sediment halt further deterioration of the archaeological record by physical agents as well as chemical and biological decomposition of organic remains (see also Schiffer 1987, 143-151).[1] If we compare the potential preservation of organic and anorganic remains in wetland and dryland situations for the period studied here, there is a clear contrast (see fig. 4.2).

The graph above was derived from survival rates of different materials plotted by Renfrew and Bahn (1996, 64). Since they use a global perspective their estimates of survival rates are rather positive compared to the correlation as depicted above for the LRA. An overview of the qualitative presence and absence estimation of the overall distribution of organic and anorganic remains at sites listed in the catalogue and the database demonstrates some important differences. For upland sites very little or no information at all has been retrieved for the categories of invertebrates, textiles, basketry/ropes, skin/hides, shell, plants and wood. The estimates for upland preservation of uncalcined antler and bone seem much too positive as do those for the preservation of carbonized remains. The amount of pottery that is preserved is also often limited at upland sites due to postdepositional processes. For the LRA wetland sites, organic evidence of textiles, basketry/ropes, skin/hides etc. is significantly less than the estimate in fig. 4.2. Furthermore, the degree to which invertebrates, bone, antler, wood and plants have been preserved is strongly dependent on the local preservation context within the excavation. In general it can be argued that since the survival rate of individual categories is dependent both on the intrinsic qualities of the objects (*e.g.* well-fired pottery) as well as specific local conditions (*e.g.* fast covering, deposition in a pit etc.), the distribution presented above can only be a rough estimate of a survival rate and

Fig. 4.2 Estimates of maximum potential preservation of organic and anorganic remains (adapted from Renfrew and Bahn 1996, 64).



mainly serves to contrast wetland and upland information. Several categories of mobilia are further discussed below.

Lithics

Stone and flint objects usually stand an equal chance of survival, both at wetland and dryland sites. Nevertheless, wetland conditions might be deemed slightly better since the prolonged exposure of these materials in the uplands to freeze-thaw cycles (thermal shock), anthropogenic or natural fires, trampling and more intensive soil movement effects (chipping etc.) leads to increased deterioration (*e.g.* Keeley 1980; Schiffer 1987, 151-158). With respect to use-wear analysis dryland lithic assemblages are less informative overall. First of all prolonged surface exposure at upland sites leads to more intensive patination, especially when compared to the discolouration observed on finds at wetland sites (*e.g.* Van Gijn *et al.* 2006, 133), which appears less destructive. Secondly mechanic alterations such as trampling and other postdepositional processes, leading to edge damage, chipping and striations, further affect the suitability for use-wear analysis. Thirdly, the matrix in which the artefacts are embedded is of little consequence with respect to postdepositional surface modifications, but, due to its abrasive effects, sand forms an exception. Van Gijn (1989, 55) states: '*All assemblages from a sandy matrix are reported to display at least some modifications; Upper Palaeolithic sites in Denmark and Mesolithic sites in the Netherlands, which are in both cases usually located on sand ridges, have consistently been rejected for microwear analysis.*' For the LRA the best results for microwear analysis have been achieved on LBK artefacts deposited in settlement pits in the loess. Wetland sites form good runners-up while tools from sandy upland locations are least informative (Van Gijn 1989; Schreurs 1992; pers. comm. A. Van Gijn 2006). Unfortunately most of the upland sites studied here are located on a sandy substratum. Currently no information is available on the qualitative and microscopic (*i.e.* phytolite) aspect of grinding stones for upland and wetland conditions. Evidence from wetland and loess (LBK) context yielded good results, but no stones from the sandy uplands have been tested. It is possible that the increased percolation of water and other substances through the soil might influence the potential of information available from upland sites (pers. comm. A. Van Gijn 2006). Apart from these aspects it should be mentioned that in general a remarkable amount of stone seems to be missing, preventing, for instance the refitting of stone. It is likely that this relates in part to behavioural factors. Sites may have been used as 'quarries' of raw material (see Schlanger 1992). Upland locations appear to have experienced longer surface exposure and were therefore potentially longer subject to these activities.

Pottery

In the LRA Neolithic pottery stands a much better chance of survival under wetland conditions than in the uplands (*contra* Groenewoudt 1994, fig. 7a). Pottery deposited in deep (LBK) pits is also well preserved, yet not all ceramics end up in features. Ceramics in wetland conditions also suffer from postdepositional processes (wet sherds soften and become more vulnerable; see Schiffer 1987, 160), but the upland pottery spectrum is severely affected by its prolonged surface exposure. Weathering by the elements and especially freeze-thaw cycles (*cf.* Skibo *et al.* 1989, for further discussion see Sommer 1991, 119-120) can destroy sherds within a very short space of time. Another important factor involved is the quality and texture of the clay, in combination with tempering agents used, and the firing procedure. The absence of SWB sherds in the uplands may relate to this problem, since the dispersal pattern of *Breitkeile* and certain lithics may indicate SWB presence there (see Niekus 2009; Raemaekers 1999; 2005[a]). Swifterbant pottery was made with a rather unstable firing technique, often in combination with the use of organic tempering agents and rather thick walls, preventing a well-fired result (De Roever 2004, 49, 120-122). The limited evidence for Hazendonk, Vlaardingen and Stein pottery from the upland Pleistocene soils may, apart from settlement location choice, also relate to the intrinsic qualities of their fabrication. It is of course difficult to assess what part of the original ceramic assemblage of a site will be preserved. The estimate for wetland sites is naturally dependent on the local conditions with respect to subsequent sedimentation. Usually the top of wetland sites will be exposed longer to 'dryland conditions', which will result in variable loss of part of the ceramic assemblage. On the other hand, pottery directly ending up in a wetland context such as a toss-zone in a swamp etc. will be better preserved, also in terms of size. The dryland estimate may be aided by a comparison of upland-wetland conditions for a number of sites (see table 4.2). Although on the basis of the current evidence it is not known to what extent these roughly contemporaneous sites are functionally comparable, they serve to show the relative difference between both geographical conditions (on a wetland dry to wet gradient, they could be listed as follows: St.-Odiliënberg-Neliske, Haamstede-Brabers/Swifterbant-S21-24, Schipluiden, Swifterbant-S3/Vlaardingen).

Carbonized and calcined remains

Carbonized organic remains such as charred remains of hazelnuts, charcoal and calcined bones are often the sole representatives of faunal and botanical remains in the uplands (see for instance the Mesolithic sites of Weelde-Paardsdrank or Bergumermeer-S64B, or Neolithic sites such as Helden-Panningen-industrieterrein or Koningsbosch in Appendix I). Survival relates to the replacement of organic matter by elemental carbon and other inorganic compounds, preventing biological decay (Schiffer 1987, 164). However, upland conditions are less conducive to the preservation of carbonized wood, *i.e.* charcoal, because of its extreme porous and brittle qualities, which make it very susceptible to physical decay. It is therefore reasonable to argue that charcoal, and to a lesser extent other carbonized organic remains, stand most chance of survival when present within features. However, with the exception of hearths, these are not common at upland sites. Furthermore while calcined remains of bone are more resistant to chemical and biological decay, there is a dramatic overall loss of strength induced by heating (see Nicholson

Site	conditions	excavation ext. m²	date cal BC	N sherds
S3/5/6	wetland	400	4300-4000	20000
S21/22/23/24	dryland	802	4450-4100	581
Schipluiden	(partial wetland)	5500	3630-3380	29957
St.-Odiliënberg-Neliske	dryland	4800	Middle Neolithic	100
Vlaardingen	wetland	4591	*c.* 3200-2600	30506
Haamstede-Brabers	dryland	1612	*c.* 2900	192

Table 4.2 Comparison of ceramic assemblages from three pairs of contemporaneous sites for upland and (partial) wetland conditions (see Appendix I for references).

1992, 79). The prolonged intense physical stress on bone in upland conditions will therefore have an effect on preservation; often any calcined bone that is preserved on upland sites is too fragmented for identification.

Botanical remains

As stated above, wood and other plant remains stand virtually no chance of survival in upland conditions unless they have been carbonised or deposited within micro-wetland environments such as wells (see for instance the wooden objects, wood and plant remains recovered from the LBK well of Erkelenz-Kückhoven; Weiner 1998[a,b]). In the wetlands wood and botanical remains are preserved quite well. At many sites (*cf.* Polderweg, Swifterbant-S3, Bergschenhoek, Hüde I, Schokland-P14, or Schipluiden in Appendix I) an elaborate analysis of these remains with respect to aspects such as subsistence, seasonality and past domestic use of wood and plant species is possible (*e.g.* Gehasse 1995; Out 2008[b]; 2009; Van Zeist/Palfenier-Vegter 1981). It should, however, be understood that most wetland sites only submerge gradually. The top of these locations, either dunes, levees, donken or other elevations, have usually suffered most from dryland conditions. It may be assumed that the amount of wood used for structures, implements and tools present on top of the dune as well as other botanical remains was once considerable.

Bone, antler and shell

Due to its tougher qualities, preservation of bone, antler and shell at upland sites is marginally better than that of wood and plants, but remains nihil in absence of calcination. Furthermore, different species of animals exhibit different preservation rates of bones and also within species some parts of the skeleton are more resistant to decay than others (Nicholson 1992). Physical weathering of bone is inflicted by exposure to heat (the sun), freeze-thaw cycles and water. Bone also deteriorates through chemical and biological agents (Schiffer 1987, 182-189). The acidic qualities of large parts of the sandy uplands are responsible for the lack of bone there, as is demonstrated by the rare and limited faunal assemblages and burials. Acidic soils dissolve the mineral fraction within the bone (*ibid.* 183). Decalcified soils, such as large parts of the loess stretches in the LRA also result in a bad preservation of bone. Exemplary is for instance the LBK cemetery of Elsloo (Modderman 1970, 45-75). Of the 66 inhumation graves located there only 18 yielded positive evidence for human burial in the form of corpse silhouettes. Apart from the above-mentioned factors influencing quantitative aspects of bone assemblages, intrinsic qualitative aspects also deteriorate. DNA for example is sensitive to temperature, but wetland conditions can be truly detrimental since the internal DNA structure is affected by micro-organisms in the water (see also Smits/Louwe Kooijmans 2006). Concerning isotope analysis, analysis of C, N and O isotopes which is mainly performed on collagen, might be more successful under wetland conditions since they inhibit microbial action. Sr isotopes on the other hand suffer from waterlogged environments, because the mineral fraction might be recrystallized, resulting in the loss of mineral signature (tooth enamel is often sampled since it is more resistant to chemical alterations; See Hedges 2002 for an overview of bone diagenesis). As with bone, virtually no Mesolithic or Neolithic data are available for antler or shell under upland conditions. At wetland sites the top of dunes and other elevations suffered more from these conditions.

Skin, hides, basketry, ropes and textiles

These categories of artefacts and remains have until now been non-existent at upland sites and also remain very scarce under wetland conditions for the period studied. This is undoubtedly in stark contrast to their abundance and importance at the time. Some sites such as Polderweg yielded pieces of rope made of bark-fibre (Louwe Kooijmans *et al.* 2001[a]). At Vlaardingen a birch bark box was discovered (Van Beek 1990; Glasbergen *et al.* 1961) and at Bergschenhoek pieces of rope (Louwe Kooijmans 1985; 1987). At Schipluiden the fills of two wells yielded some small fragments of woven fabric as well as pieces demonstrating a twining technique (Kooistra 2006). Textiles are extremely vulnerable. They either consist of plant fibres containing cellulose, or animal fibres containing keratin. Both are vulnerable to biological decay in the form of bacterial or fungal attack (Schiffer 1987, 181-182). Textiles, except when deposited under special conditions, decay before they can be preserved in waterlogged conditions. These special conditions may be the same that lead to the preservation of bog bodies (*i.e.* skin or hide); a very acidic environment (see Darvill 1987) and a direct and irreversible deposition.

Invertebrates

Invertebrates such as arthropods mainly provide ecological information as well as anthropogenically related information on waste disposal etc. The fact that they receive specific attention in the publications on Hardinxveld-Polderweg (Hakbijl 2001), Hoge Vaart-A27 (Schelvis 2001) and Schipluiden (Hakbijl 2006) is emblematic for their retrieval in wetland context. In general they are present but often overlooked if not especially sampled for. No substantial information on invertebrates is available for upland sites in the LRA.

4.3.2 Preservation of features

If we focus on evidence available in the form of features, differences between upland and wetland sites also become apparent. Apparently many features, especially when not including hearths, have been lost in upland contexts. One therefore encounters most features in the loess region, again mainly relating to LBK settlement context, as well as the wetlands. The Pleistocene sandy uplands only have a marginal count. Several reasons for this have already been touched upon above. The most plausible (but perhaps not solely occurring) explanation is probably the severe taphonomic disturbance of upland features (*e.g.* Burnez-Lanotte *et al.* 1996; Groenewoudt 1994; Vanmontfort 2004) through dissipation and soil processes.[2] This contrast becomes evident in table 4.3. Depicted are several (roughly) contemporaneous sites in the Late Mesolithic and Middle Neolithic of the LRA. Clearly visible is the contrast between wetland sites (in bold) and upland sites with respect to features.

One site that is clearly missing from the example above is Mariënberg. Over an area of 14000 m^2, the site yielded approximately 400 hearthpits spanning a Boreal and Atlantic occupation period of over 2500 years (see Verlinde/Newell 2006; Appendix I). This relatively high number of features for an upland context underscores the aspect of visibility. Apparently only qualitatively rich and contrasting features stand a reasonable chance of discovery in this area. Furthermore only Bergumermeer-S64B has yielded a considerable number of features even without the hearths.

Site (Mesolithic)	**Area excavated (m²)**	**N features (hearths in brackets)**
Hardinxveld-Polderweg (wet)	448	46 (6)
Weelde-Paardsdrank	337	4 (3)
Brecht-Moordenaarsven	172	(9)
Opglabbeek-Ruiterskuil	134	(2)
Bergumermeer-S64B	1200	47 (19)
Dilsen-Dilserheide III	146	-
Meeuwen-In den Damp I	648	-
Helmond-Stiphoutsbroek	2115	(1)
Lommel-Maatheide	85	-
Lommel Vosvijvers 3	?	(3)

Site (Neolithic)	**Area excavated (m²)**	**N features (hearths in brackets)**
Swifterbant-S3 (wet)	***c.* 400**	***c.* 650 (110)**
Schipluiden (partially wet)	**5500**	**4609 (56)**
Wateringen-4 (wet)	**2032**	***c.* 133 (1)**
Vlaardingen (wet)	**4591**	***c.* 2290**
Meeuwen-Donderslagheide	300	-
St.-Odiliënberg-Neliske	4800	>2?
Helden-Panningen-industrieterrein	9630	>3?
Koningsbosch	560	-
Linden-De Geest	2200	>1?

Table. 4.3 Comparison of number of features counted for several Mesolithic and Middle Neolithic upland and wetland (bold) sites.

This could be related to the fact that the terrain was eventually covered by peat (Casparie/Bosch 1995, 235). Unfortunately none of the features or contextual information has been published in any detail (see Newell 1980; see also Niekus 2012).

It can be stated that favourable conditions for the preservation of features in wetland situations are created by the temporally limited effects of bioturbation and the fact that most former habitation layers will be beyond the reach of many processes of soil formation. This also applies to sites that are situated in the upland-wetland margin (such as Schokland-P14 and Urk-E4) and that were only covered at a later stage. However, there is no absolute 'black-and-white' distinction between wetland and upland sites, since the former have all been exposed as well for a shorter or longer period and the subsoil of most wetland sites (apart from for example levee locations) also consists of a body of (dune) sand. Wetland sites therefore find themselves at the end of a qualitative (and quantitative) continuum.

4.3.3 Upland Bergschenhoek

Translating the difference of potential preservation on upland sites versus wetland sites into archaeological reality is often a difficult undertaking. It remains an estimation (see also fig. 4.2) that is dependent on a wide variety of anthropogenic and natural factors (see Schiffer 1995). Nevertheless, hypothetically positioning a site in a different context and extrapolating what information remains, may be altered or will no longer be found may serve as a tool for realising the actual

Bergschenhoek			
wetland reality		upland reflection	
finds	information	finds	information
3 flint artefacts	*raw material provenience; (curated) technology; function*	3 flint artefacts	***finds*** *raw material provenience; (curated) technology; function*
fragm. stone axe	*technology; interaction; function*	fragm. stone axe	*technology; interaction; function*
4 14C dates	*correlated dates*	1 14C date	*increased problems of contamination/association*
pottery	*cult+chron. affiliation: middle phase SWB, southern group; repair holes: curation/availability; technology; local fabrication?*		
clay netweights	*technology; local fabrication; subsistence*		
reed bundles; wooden boards; small trees	*site re-use; investment; architecture*		
irregular boards of a canoe	*technology; transport; curation*		
4 fishweirs (dogwood)	*subsistence; technology; procurement strategies (passive fishing)*		
pointed sticks	*subsistence; technology*		
leister prongs	*subsistence; technology; procurement strategies (active fishing for leister)*		
pointed arrows (ash)	*technology; subsistence; procurement strategies (active hunting birds/mammals)*		
awl of birdbone	*subsistence; technology; maintenance activities*		
pieces of rope	*technology; use*		
superimposed hearths	*re-use; duration: 10-11 phases: 3-6 years*	charcoal scatter	*14C date; no association carbonized remains?* ***features***
dog	*site function: hunting?; subsistence?*		***fauna***
fowl (various species)	*subsistence; hunting territory; seasonality (winter)*		
fish (various species)	*subsistence; hunting territory; seasonality (winter)*		
mammals (various species)	*subsistence; hunting territory*		
botanical remains	*subsistence; seasonality; local procurement or dried/stored?*		***botanical***
	information on site function; group size; duration and permanency; investment; subsistence; technology; hunting territory; procurement strategies; maintenance activities; interaction; settlement systems; cultural affiliation		***combined*** *some information on site size, function and interaction; vague chronological indication; no distinct spatial information*

Fig. 4.3 Schematic representation of the dichotomy between upland and wetland sites as illustrated by the site of Bergschenhoek in its real and in hypothetical upland conditions.

differences between data sets with which we are confronted. One of the most emblematic examples is provided by the site of Bergschenhoek (see Appendix I). The site was situated at the edge of a lake in the vicinity of Rotterdam, north of the Rhine-Meuse estuary. It was a small fishing and fowling camp, centred around a hearth. It was visited and maintained for a period of some ten years. Regular quick sedimentation made for ideal preservations conditions for organic remains; therefore the site has yielded a wealth of information on past human activity and the way in which the site was used. In contrast lithic remains are relatively scarce. The theoretical exercise of transporting Bergschenhoek to the Pleistocene coversand landscape several kilometres further south is therefore especially telling with respect to the type of information that is lost (see fig. 4.3). Apart from the lithic remains (three artefacts and a fragment of a stone axe) not much information would have remained (see also Orme 1981, 33-42) and the site, if discovered at all, would probably have been interpreted as an off-site activity.

4.3.4 Artefacts, features and information

What may be concluded from this brief overview regarding the preservation of artefacts, other mobilia (faunal remains etc.) and features at upland and wetland sites is that there is no absolute distinction between both. Wetland sites at least partially harbour aspects such as exposure and soil conditions that are comparable to upland sites. On the other hand, the local conditions created by sedimentation of clay and development of peat and especially the ensuing anaerobic conditions create an environment that is much more conducive to the preservation of organic remains. Furthermore the absence of bioturbation and other physical and chemical weathering processes in the soil also positively affect the preservation of features to some extent. While we are in fact dealing with a continuum of conditions there is a distinction between upland and wetland sites which generally involves the notion that the overall level of information available at wetland sites will be much higher. This will evidently lead to more well-founded conclusions concerning the interpretation of past activities. This difference is schematically depicted in fig. 4.4.

4.3.5 Spatio-temporal patterning

Apart from the primary differences between upland sites and wetland sites with respect to the quantitative and qualitative preservation of artefacts and features, preservation of spatio-temporal patterning forms another important factor. Binford's initial optimism in 1964 (pp. 425; see also Binford 1962) about the existence of a fossil record of the activities of extinct society, before long gave way to an increased realisation of the various factors at play in distorting this record (*e.g.* Binford 1982; 2002(1983); Gifford 1978; Schiffer 1976). Various syn- and postdepositional factors influence deposited materials and features and as described above, qualitatively dependent on the upland or wetland context of a site, a continuous decrease of available information takes place. Apart from primary aspects of preservation of (parts of) the archaeological record, this also refers to the potential of inherent spatial and chronological information. The loss of spatial and chronological information might be defined as spatio-temporal collapse (Conkey 1987).[3] The degree of collapse is related to both natural and cultural factors. Cultural factors involve all anthropogenic activities taking place

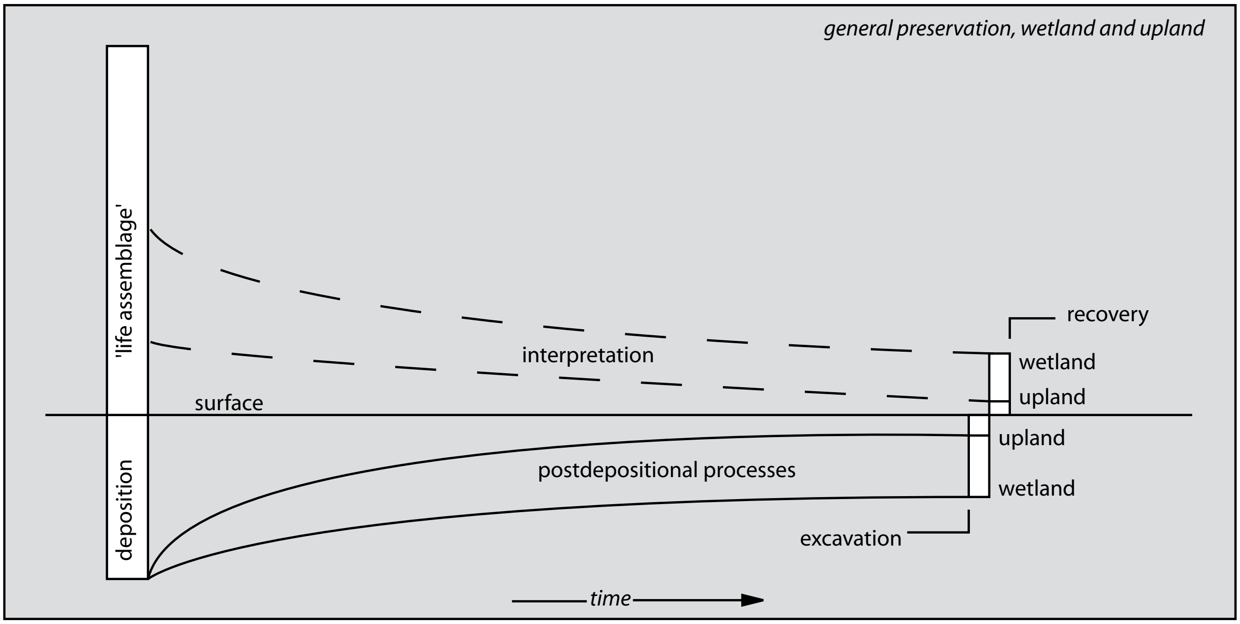


Fig. 4.4 Schematic representation of the contrast between information from upland and wetland preservational contexts. The more intensive exposure to postdepositional processes has impacted the quality of information available for upland sites to a greater extent. This results in less information for the reconstruction of past behaviour. (Note that the information that is excavated will always be less than the information that might have been excavated).

in the same location and resulting in an obscuring of the initial patterning. It is important to realize that there is a certain balance between the signal and noise and that repetition and redundancy of activities are not analogous to disturbance of patterning (see Sommer 1991). These cultural factors will be further discussed below. Natural factors can be subdivided into active and passive agents. Active agents are postdepositional processes responsible for spatio-temporal collapse (for instance bioturbation, argiliturbation, cryoturbation, erosion; for discussion and further references see *e.g.* Bubel 2002/2003; Schiffer 1987). Passive agents refer to the gradual or episodic burial of a site through sedimentation or submergence. This will by and large preserve a certain qualitative degree of the former spatial patterning. Objects and features become 'sealed' in context as it were. At the same time a layer of variable thickness is created enabling a temporal isolation of finds and features.

From wetland and upland contexts there is a gradual increase in the exposure to and the effects of spatio-temporal collapse. More often than not the level of information available for upland sites on stable surfaces will be a fraction of that of their wetland counterparts. In fig. 4.5 and fig. 4.6 both situations are visualized for 'single phase occupations.'

The figures demonstrate the differences in syn- and postdepositional processes, of both a systemic and natural background, acting upon the material remains of occupation. Of importance is the different degree to which the deposited sample, itself only a part of the former 'life assemblage', is affected by these processes, resulting in a qualitatively and quantitatively different excavation potential. The diversity in information available for wetland sites subsequently represents increased possibilities for reconstruction of the actual dynamic past of the 'life assemblage'.

Several factors are of importance that affect the spatial and temporal disintegration of information. Their impact is directly related to time and the development of a cover as can be seen in fig. 4.5 and fig. 4.6. A number of

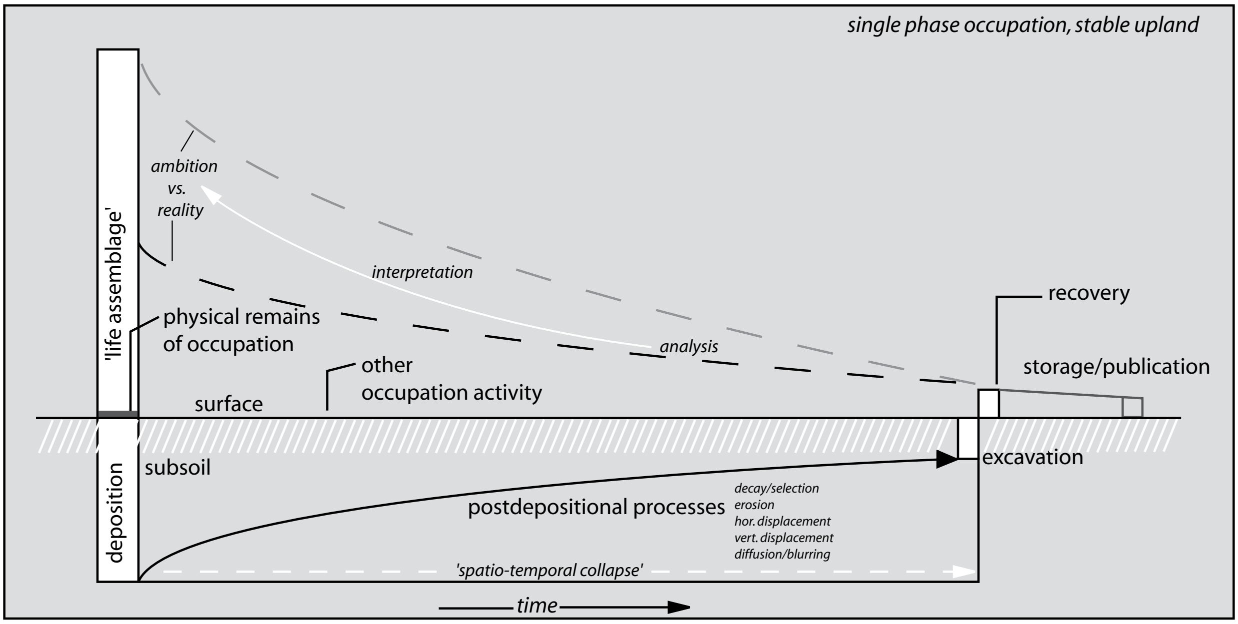


Fig. 4.5 Schematic representation of postdepositional and distortive processes for upland sites with a single phase of occupation. Note the decrease in information between the 'life assemblage', deposited assemblage and recovered assemblage in relation to analysis and interpretation.

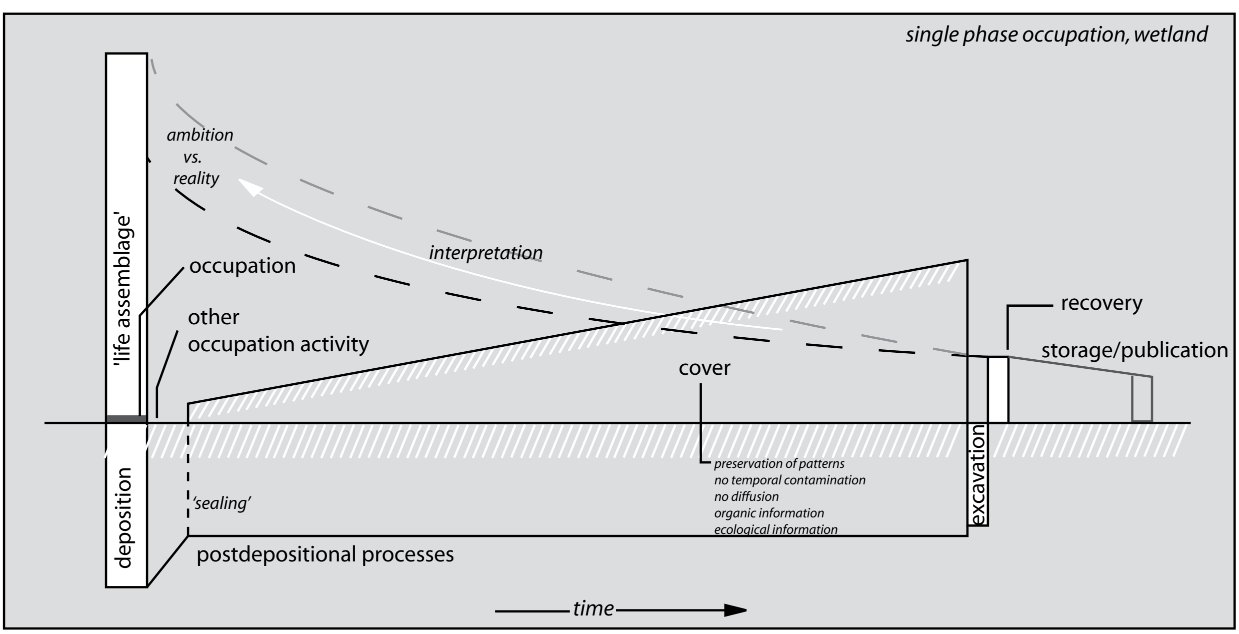


Fig. 4.6. Schematic representation of postdepositional processes and the effects of preservation for wetland sites with a single phase of occupation. Note the effect of 'sealing' on post-depositional processes. Compare 'ambition vs. reality' to fig. 4.5.

these factors that are of special importance for understanding the site formative processes in the LRA are discussed below.

4.3.5.1 Vertical displacement of artefacts

The vertical displacement of artefacts is brought about during the use phase of a site as well as after its abandonment and after burial of the assemblage (the biocoenose, thanatocoenose and taphocoenose stages of a site; see Schiffer 1987 and Sommer 1991). In the first case the artefacts are usually at the surface and a major influence in their disturbance is trampling (for an elaborate discussion see Schiffer 1987, 126-127). Bioturbation forms an important factor during the second stage.

Trampling

Trampling is dependent on the occurrence of remains on the ground, the intensity of the trampling and the nature of the surface (Schiffer 1987, 126). Longer surface exposure, as is the case with upland sites, leads to increased dissolution of patterning. Trampling has two general effects. Firstly, artefacts are physically affected due to pressure or contact-related stress. This leads to deformation such as chipping and abrasion of flint, breaking of bone and almost complete disintegration or crumbling of sherds (*e.g.* Van Gijn 1989; Nicholson 1992; Nielsen 1991; De Roever 2004; Schiffer 1987, 276-278; Sommer 1991). Although this destroys the primary information value of artefacts it leads to insight on another level, namely intrasite spatial organisation. Artefacts affected by trampling might be indicative of activity areas, structures and fixed routes within a settlement or campsite. At Schipluiden, for instance, a trampling zone substantiated the claim of the existence of a continuous fence for keeping out cattle (Hamburg/Louwe Kooijmans 2006). At Schokland-P14, Oudenaerde-Donk, and possibly at Ypenburg, trampling is also indicative for the presence and importance of cattle at these sites (see Appendix I). Furthermore it may be indicative of the use intensity of a site. At Swifterbant-S3 the combination of trampling-intensive zones with small sherds and areas where larger sherds were preserved was attributable to the presence of a house or hut and activities around hearths (De Roever 2004, 35-36), whereas at Hardinxveld-Polderweg the relative size of the sherds enabled a a distinction to be drawn between the intensively used lower slope of the donk and the surrounding marsh area (Raemaekers 2001[a], 114). Nevertheless, caution is warranted in the interpretation of trampling zones, since the presence of smaller fragments of for instance pottery does not directly signal intensively used areas. This is can also be dependent upon the differential rate at which a site has been covered by subsequent sedimentation as well as culturally specific modes of waste disposal among other things (see for instance De Roever 2004, 35; Sommer 1991).

In combination with other processes trampling is also responsible for vertical displacement of artefacts in the soil. Table 4.4 indicates that vertical dispersal of artefacts is a problem at Mesolithic and Neolithic sites, both on the uplands and in the wetlands (see also Villa 1982). Apart from trampling other factors are also responsible. At Swifterbant-S3 cryoturbation might be responsible for an increase in the percentage of flint in the upper layers (De Roever 2004, 33). Of much more importance, however, are the effects of bioturbation on the archaeological record.

An elaborate study of this effect, including experimental research, has been done by S. Bubel (2002/2003).

Bioturbation

Bioturbation can basically be subdivided into floral turbation and faunal turbation. Falling under the former category, especially wind throw or tree fall features have a huge impact (Bubel 2002/2003, 61-147). This is very clear at the site of Bergumermeer-S64B for example, where wind throw features obscure almost 50% of the horizontal and vertical information available. Furthermore they have often been misinterpreted as hut features or dwelling structures (see Newell 1980; see also Niekus 2012). Faunal turbation can be subdivided in turbation by earthworms, arthropods and mammals (Bubel 2002/2003; Schiffer 1987, 207-210). Concerning earthworms, Darwin (1883 (1881)) already noted their effect on the archaeological record. They are capable of altering the provenience and context of artefacts and also of blurring feature boundaries and stratification (Bubel 2002/2003, 167). The effects of arthropods are less known, but comparable. They prefer sandy soils (*ibid.* 188). Arthropods were partly responsible for destroying the spatio-temporal integrity of the Weelde-Paardsdrank site (Huyge/Vermeersch 1982, 132, 137). Depending on their size and number, burrowing mammals also disturb sites considerably. Often their impact is still visible in the form of so-called krotovinas (an animal burrow filled with organic or mineral material from another soil horizon), which also exist for earthworms and arthropods (Bubel 2002/2003, 229). Based upon experimental research simulating these *krotovinas*, Bubel concluded that size-sorting takes place. Overall the greater the size and weight of artefacts the deeper they were buried (*ibid.* 304). This was subsequently tested at, amongst others, the sites of Meeuwen-In den Damp I and Brecht-Moordenaarsven 2. Both, though Brecht to a lesser extent, confirmed the hypotheses generated by the experiments (*ibid.* 334-363, 438). Contrastingly, however, at other sites a reversed pattern seems to exist, for example at Merselo-Haag or Posterholt-HVR 165. In the latter case a tree fall feature had preserved the original find composition. This contrasted with the surrounding area where smaller pieces were embedded deeper in the subsoil and larger pieces remained on or at the surface and were displaced by ploughing (see Verhart 2002, see also Bubel 2002/2003, 27-32; Sommer 1991, 110). This pattern is generally explained by referring to the greater amount of energy involved in mass displacement of larger elements downwards (size sorting effect). It is thus important to realize that both situations might exist on the basis of the criteria mentioned above in combination with postdepositional processes (it is for instance likely that size sorting is less of a factor in displacement by tree falls or burrowing mammals).

Differential impact

It is important to note that especially sites with sandy sediments experience a high degree of vertical displacement (see also Bubel 2002/2003; Vermeersch 1999; Vermeersch/Bubel 1997). This means that especially the upland dataset studied here is seriously affected. Several reasons may be mentioned. First of all the often loose composition of sandy sediments is of a much more permeable nature than for instance loess or clay. Objects will be transported up and down with greater ease. Secondly, as was mentioned above, certain types of animals prefer sandy soils and their burrowing holes are probably less stable in these sediments. Of major importance however is the fact that Pleistocene sandy upland sites are exposed

Site	displacement	material	References
Brecht-Moordenaarsven 2 (u)	15-35 cm	flint	Bubel 2002/2003; Vermeersch *et al.* 1992
Dilsen-Dilserheide III (u)	≤ 60 cm	flint/pottery	Luypaert *et al.* 1993
Hardinxveld-De Bruin (w)	+	pottery	Raemaekers 2001[b]
Meeuwen-In den Damp I (u)	≤ 20 cm	flint	Bubel 2002/2003
Melsele-Hof ten Damme (w)	+	artefacts	Van Roeyen *et al.* 1992
Opglabbeek-Ruiterskuil (u)	≤ 15 cm	flint	Vermeersch *et al.* 1974
Schokland-P14 (u/w)	+	^{14}C sample	Lanting/Van der Plicht 1999/2000
Swifterbant-S3 (w)	≤ 40 cm	pottery	De Roever 2004
Weelde-Paardsdrank (u)	30-40 cm	flint	Huyge/Vermeersch 1982

Table 4.4. Several examples of Mesolithic and Neolithic upland (u) and wetland (w) sites in the LRA that yielded information on vertical dispersal.

to more prolonged and intensive bioturbation due to the absence of a preserving cover and waterlogged conditions. Bioturbation thus often continues for millennia whereas at wetland sites it is largely limited due to sedimentation, submergence or peat growth. Finally, upland sites lack the means to control or correlate for the effects of vertical dispersal. Different occupation periods are mixed, whereas at wetland sites intrusive elements and dispersal of related artefacts may be singled out and attributed to the correct layers (see for example Raemaekers 2001[b], 122-123; De Roever 2004, 37-38).

4.3.5.2 Horizontal displacement of artefacts

The counterpart of vertical displacement is horizontal displacement and many of the above-mentioned factors also lead to horizontal displacement of artefacts. Overall, the effects of bioturbation on horizontal movement might in most cases be considered to have less impact (see Bubel 2002/2003, 286, see also the effects of bioturbation on the site of Melsele-Hof ten Damme, Fechner/Langhor 1993; Van Roeyen *et al.* 1992). On the other hand, other factors might have seriously influenced the horizontal integrity of a site. Especially the proximity of running water in the form of rivers and streams can be influential (*e.g.* Jardinga and Liège-Place St.-Lambert in Appendix I). Trampling (and kicking etc.) also forms a serious factor. Especially on stable dry surfaces, continuous or repeated use of the same location can lead to considerable horizontal displacement of artefacts. At the Swifterbant-S3 site sherds of one and the same pot were found within a 20 m radius, although the majority was found within a couple of meters' radius (De Roever 2004, 37-39). At Weelde-Paardsdrank trampling might have been partly responsible for the distribution of artefacts over up to 25 m (*cf.* Huyge/Vermeersch 1982, 149). However, the distribution, especially of flint, might also relate to conscious activities like particular areas of waste disposal, curation of previously abandoned artefacts and scavenging of sites (see Schlanger 1992). Finally, various slope processes such as erosion and colluviation have a major impact on original horizontal patterning. These will be discussed below. As with vertical dispersion the effects of horizontal dispersion are also directly related to the use-intensity of a site in combination with the present conditions of sealing. From this it can be concluded that under conditions of equal site use intensity, the horizontal displacement of artefacts at upland sites will be more intense. Furthermore their shallow position near the surface makes them vulnerable to the effects of (deep)ploughing and other postdepositional activities.

4.3.5.3 Erosion, colluviation, slope effects and 'decapitated' sites

Almost all sites figuring in Appendix I and probably most of the sites known for the period under investigation are located upon an of elevation of some sort and origin (see table 4.5; see also Peeters *et al.* 2002, 105).

Sites that are not located on a distinct elevation or in a valley floor location, such as Jardinga, Bergschenhoek and Bronneger, may all have had a rather specific site function. From this it may be concluded that most residential or domestic settlement locations known from this period to some extent suffer from postdepositional effects related to slope processes. Together with the aforementioned trampling these processes distinctly transport or displace artefacts. This contrasts with most of the effects of bioturbation which mainly result in a smearing and blurring of intra-site patterns. Three important slope processes can be mentioned: downhill displacement, erosion and colluviation. The effects of all three naturally increase with the gradient of the slope. Hardinxveld-Polderweg and the Hazendonk for instance have a gradient of approximately 20%, while the Schipluiden dune is low and only has a low gradient of a few degrees.

A certain degree of downhill displacement of artefacts is very likely, especially when the elevation is still in use. Potentially the larger and heavier artefacts may cluster lower on the slope, since they are less easily embedded. The effects of this might, however, be limited as was demonstrated by the distribution of cores at Hardinxveld-De Bruin (Van Gijn *et al.* 2001[c], 160). Of considerably greater impact are the processes of erosion and colluviation. In combination with the slope gradient, trampling, soil creep and slope wash are important factors within these processes, as well as the degree to which past behaviour is influenced by the slope (distribution patterns of activity areas, waste disposal areas, tracks etc.). Archaeological remains as well as the surrounding matrix are mainly transported down the slope. At Hardinxveld-Polderweg and De Bruin colluvial layers were revealed in thin sections and, partially, through the sloping orientation of longitudinal fragments of bone and charcoal (see Louwe Kooijmans/Mol 2001; Mol/Louwe Kooijmans 2001). At these sites this led to a complex alternation of colluvial layers within the surrounding peat matrix. A colluvial zone also was identified at the foot of the much flatter and lower dune of Schipluiden, while erosion caused distinct gaps in the distribution patterns (Mol *et al.* 2006; Wansleeben/Louwe Kooijmans 2006, 75).

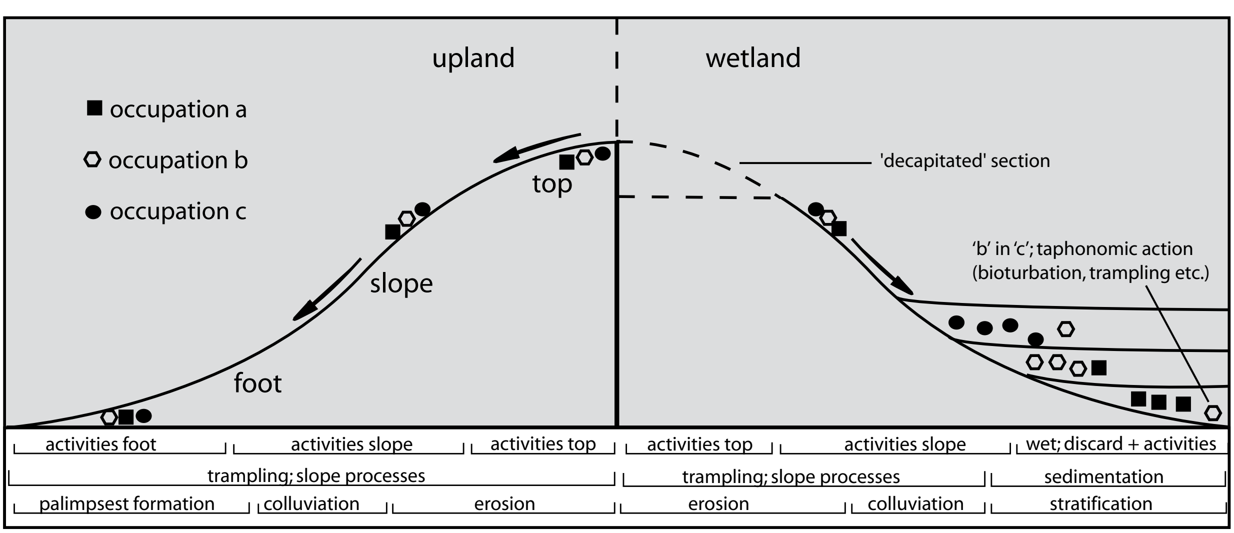
Location	N sites
coversand ridges or dunes	20
levees	6
river dunes or donken	5
coastal dunes or barriers	4
low elevations	3
upper terrace or valley margin	2
boulder clay outcrop	1
Other/valley floor	4

Table 4.5 Non-exhaustive but exemplary distribution of site locations scored in the catalogue (Appendix I).

Colluviation and associated processes

Two further effects should be mentioned that result from erosion, colluviation and associated processes. An important phenomenon at a number of wetland sites is the destruction or absence of spatial and chronological information deriving from the top of sites. Due to the lack of a cover in combination with intensive use and upland conservation conditions, objects as well as features become part of a palimpsest, but might also be partially or entirely absent due to continuous bioturbation, trampling and large-scale erosion (see for example the section drawings of the dune of Schipluiden, Mol *et al.* 2006, fig. 2.7). This leads to more or less 'decapitated' sites which especially lack information concerning activities and structures located on the top, which is often assumed to be the core habitation or residential area (see also fig. 4.7). Examples of 'decapitated' sites are Brandwijk, Hardinxveld-Polderweg, Hardinxveld-De Bruin, the Hazendonk, Hoge Vaart, Urk-E4 and Swifterbant-S21-24. At S21-24 the formation of the Almere lake in historical times caused the erosion of the covering peat as well as of the tops of the river dunes, resulting in decapitated profiles. At S21-24 this resulted in an erosion of 45 cm of the top of the dune (Ente 1976; De Roever 1976). At S23 erosion caused a virtual absence of finds from the top of the dune and at S21 some of the hearthpits might have been obscured by erosion (De Roever 1976; 2004, 27). Erosion would also have led to displacement of artefacts. At Schipluiden part of the feature level on the top was preserved, yet the entire occupation layer and internal spatial patterning had disappeared through erosion (Wansleeben/Louwe Kooijmans 2006). The decapitated profiles are partially down to the dry aspects and conditions of the tops of wetland sites and result in a selective preservation in zones. This represents a second effect in relation to erosion. Trampling and activities on the slope of a site will, in combination with water (rain), have led to colluvial processes. The main problem of these processes is the mixing of displaced (secondary) material from the slope with primary deposited remains at the foot of the elevation. Apart from spatial contamination of the existing patterning this also leads to chronological contamination (see fig. 4.7). Dependent on the rate of sedimentation or cover of the foot of the elevation, more or less admixture of older remains from the slope will take place.

Fig. 4.7 Influence of trampling, colluviation and slope processes on spatio-temporal information from upland and wetland sites. Note the 'decapitated' section of the wetland site.



It may be concluded that erosion, colluviation and slope effects affect every site located on a slope. Apart from the gradient of the slope, a sandy substrate, as is the case for most upland sites and the donken, is probably most vulnerable due to its loose internal structure. Furthermore, while the impact and scale of these effects might to some extent be similar for both upland and wetland sites, the means to identify and control them stratigraphically are usually absent at upland sites.

4.3.6 Persistent places and consistent use

Another aspect that should be discussed here is of a cultural nature and involves the regular or interspersed re-use of the same location for similar or different activities (see Binford 1982). This involves the resolution of redundancy and the visibility of patterns (see Sommer 1991, 61). Except for sites such as Bronneger and perhaps Gassel, most sites figuring in Appendix I show evidence of repeated occupation or use. This ranges from several years, as is the case for Bergschenhoek, to several millennia as was documented at Mariënberg. If similar activities were carried out, one could assume that the signal of these activities would be stable and readable. At Polderweg the patterning of and gradient in activities was to a great extent repeated with each visit (see Louwe Kooijmans 2003). At the sedentary site of Schipluiden, there is a distinct degree of spatial continuity in site layout and site structure and consistency in use. The location of the general habitation area as well as the site perimeter, marked by a fence, an area with waterpits and several dump and activity areas remains constant over time (see Hamburg/ Louwe Kooijmans 2006; Mol *et al.* 2006; Wansleeben/Louwe Kooijmans 2006). The recognition of these patterns was of course strongly dependent on wetland conditions and stratigraphic control, yet other factors are also of importance. These relate to similar cultural choices with respect to the spatial structuring of the site, or returning to the same places.

Apart from the intra-site consistency in use of a location, the development of 'persistent places' over time may have numerous reasons, ranging from strategically positioned locations for hunting or seasonal activities and or investment in (fixed) facilities to the presence of (re-)useable material or the social attachment to a place (Barton *et al.* 1995; Schlanger 1992). The frequent return to sites over time of course also affects archaeological patterning and information at these locations, especially when immediate cover is absent. From a semi-Braudelian (1966) perspective three different time ranges may be defined that help explain the cultural messiness of site patterning. These are briefly discussed below.

4.3.6.1 Short duration – direct change

In this case activities performed at sites during one period of use or occupation have no fixed location. They shift from day to day, hour to hour, or person to person. Cultural debris, often in the form of waste, is left at the place of use or origin (*e.g.* knapping debris). Except for hearths, other fixed structures and built environment of some size are mostly absent (these often function as structuring and directing elements for fixed site patterning, see Binford 1987[a]). Schiffer (1972) argued that these situations exist at sites that are occupied for a brief period of time by a limited number of people. He proposed that with increasing site population (or perhaps site size) and increasing intensity of occupation, there will be a decreasing correspondence between the use and discard locations for all elements used in activities and discarded at a site. Therefore these short-term locations will consist mainly of primary refuse, clustering in discrete or overlapping locations (Schiffer 1972, 162; see also Rafferty 1985). Although this observation is a case in point it also calls for a certain reservation. Ethnographic analysis (*e.g.* Kelly 1992; 1995; Sommer 1991) has indicated that the cultural variability with respect to sites and site structuring is very large. 'Laws' as defined by Schiffer might form an observable general trend, but there are exceptions to the rule. An example at a different scale for instance is the mobile nature of cedar plank houses built by Northwest Coast people that could be moved seasonally (*e.g.* Ames 2006; Kelly 1992). Another example is formed by the fact that sites might be structured according to their anticipated use, which need not be similar to the actual use of a site (Kent/Vierich 1989, 124). In general it may, however, be concluded that short repetitive stays or uses of a location will often be characterized by a (somewhat) indiscriminate use of space. And therefore by less distinct patterning. On the other hand, if the activities are homogeneous (not unlikely in a hunting camp), the resulting waste is limited and spatial overlap is not conditioned by the layout of the location (*i.e.* there is enough space), then the archaeological patterning might be relatively clear and informative. Overall the above-mentioned type of site patterning is characteristic for short-term hunting or maintenance camps, overnight stays etc., but this is no definitive classification.

4.3.6.2 Medium duration – mobility and the seasonal round

Of a different magnitude is the aspect of mobility and the seasonal round. Within the time period under investigation we are largely dealing with non-sedentary hunter-gatherers and early farmers, which is why the existence of settlement systems, seasonal rounds and site diversification adds another dimension to the problem. Binford, after defining between systems of logistical and residential mobility in his famous 'Willow smoke and dogtails' article (1980), came to the same conclusion in his article 'The archaeology of place' (Binford 1982). In it, he acknowledged that '*the same places have different economic potential relative to the sequence of base camp moves*' (1982, 12). This implies that what is a base camp at one moment in one season, might in the following season function as a hunting camp, an observation stand, a logistical camp etc. Archaeologically this implies that '*the locations preferred for residential camps can be expected to yield a most complex mix of archaeological remains since they were commonly also utilized logistically when the residential camps were elsewhere*' (1982, 15). Re-using the same location for different activities with a different material signature will blur the original patterning that existed. To this one might add further complicating factors such as irregular use or hiatuses in use of the same location, re-use or scavenging of materials present at the site, shifts in the number of users, due to for example group fissioning, or cyclical patterns with a longer than annual cycle (long-term mobility; *e.g.* Schlanger 1992, 99). In correlation with Schiffer's intensity argument Binford argues that '*the overall effect of reduced residential mobility among logistically organized hunters and gatherers, from the standpoint of patterning, would be an archaeological record characterized by better defined "types" of sites giving the appearance of greater specialization in functions…*' (1982, 21). What this means is that with an increased level of sedentariness the subsequent 'sedimentation' of functions in the landscape could potentially lead to increased archaeological visibility. This is why it is important to address the issue of the degree of permanency (*cf.* Louwe Kooijmans 1993[a], 90-92, see also Rafferty 1995) when studying a site in the period under consideration. The seasonality aspects of the site of Hardinxveld-De Bruin give a good example of the problem defined above. There are faunal and botanical indicators for a presence in every season, yet on the other hand the limited dimensions of the drowning donk would appear to cast doubts on a permanent year-round occupation. The most likely explanation seems a continuation of the winter basecamp function of Polderweg in combination with a logistical function at other times throughout the year (Louwe Kooijmans 2001[b], 513-514). It should be realised, however, that even at a wetland site with qualitatively good preservation, one faces a complex palimpsest of remains of different activities.

4.3.6.3 Long duration – persistent places

In a long-term perspective the comprehension of archaeological patterning is hampered by cultural and natural factors and patterning on a larger time-scale. This involves the re-use of specific site locales over extended periods of time, often with hiatuses in occupation lasting anywhere from several centuries to millennia. Louwe Kooijmans referred to this as '*the duration of occupation at a certain location*', which can be '*measured in years and irrespective of the permanency-factor, can be seen as reflecting the continuity and especially the stability of the community*' (1993[a], 90). However, realising the time depth recorded for some sites such as for example Mariënberg, Bergumermeer-S64B or Hoge Vaart-A27, in combination with the hiatuses in occupation, suggests that apart from those sites that remained of importance over many generations and centuries, non-related communities also made use of the same locations over long time-spans. This means that particular site qualities, such as desirable geographical and ecological circumstances, rather than stability and continuity in community site use will have been an important factor. On the other hand long-term memory of places and their existence on mental maps, even in the face of long hiatuses cannot be ruled out (Feld/Basso 1996; Jones 2007; Van de Noort/O'Sullivan 2006). In either case we are dealing with sites that were the object of a long-term focus of one or several communities. A useful approach for studying these sites was presented by Schlanger (1992). In a study of Anasazi settlement patterns near the Dolores river in Colorado, Schlanger argues for a more flexible use of concepts such as site and find by replacing them with the concept of *persistent place*. Persistent places are locations that were repeatedly used during the long-term occupation of a region (Schlanger 1992, 92). Analogous to Binford's analysis (1982) the locations might also change function during re-occupation. A site with a residential focus may for example change into a location with a logistical focus, or into a special activity site. What is different about Schlanger's approach, however, is that shifts in site function are not related to a seasonal round, but to long-term changes in settlement pattern, for example in response to climatic and environmental changes (*ibid.* 93-95). The concept of persistent places will return later on (Chapters 5 and 8; see also Amkreutz 2013[a,b]). It is, however, evident that many such places existed in the LRA. A good example is Mariënberg (see also Appendix I). Within a set of 41 ^{14}C dates spanning a period between roughly 7600 and 5000 cal BC, Newell and Verlinde were able to distinguish four main occupation phases separated by three substantial hiatuses. On statistical grounds they defined another eight short hiatuses, resulting in twelve chronologically and spatially separate occupation phases (Verlinde/Newell 2005). Another example is the Hazendonk site. Over a period of more than 1500 years it witnessed occupation by Swifterbant, Hazendonk and Vlaardingen communities. There are even traces dating to the Late Mesolithic. In between some of the occupation periods there were (extended) hiatuses (see Appendix I; Louwe Kooijmans 1993[a]). Other sites that may be characterized as persistent places are, for example, Schokland-P14, Swifterbant-S21-24, both Hardinxveld sites, and Brandwijk.

Persistent places and long-term patterning form a last cultural factor influencing spatio-temporal resolution. While the former two time-frames involved limited spatial distinction in activities or different activities over the year, distortion at this level involves long-term shifts in the use of locations by different groups. Due to changes in natural or other circumstances this means that the type of activities at a location may diverge considerably from previous occupation or use phases. It is meanwhile evident that the degree to which these different use phases of a site may be distinguished is dependent on the degree to which there may have been a sedimentation episode or cover. It is evident that under upland conditions material from chronologically widely distinct use episodes of a sites may end up in the same context. Typical difficulties in interpretation may arise from this. Examples are the intrusion of pottery in a Mesolithic hearthpit at Swifterbant-S23 (see Appendix I; Price 1981; De Roever 2004, 27) or the presence of a MK vessel at a Mesolithic site in Dilsen (Amkreutz *et al.* 2010).

4.3.6.4 Dealing with scales of patterning and disturbance

The three time perspectives described above, each have a profound impact on sites, intra-site patterning and the information we may extract from it. Matters are complicated due to the fact that all three scales operate simultaneously, making it difficult to define the proper agents responsible for the patterning (or lack of it) that is discovered. It may be evident from the previous discussion that the impact of repeated use of sites within these different scales differs considerably in relation to site formative processes taking place (or the absence thereof). Again the difference between upland and wetland sites is evident. It is especially the absence of a potential cover or sedimentation at many upland sites, in combination with surface stability and continuous bioturbation and slope processes, that inhibits the distinguishing of different episodes of use over time. This is depicted in fig. 4.8 and fig. 4.9.

In fig. 4.8 two phases of occupation are depicted with an intermediate hiatus. During the period of occupation (indicated by the width of the bar), material accumulates (indicated by the height of the bar) and becomes deposited on and in the subsoil. From this moment on, various syn- and postdepositional processes start working (trampling, gnawing, re-use, scavenging, loss etc.). The grey shaded area is the eventual accumulation of debris and its internal structuring that form the material reflection of the entire period of occupation. This will likely, at least to some extent and depending on the spatial separation and period of use of the site, be a palimpsest. After abandonment of the site postdepositional processes further affect the deposited remains and continue to destroy intrasite patterning. During this process a second occupation takes place, this time less extensive and

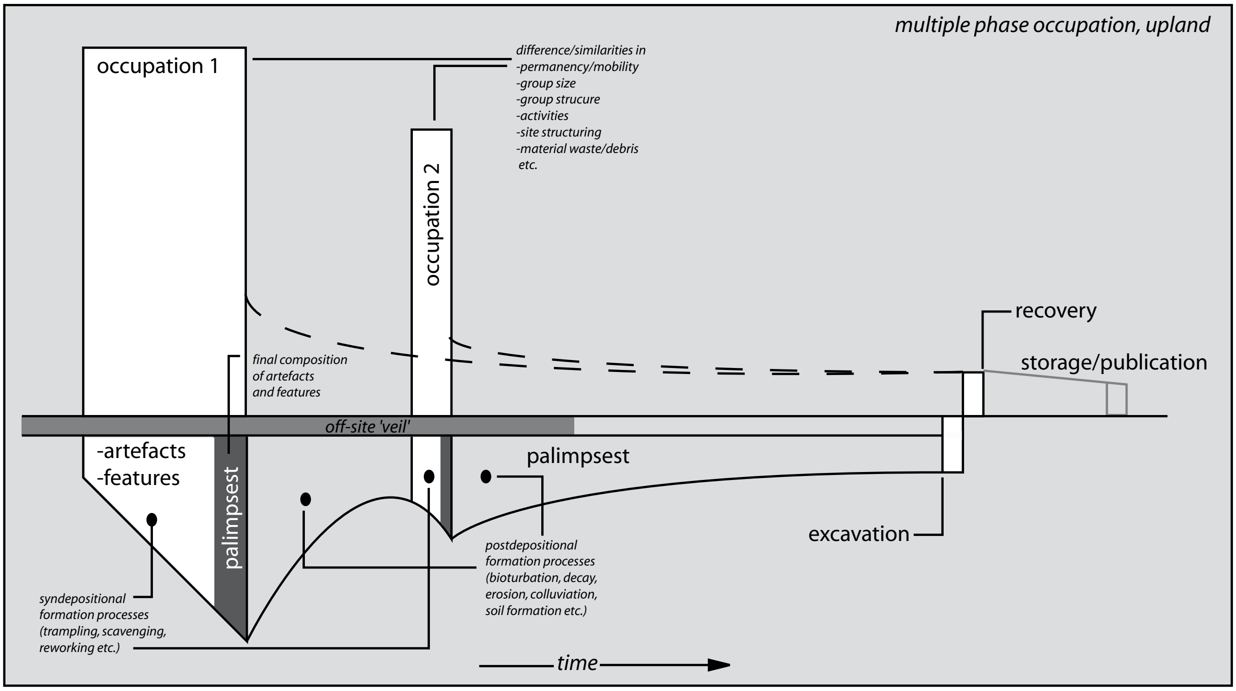


Fig. 4.8 Schematic representation of syn- and postdepositional processes and the effects of multi-period occupation on upland sites. Note that the superposition of the occupational remains of different non-related periods of site-use, in combination with the absence of a cover contributes significantly to the palimpsest character of the site.

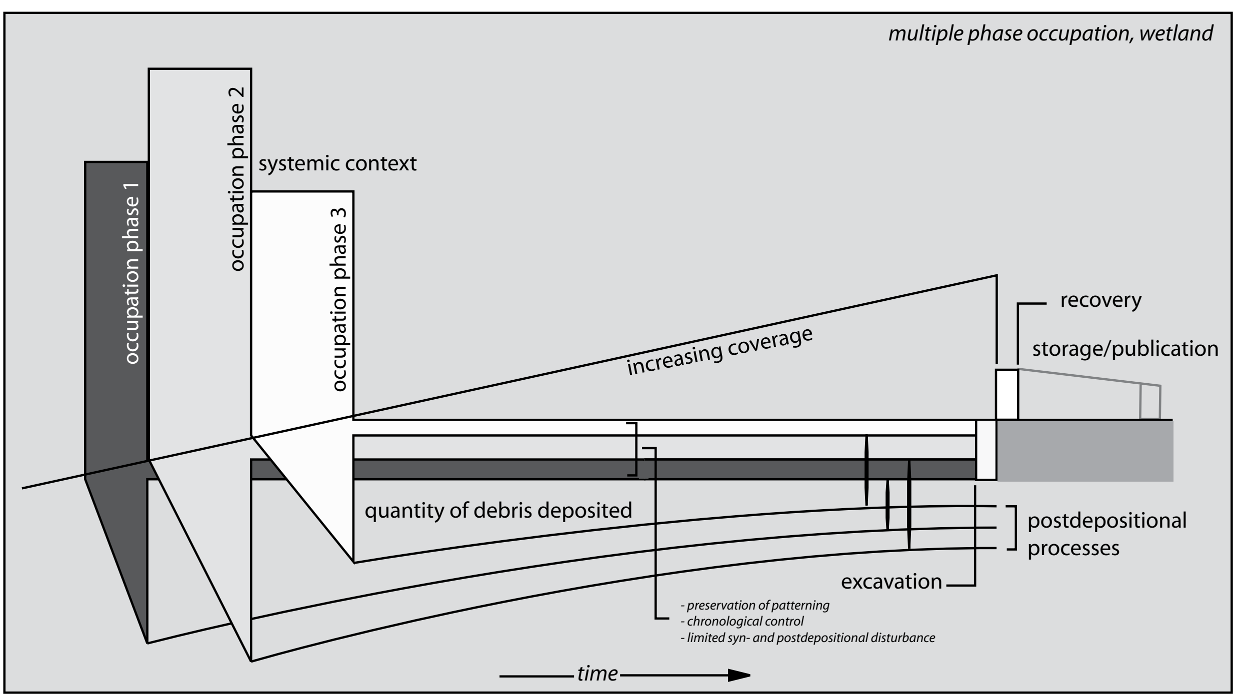


Fig. 4.9 Schematic representation of syn- and postdepositional processes and the effects of multi-period occupation on wetland sites. The frequent cover of a site during or after periods of site-use leads to the formation of stratification and subsequently spatio-temporally separated evidence of occupation.

with a more limited material impact. The material record on and at the surface is enriched by this second phase of occupation which might have a very different character and output compared to the first. The grey shaded area again indicates the eventual accumulation of artefacts and features. It is likely that the previously existing 'signal' of the first occupation will be further obscured by the second. Again syn- and postdepositional processes act upon the archaeological record. A further complicating factor is depicted in the horizontal bar. The 'off-site veil' is a concept coined by Roebroeks *et al.* (1992) to describe and interpret a Middle Palaeolithic low-density scatter, contrasting with high-density patches (see also De Loecker 2006). In the model above, the presence of an off-site veil serves to indicate that the sites we define are also part of a landscape of activities. The reason we identify these locations as sites is the concentration of relics and features at these places. This indicates that part of the material record at the site may also be part of the overall scatter or veil instead of belonging to the patch or concentration defined (see also Roebroeks et al.1992, 11-13). The veil might consist of a variety of small-scale activities that, amongst others, took place at that location. These activities might form part of one of the cycles or time perspectives described above. Due to the stability of the landscape the chronological and spatial separation of activities related to either the occupation of the site, or to the veil, is lost. Eventually the site might become buried, but due to its upland conditions burial will often not be very deep, nor will postdepositional processes cease to distort what is left until excavation. Examples of sites that on the whole fit this schematic representation are, for example, Bergumermeer-S64B, Brecht-Moordenaarsven 2, Koningsbosch, Merselo-Haag and St.-Odiliënberg-Neliske (see Appendix I for details).

In contrast fig. 4.9 depicts a wetland situation with three phases of occupation, differing in length and material output. No elaborate hiatuses are observable between the phases of occupation, but these could very well be imagined. After deposition the material record of each phase was again subjected to syn- and postdepositional processes. The main difference with the upland situation, however, apart from the potential waterlogged conservation of organic remains, is the development of a cover. Due to the non-stable character of this cover each occupation period may witness individual 'sealing', preserving intrasite patterning and providing a degree of chrono-stratigraphic control during excavation. Intermixing of anachronistic site- (or veil-) related activities and their material debris will be more limited and a better grasp on intrasite structuring within a syn- and diachronic perspective is possible. Sites that match this profile (although with different length and frequency of occupation) are, for example, Hardinxveld-Polderweg, Hardinxveld-De Bruin, Bergschenhoek, Brandwijk, Hazendonk, and Schipluiden (see Appendix I). As was noted earlier, chronological separation of different use phases may take place at these wetland sites, but often does not include the entire site. Often the top is characterized by long-term upland conditions while sedimentation and submergence (and the resulting spatio-temporal control) feature on the slopes.

4.3.7 A continuum of conditions

Of course the distinction sketched above for upland and wetland sites with respect to occupation phases and syn- and postdepositional processes is far from absolute. The models presented should rather be perceived as opposite ends of a gradual sliding scale very much dependent on the specific geomorphological specifics of the site location, the intensity with which the location is used and the nature as well as the moment of the creation of a cover through sedimentation or submergence. The site of Hüde I provides a good example. Located in the marshlands on the southern shore of Lake Dümmer, the site is ideally situated for good preservation. Nevertheless a considerable difference exists in the preservation between different layers. The lower find horizon (*Unteren Schicht*) is much better preserved. Especially towards the edges of the settlement this layer yielded spectacular remains in the form of the remnants of six potential huts, constructed of posts and beams. Parts of walls, the floor and other structures were also documented and most finds belonged to the earlier pre-TRB phases of occupation (Kampffmeyer 1991; Stapel 1991). This excellent preservation is down to the fact that during this phase the site was partially or completely surrounded by water because of the active channels of the Hunte river. As the documented structures bordered on the channel delimiting the site to the northeast, frequent flooding must have taken place (Kampffmeyer 1991, 66-71). Eventually alder carr or peat deposits (*Bruchtorf*) covered parts of the site. Contrastingly, the upper layer (*Oberen Schicht*) consisted of compacted peat harbouring charcoal, wood and other finds (Deichmüller 1965; 1969). This layer contained finds from all periods, indicating that it had been subject to serious trampling, compression and soil formation (see Kampffmeyer 1991, 74). Little spatial information was available for the upper layer and not many posts were found (see also Appendix I). It is most likely that the later phases of Hüde I were exposed for extended periods of time resulting in accumulation and compression of archaeological remains. It may be concluded that rather extreme differences can exist within the preservation of remains at the same location that develop over the span of several centuries or perhaps even decades. Another example is provided by the site of Schokland-P14. There, repeated sedimentation on the lower slopes has led to an internal stratigraphy subdivided into five phases (A to E; see Ten Anscher 2012; Gehasse 1995, 27). The first of these, however, already spans a period of no less than eight centuries. This indicates that the presence of covering sediments in a wetland location is no guarantee for the preservation of remains, or for spatio-temporal information. It should be noted then that although a general upland-wetland distinction may be made, favouring the latter in issues of organic preservation as well as spatio-temporal information and chrono-stratigraphic control, this is an artificial distinction. All sites in fact are positioned along a continuum and their information potential is shaped by locally variable natural and systemic factors that influence preservation and level of information. For the period and area studied it is, however, the wetland side of this spectrum that has yielded most information.

4.4 Methodological perspectives

The regional differences sketched above in organic and spatio-temporal preservation and the differences in opportunities these offer with respect to qualitative information also have repercussions for the way in which sites have been and are excavated. In the following, several characteristics of these methodological aspects will be presented. First, a number of theoretical considerations affecting both natural and cultural factors influencing the composition of the archaeological record will be discussed. Subsequently a brief and general overview of the main research tradition in the LRA with respect to Mesolithic and Neolithic research will be sketched. This is followed by a number of methodological contrasts and approaches in regional and period-specific research.

4.4.1 Theory for patterning

For interpreting the patterns we deal with at sites in different environments a good understanding of the various factors that influence our regional datasets is a basic requirement. An overview of these processes with respect to site formation and taphonomy was given in the previous paragraphs. This information forms part of a set of filters that stands between our interpretation, which is based on what we excavate and, what Binford (1964, 425) has termed, the 'fossil' record of the actual operation of an extinct society. Especially in the positivistic era of 'New Archaeology', it was argued that certain heuristic methods would enable a better understanding of the relationship between the static archaeological record and past dynamic systems (*e.g.* Binford 1977; 1981[a,b]). An important example of this set of 'middle range theories' (see Rowley-Conwy 2004) was for instance the body of theory dealing with the factors surrounding the discard or deposition of artefacts and their subsequent archaeological recovery (Gifford 1978; Ratjeh 1974; Schiffer 1972; 1987; 1995). Schiffer's (1972, 14-15; 1995, 28-41) distinction between archaeological and systemic contexts and the natural and cultural transforms (C-transforms and N-transforms) operating between them remains a valuable approach for defining various processes affecting assemblage formation. Another useful perspective is offered by a number of studies distinguishing the various stages in processes acting upon the archaeological assemblages (*e.g.* Clarke 1973; Eggers 1959). One of the most comprehensive of these originates in palaeontology and distinguishes between four different stages of archaeological assemblages and the intervening processes (see Schiffer 1995; Sommer 1991. Activities and artefacts work or move between these assemblages, which range from a *biocoenose* (life community or assemblage), through a *thanatocoenose* (death assemblage) and a *taphocoenose* (burial assemblage) to an *oryktocoenose* (excavation assemblage). Defining how various processes act between and within these stages is very helpful when interpreting the way in which data has been patterned. A further contribution that is valuable in this respect is Binford's (1980; 1982) emblematic demonstration of the way in which sites develop into palimpsests by repeated (seasonal) site use, often with a different purpose.

Information, interpretation and redundancy

This body of theory helps to explain how archaeological information yieldsed to us over time. In this respect it informs us which crucial conditions have to be met for archaeological visibility. According to Gifford (1978, 98) there are three:

- Human activities have material consequences
- These material consequences must be potentially preservable
- Natural processes must act in such a manner as to preserve them

Sommer (1991, 60) identified a fourth:

- Anthropogenic artefacts and features must be recognizable as such

These points are 'basic knowledge' yet they are at the core of archaeological discourse. In line with them the archaeological procedure as a whole can best be classified as an internal paradox. Past dynamic communities generate a static pattern of cultural debris and potential information. This static pattern is then, partially preserved and varyingly distorted, transferred to the present day where it is documented by archaeologists.[4] Following this, what was recorded of the static pattern is used to arrive at statements concerning these past dynamic communities, aided by external information and experience. Within this classification two general processes are at work. On the one hand there is a decrease in the transfer of information; a signal, hampered by noise moving upward through the various filters. On the other hand a process of increasing interpretation moves in the opposite direction. In order to arrive at balanced statements on the dynamic aspects of past communities, we are dependent on both our capability to identify and compensate for the intervening processes of site formation as well as our willingness to keep an open mind with respect to the interpretation of past behaviour (see fig. 4.10).

A final factor of importance in interpreting current patterning is the behaviour of past communities. Crucial in this respect is the concept of redundancy, which implies the level of repetition generating a pattern. There is a delicate balance between repetition and recognition. The 'signal' of a hunting camp (*e.g.* Bergschenhoek, see Appendix I) may go unnoticed if the material correlates of the activities taking place there are too limited. Repetition of these (hunting and fishing) activities and accumulation of the associated material debris may, however, enable archaeologists to distinguish 'the signal' from the noise (other activities or taphonomic processes). On the other hand, the ongoing repetition of signals and their material repercussions in the same location will eventually again distort the information available and turn into noise once more. This is, in fact, palimpsest formation (see fig. 4.11; Bailey 2007). Sommer (1991, 61) points out that 'signal' and 'noise' are not absolute concepts. Due to repetition and other activities, the signal of a specific intrasite activity might turn into noise, while this same noise

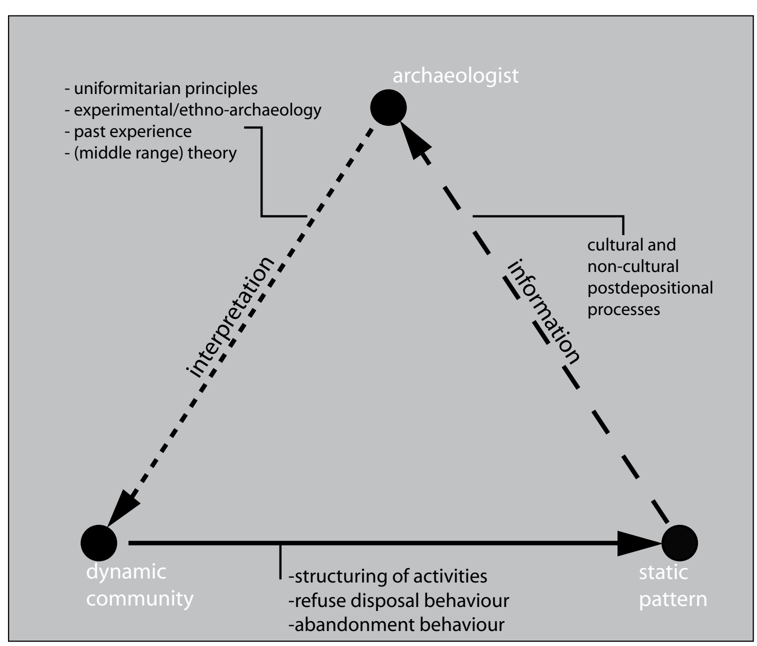


Fig. 4.10 Schematic representation of a number of factors and processes influencing patterning, information and analysis during the various stages of site formation and development of archaeological information.

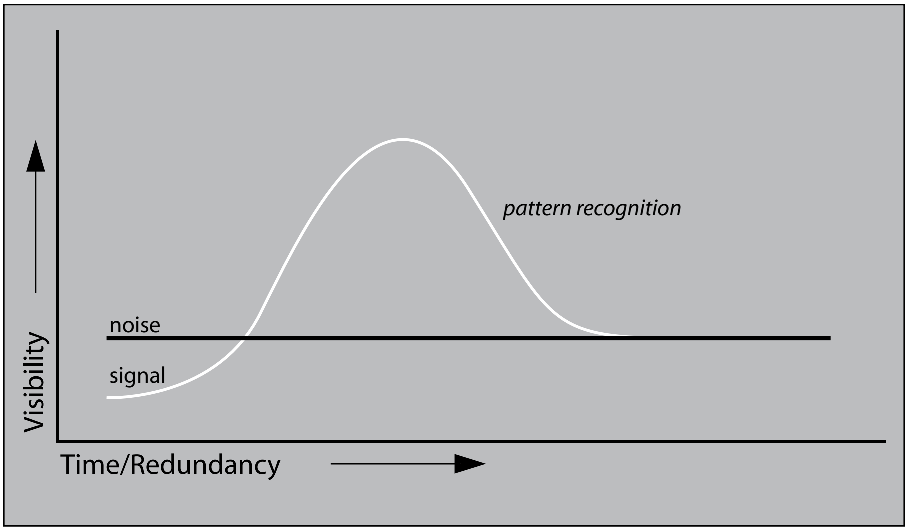


Fig. 4.11 Schematic representation of redundancy, 'signal, 'noise' and pattern recognition. Note that repetition and redundancy may both promote as well as distort the visibility of a signal.

again forms a signal on a higher level. For example retouch activities of points might get lost within the overall knapping debris, which in turn is indicative of an activity area on the level of the site. Realisation of the scale and resolution of the data available and adjusting the scope of the questions we ask and the type of research conducted is therefore crucial in understanding past patterning. It also forms the basis for explaining the (historical) differences in regional research traditions.

Reflections on Mesolithic and Neolithic perspectives

Apart from the theoretical background to the formation of regional information that may be sketched for the LRA, a further point of attention for understanding research approaches is formed by the specific connotations of the chronological division into a Mesolithic and Neolithic period.

It should be noted that archaeological discourse has long since moved on from any earlier stereotypical idea of opposing lifeways of hunter-gatherers and farmers (*e.g.* Childe 1952; see also Pluciennik 1998, 63). Based on ethnographic as well as archaeological studies the awareness arose of variation and mixing between these different categories (see Clark 1952; Lee/DeVore 1968; Zvelebil 1989). Nevertheless, as argued earlier (see Chapter 3) the concepts of Mesolithic and Neolithic are retained as heuristic categories that serve for studying past communities. This also means that they may, on a subliminal level, influence archaeological excavation and interpretation (Strassburg 2003, 542-544), simply because many of our methodological tools and approaches are derived from one or the other tradition of research and analytical thinking. In dealing with sites that may be positioned within a process of Neolithisation, harbouring aspects of both lifeways, it is important to be aware of this.

4.4.2 Research traditions in investigating Mesolithic and Neolithic sites

Situated between the Eastern European and French continental traditions focusing on data and classification and the Anglo-American theory-driven approach, archaeology in the LRA has long found itself in an intermediate position. The focus was mainly on data and the paradigmatic shifts experienced elsewhere were only pragmatically incorporated. For the second half of the 20th century, a number of influences may be mentioned briefly. It should be noted, however, that this is not an exhaustive analysis of research traditions and influences.

A first tradition is characterized by the functionalist and ecological approach, mainly originating from the post-war BAI (currently GIA) in Groningen (Waterbolk 2003), which was also implemented at other Dutch institutes in Amsterdam and Leiden. This approach might be characterised as ecological because of the relative importance of zoological, botanical and palynological studies. It has had an important influence on Meso- and Neolithic research in the study-area (*e.g.* Bakels 1978; Clason 1967; Groenman-van Wateringe/Jansma 1969; Waterbolk 1954) and continues to do so (*e.g.* Bakker 2003[a,b]; Out 2009). A second influence, dating to the 1960's and 1970s, is the positivist processual approach of New Archaeology, generated by several visiting scholars from abroad. They mainly focused on the Mesolithic and the transition to agriculture in the Netherlands and introduced elements of testing, statistics and spatial analysis into Dutch archaeological discourse (*e.g.* Newell 1970; 1980; Price 1978; 1981; Whallon 1978).

In the meantime German research concerning the Mesolithic and Neolithic in the study area was mainly dominated by the extensive LBK- and Rössen excavations of the Aldenhovener Platte (*e.g.* Lüning 1982[a,b]). These investigations can be seen in the light of the extensive research into *Siedlungslandschaften*. Analyses to a significant degree also focused on the sequencing of artefacts and chronology (*e.g.* Arora 1976). Much research in Belgium, apart from several LBK and MK excavations, focused on the Mesolithic (*e.g.* Gob 1981; Vermeersch 1984; 1989). Next to chronology and typology the Leuven school also meticulously excavated several sites such as Weelde-Paardsdrank and Brecht-Moordenaarsven in order to investigate aspects of spatial analysis and taphonomic disturbance (Huyge/Vermeersch 1982; Lauwers/Vermeersch 1982). Simultaneously the low-lying parts of the LRA saw the development of a wetland excavation tradition, characterized by the combination of various sources of information, mainly because of the preservation of organic remains. Excavations at Swifterbant fall within this spectrum as do those at Hekelingen and Vlaardingen (*e.g.* Deckers *et al.* 1981; Modderman 1953). Recently excavated sites within 'Malta archaeology', such as Hardinxveld-Giessendam, Hoge Vaart, Ypenburg, Doel-Deurganckdok and Schipluiden may also be placed within this context. An early German example is formed by Hüde I in Niedersachsen (Deichmüller 1969).

From a distinct theoretical perspective developments have been more limited. Van de Velde (1979) for instance focused on the social aspects of the LBK. Verhart (2000) studied the transition to agriculture in the light of contact and exchange between foragers and farmers and Raemaekers (1999) used cultural transmission as a means to study the rate of the process of Neolithisation. Recently, Louwe Kooijmans (2009) introduced the idea of 'agency' in relation to an analysis of Hazendonk sites in the Delfland region. Overall these approaches have been intent on arriving at distinct models for defining society and as such have also remained distinctly functional.

Limited change

It may be concluded that, in contrast to developments in British, Irish and Scandinavian archaeology, the basic outline of Meso- and Neolithic research in the LRA remained relatively constant. Several traditions, each with their own emphases, might be defined. This may lead to problems of comparability, but these are mostly of a practical nature. For instance, a meticulously documented Mesolithic flint scatter is not readily comparable to a Mesolithic site where most analytical attention has been devoted to studying the contents of hearthpits. In this respect one of the major changes of the last few years may prove to be the introduction of commercial archaeology. This has on the one hand led to a different work-ethos which is often more inclined towards purely recording due to constraints of time and money. On the other hand it (albeit incidentally) enabled excavations of a previously unknown scale and importance. The impact of recent excavations of sites such as Hardinxveld-Giessendam Polderweg and De Bruin, Schipluiden, Ypenburg and Hoge Vaart on the existing body of knowledge for that specific period is indicative of the large differences in quality and potential existing in the available dataset. This raises the need for an assessment of these differences as well as of the limits of comparability between high and low quality sites.

4.4.3 General emphases in excavation practice

A major impact on the way in which sites are excavated, apart from issues of time and funding, is the specific interplay between the nature of the archaeological remains and the regional and local geological and geomorphological situation. An important result of this is the fact that we use different scopes to study the past in different areas. This can be demonstrated by a topical discussion of a number of aspects.

Scale

For instance, many upland Mesolithic locations have been studied through small-scale excavation, focusing on the concentrations of artefacts (Crombé *et al.* 1999). In contrast upland Neolithic sites are usually excavated more extensively because of the assumed potential for finding features and structures and, often, the less distinct spatial information present at the surface. Wetland excavations are again often limited in size due to the financial and technical restrictions in excavating waterlogged sites. Also the limited surface of the inhabited elevation, for instance a levee or a river dune may form a factor in this.

It should be noted that these differences are not absolute. The excavation of a wetland site on a coastal barrier, such as for instance Schipluiden or Ypenburg, is, to some extent, more comparable to an upland Neolithic excavation than to, for instance, more distinct wetland sites and excavations, such as those at Hardinxveld or at Swifterbant-S3. While there is thus a coarse-grained distinction in the scale of excavation between Mesolithic and Neolithic upland sites and between upland and wetland sites, it is important to remark that the physical extent of the excavations and the level of detail is significantly influenced by constraints of time and money and technological possibilities. Recent commercial excavations such as those at Hardinxveld, Hoge Vaart, Schipluiden and Ypenburg, under the flag of large-scale infra-structural works (see Appendix I) in this respect are at the positive end of a diverse spectrum. Next to this factor the (expected) characteristics of archaeology from a certain period or analogous site and specific research questions also shape the characteristics of excavation.

Finds and/or features?

Apart from scale there are also other differences in field methodology, often related to the type of archaeology that one may expect to encounter. As argued above, many excavations of Mesolithic upland sites are aimed at recording artefact distributions (see Weelde-Paardsdrank or Brecht-Moordenaarsven in Appendix I), while features form a prominent research aim at upland Neolithic sites (see Veldhoven-Habraken, Appendix I). At wetland sites, both features and finds are often preserved and may be recorded. These contrasts relate to whether previous patterning in finds was present or whether features were there initially, as well as to the extent that both have been preserved. For instance, apart from hearths certain other features may not be expected or preserved at upland Mesolithic sites, and, as at Mariënberg, pattering in finds may be absent altogether. In other situations features may be extremely difficult to discover, as at many Middle Neolithic sites on the sand and loess. Decisions are therefore made based on the assumed presence, or absence for that matter, of features and patterning in finds, which means that different emphases exist in excavation strategies.

4.4.4 Methodological characteristics of upland and wetland excavations

Apart from the more general contrasts discussed above a number of additional aspects may be mentioned. In the following, a number of differences between methodological approaches of sites will be discussed for Mesolithic and Neolithic upland sites and for wetland locations. While these are not exhaustive, they serve to illustrate the differences in datasets we are dealing with and the different emphases that exist in methodological approaches (see also Peeters *et al.* 2002).

4.4.4.1 Artefacts

Because of the characteristics of preservation at sites, in combination with period-specific artefact categories (*i.e.* absence of pottery at Mesolithic sites, however see Amkreutz *et al.* 2010), sites have been excavated with different emphases in recording and analyses. In general, research at most Mesolithic upland sites has been aimed at typo-technological analysis and spatial distribution. Both are affected by the palimpsest effect due to recurrent (yet varying) use at different times, the absence of a cover and post-depositional processes. The value of a definition of certain subgroups, as for instance has been done by the Leuven school (*e.g. Groupe du Moordenaarsven*, *Groupe du Paardsdrank or Groupe du Ruiterskuil*), is therefore of limited chronological or functional value (see also Vermeersch 1984, 186-193). Similarly, many techniques that were employed in the 1970s and 1980s to deal with spatial patterning (*e.g.* Newell 1984; Price *et al.* 1974; 1978; Huiskes 1988; Whallon 1973; 1974; 1978) proved incapable of countering the palimpsest effects (see Binford 1987a, 502-508; Hodder/Orton 1976, 239; Newell 1987). The usefulness of, for instance, 3D-recording as was initially done at sites such as Bergumermeer, Weelde or the Hazendonk (see Appendix I; Huyge/Vermeersch 1982) is currently being questioned due to the many occupation events that took place at these sites and their long exposure to post-depositional processes. For the well-preserved Federmesser site of Rekem, the excavators argued: '*Although they may have some heuristic value, and can certainly be used for testing hypotheses, we have the overall impression that many of these procedures are no match for the complex processes involved in artefact distribution and they generally fail to contribute to the ultimate interpretation of the layout*' (De Bie/Caspar 2000, 29). The regular use these days of applied archaeological cartographic software is also more geared towards enhancing the visual and thematic interpretation of sites. It therefore appears that the erstwhile popular procedures involving intensive three-dimensional recording and complex statistical analysis have become obsolete for most of the studied sites in the LRA. The complex nature of syn- and postdepositional processes and the differences among these are much better controlled by a flexible and contextual perspective that correlates the precision of the excavation technique with the level of taphonomic disturbance.

At Neolithic upland sites the distribution of finds, even in the plough soil, has recently received increased attention, because of the possibilities of correlation with visible or expected features below (Rensink *et al.* 2006).[5] Overall, for the sites studied some patterning in upland finds may be witnessed, but this seems related to a significant degree to the exposure time before a cover formed. The spatial patterning in finds at a site such as Sint-Odiliënberg-Neliske is inferior to that at sites that were covered shortly following occupation, such as for instance Gassel or Schipluiden (see Appendix I).

Specific preservation

Another aspect related to this is the degree to which certain artefact categories have been preserved. A first example is formed by pottery. Apart from some Mesolithic sites with questionable association pottery does occur at Neolithic upland sites, but only to a limited extent. In contrast to, for example, the preservation environment in LBK pits, pottery at Neolithic upland sites seems to have suffered intensively from post-depositional processes and exposure to the elements. Its survival is dependent on baking temperature, clay and temper used and the acidity of the soil in which the sherds have become embedded (Groenewoudt 1994, 113; Raemaekers 2005[b], 16). This poses a distinct problem for the identification of (the nature of) sites and their cultural attribution in upland environments. Examples included Middle Neolithic flint scatters or the question to what extent Swifterbant and Hazendonk sites occur on the Pleistocene sandy soils (*e.g.* Amkreutz/Verhart 2006; Niekus 2009; Raemaekers 1999, 123; Raemaekers 2005[a], 262; Vanmontfort 2004, 313).

Apart from lithic and ceramic finds, organic artefacts are virtually absent in the upland areas. This forms a strong contrast to wetland sites where, for both the Mesolithic and Neolithic periods, organic remains, including artefacts, provide a wealth of information (Coles/Coles 1989; Louwe Kooijmans 1993[a], 73). Since this forms a problem for comparing sites, other categories such as site size, feature type and lithic assemblage provide a means for analysis of similarities in use and function (see also Chapter 5). Evidently the differences in preservation have also influenced excavation and sampling choices as well as analytical techniques.

4.4.4.2 Features

Concerning features, Mesolithic upland sites are characterised by surface hearths and hearthpits (see for instance Mariënberg, Weelde, or Opglabbeek in Appendix I). Finds from these features are often limited to (some) calcined bone, charcoal and charred botanical remains. For the category of hearthpits research points to their use as specific facilities for low combustion burning, perhaps in the preparation of food or tools (Niekus 2006; Perry 1999). Other features are rarely recorded (for an exception see Mariënburg, Louwe Kooijmans 2012[b]; Verlinde/Newell 2006) and are sometimes interpreted as 'ghost-structures' based on the artefact distribution. At the sites of Weelde and Meeuwen-In den Damp, for instance, the presence of huts, or tents and activity areas is inferred by the patterning in lithic remains (see Appendix I; Huyge/Vermeersch 1982; see also Stapert 1992). The supposed hut features recorded at Bergumermeer-S64B are no longer tenable as such (Niekus 2012). The absence of many structural features for Mesolithic upland sites may very well reflect the limited investment in built environment by these mobile groups.

Absence of evidence?

For Neolithic upland sites the overall absence of features, except for the Early Neolithic LBK, poses a problem in the recognition and interpretation of sites. A good example is formed by the sparse information available for MK and SWV settlements in the study area. most of these sites consist of scatters of flint of variable extent, some pottery and often no or very few features (*e.g.* Louwe Kooijmans 1998[a], 413; Schreurs 2005, 309-310; Vanmontfort 2004, 313). Only in some cases are house plans discovered, such as recently at the Stein-culture site of Veldhoven-Habraken (Van Kampen/Van den Brink 2013/in prep.) Their virtual absence on the sandy soils can be explained in several ways. From a behavioural perspective it might be indicative of a rather ephemeral settlement system, marked by light structures and a frequent displacement of houses to new locations. Evidence for a partially comparable system is available from Southern Scandinavia, Britain and Ireland (*e.g.* Barclay 1996; Sheridan 2013; Smyth 2006). The often-solitary occurrence of features furthermore led to the assumption of single house sites, which were regularly rebuilt elsewhere as the soil was depleted (see Cauwe *et al.* 2001; Verhart 2000, 219). We thus may overestimate the visibility of the initial material reflection of this type of settlement system. The elaborate houses from Veldhoven, however, seem to argue against this (although they, of course, need not be emblematic for Neolithic upland occupation). The absence of decent faunal spectra for upland Neolithic sites, or evident indications for crop cultivation unfortunately means no further light can be thrown on issues of site duration and permanence.

There is on the other hand also evidence of severe taphonomic disturbance of features dating to this period (*e.g.* Burnez-Lanotte *et al.* 1996; Groenewoudt 1994; Vanmontfort 2004; see also below). Groenewoudt (1994, 113) mentions the disturbing effects of bioturbation and soil formation processes leading to the gradual disappearance of features, especially on well-drained sandy soils. Features have often disappeared or are only visible on a lower level and thus easily missed (see table 4.6). To some extent this is less the case with features at, for instance LBK, or Late Neolithic sites, at least on the loess. These seem to have been dug

Site	Nfeatures	N preh. features/Neolithic	N Neolithic structures
Gassel	?	-	-
Grave-Pater Berthierstraat	10	3/1	-
Helden-Panningen Industrieterrein	>318	318/3	-
Ittervoort-Santfort	>300	*c.* 100/3	-
Kesseleik-Keuperheide	>4	4/1	-
Koningsbosch	-	-	-
Linden-de Geest	57	16/1	-
Linden-Kraaienberg	45	45/3	-
Meeuwen-Donderslagheide	-	-	-
St-Odiliënberg-Neliske	42	17/2	1?
Sweikhuizen	-	-	-

Table 4.6 Indication of the presence and visibility of Neolithic features on the upland sandy soils. The second column indicates the number of prehistoric features and positively identified Neolithic features on the basis of their contents (see Appendix I for further details).

before and after the period of soil formation respectively (pers. comm. J.W. de Kort 2012; see also Rensink *et al.* 2006; St.-Odiliënberg-Neliske in Appendix I).[6]

Finally, we might be looking for these structures in the wrong manner. By opening long and narrow commercial test trenches, Neolithic house sites, possibly consisting of dispersed functionally distinct areas, might easily slip through the established mesh as was demonstrated for the site of Stora Herrestand in Sweden (Rowley-Conwy 2004, 93-94).

At wetland sites features are in general reasonably well-preserved, due to (often relatively) quick sedimentation rates. As demonstrated at sites such as Hardinxveld, Schipluiden, Ypenburg and Hoge Vaart, this offers the opportunity of combining information from finds and features, which affords a better handle on occupation dynamics. A good example is formed by the clustering of finds at Schipluiden (see Wansleeben/Louwe Kooijmans 2006) and the information this yielded on the habitation areas defined by clusters of posts.

4.4.4.3 Chronology and dating

Apart from feature- and find-related contrasts between upland and wetland locations, both also offer a different potential for sampling. With respect to absolute and relative dating and chronology of sites, the differences are marked. Upland sites suffer from a limited amount of material suitable for radiocarbon dating. Furthermore, especially charcoal has often been contaminated, or suffers from the old-wood effect and problems may arise in the pre-treatment of samples (Crombé *et al.* 1999; 2012; Lanting/Van der Plicht 1999/2000, 4-5; Van Strydonck *et al.* 1995; Waterbolk 1971). Short-lived samples such as hazelnut shells may yield better results. Nevertheless, one of the major issues at these locations is the question of association of samples and the phenomenon that is to be dated (Waterbolk 1971, 15-16). Van Strydonck *et al.* (1995, 291; see also Crombé *et al.* 2012) mention the fact that especially archaeological sites on the sandy soils suffer from the dislocation of artefacts and datable material. The main reason is the lack of an adequate and swift covering of previous habitation surfaces. The long-term stability of the landscape therefore leads to contamination due to syn- and postdepositional processes. Verhart (2000, 213), for instance, mentions the intrusiveness of material from other levels. Another important aspect is the general absence of pit fills at upland sites as argued above. Based on these characteristics Van Strydonck *et al.* (1995, 296) have therefore opted to abandon the classic relationship between dates, stratigraphy and artefacts in some cases and to treat the available ^{14}C dates as a group within which clusters can be defined.

For wetland sites one of the problems is formed by the reservoir effect, which causes ^{14}C samples of animal and human bone as well as food remains (residue on pottery etc.) to be dated as much as several hundreds of years older than expected.[7] Samples from several species of water plants are also unreliable because of their uptake of water with an ancient signature (hard water effect).[8] In general, however, wetland sites offer a range of benefits for dating and establishing site-chronology. With respect to absolute dating the organic material and its association to the archaeological finds or features that are to be dated is often far less ambiguous. Apart from that, the (potential) cover by peat or clay in subsequent phases of sedimentation offers a 'partitioning' of the site in stratigraphical layers (see also above). The relative periodization of these sites therefore offers a better framework for dating phases and events. It may therefore be concluded that the degree of spatio-temporal and general chronological control is appreciably greater at wetland sites.

4.4.4.4 Subsistence, seasonality and ecology

Although self-evident some remarks may be made regarding the information available for reconstructing subsistence, seasonality and ecology. Regarding all three topics the potential degree of information available from wetland sites is considerably larger when compared to upland locations (see wetland sites in Appendix I). This mainly relates to the fact that a much wider array of organic remains, informative on subsistence and the wider environment is preserved at these sites, whereas most organic information on upland sites has to be derived from charred botanical remains or calcined fragments of bone. These offer a much smaller and distorted sample that is also filtered by the necessity of fire for preservation and therefore (often) only represents a hearth-related sample. A good example is provided by the wealth of organic information available for the wetland Mesolithic sites of Polderweg and De Bruin (Louwe Kooijmans 2003), in comparison to for instance the botanical information from hearthpit sites such as NP-3 (Perry 2002) or the faunal remains preserved at Weelde-Paardsdrank (Huyge/Vermeersch 1982). With respect to environmental reconstruction pollen forms a category of information that may be present in both upland and wetland contexts, although it should be noted that problems of association or intrusion occur more frequently and intensely at upland sites (*e.g.* Vermeersch *et al.* 1992).

While it is easy to caricaturize the distinct contrasts that exist in this respect between upland and wetland sites, this is not helpful. Yet, it should be stressed that we are dealing with very different datasets that are hard to compare and that make inferences about subsistence, site location choice and seasonality or mobility in different landscape zones difficult. It therefore remains necessary to integrate organic data, or the absence thereof, with artefact categories or other aspects, such as site location choice, features and sources of information such as pollen etc. that are intercomparable and that may offer a better understanding of the similarities and differences in behaviour in different (upland and wetland) areas (see also Chapter 5).

Something that redresses the (dis)balance in information a little is the fact that the wider palaeolandscape in the wetlands can only be established by augering and removing covers, while on the uplands it is to a large extent visible at the surface. Differences do of course arise once again when attempting to reconstruct vegetation and fauna, for which upland locations offer fewer and more limited opportunities.

Problems in sampling and analysis

While the quantitative and qualitative balance in available sources of (organic) information clearly lies with sites in the wetland spectrum, this does not mean that the information deriving from them is necessarily straightforward. Especially with respect to faunal and botanical remains, many problems and pitfalls can be encountered when trying to establish an idea of subsistence, seasonality or ecology (see also Rowley-Conwy 2004). Without attempting to be exhaustive a number of these may be briefly mentioned.

For botanical remains this for instance involves differences in the degree to which certain species will be preserved (for instance hazelnuts), due to their physical qualities or preparation in cooking etc. With respect to agriculture there is a difference in the importance of specific sources of information. Palynological information may shed light on threshing or cultivation activities (*Cerealia* and *Landnam* pollen), or the presence of open spaces. Ard or hoe marks may point to crop cultivation, as does sickle gloss on lithic instruments or, potentially, the presence of long straws among the botanical remains. Grinding stones again only point to consumption, while macro-remains of cereals may point both to consumption and preparation (threshing or winnowing in the case of chaff and consumption in the case of cereals). Non-local weeds may indicate where cereals were grown and whether they were imported (*e.g. Bromus secalinus*). Arguably it is the combination of these indicators in relation to quantitative issues and site location choice that may shed light on, for instance, the question of local cultivation versus the import of cereals (see also Bakels 1986; Cappers/Raemaekers 2008; Out 2009; Rowley-Conwy 2004).

Similar considerations apply to faunal remains. For instance, regarding the differential preservation of bones (*e.g.* autolysis in fish bones, and the predominance of bony sturgeon plates, or the superior preservation of longbones in mammals compared to other skeletal elements etc.). Related to this is the number of identifications compared to the number of counts (*e.g.* Van Neer *et al.* 2005, 282), the elements that are taken to the sites and the interpretational differences between the number of bones, the bone weight and the caloric or meat value attached to these. This is especially poignant when attempting to compare the subsistence contribution of diverging categories such as fish, birds and terrestrial animals. Another aspect is formed by the presence of background fauna (and flora) that should be filtered out (see also Beerenhout 2001; Binford 1981[b]; Zeiler 1997).

A different topic involves the difficulties that arise in metric distinction between wild boar and pig and aurochs and cattle and the validity of distinguishing a combined category of pig and wild boar (as was for instance done at P14, see Gehasse 1995, 5; see also Albarella *et al.* 2007; Rowley-Conwy *et al.* 2012). It should be realised what consequences this has for identifying the (economical) stage of Neolithisation based on faunal counts, as is for instance done in the availability model (see Zvelebil/Rowley-Conwy 1984; Zvelebil 1986[a]; Raemaekers 1999). Of a different nature, but also important are the specific questions addressed to the faunal samples. Was the aim to arrive at a purely biological count, or were more behavioural questions such as subsistence, environment, seasonality and hunting strategies taken into account?

These considerations indicate that many factors and filters impose themselves on our interpretation of botanical and faunal information, for answering questions of subsistence, seasonality and land-use. Although wetland sites may be regarded as qualitatively superior in preservation, and thus also in terms of information regarding many of these issues, the actual value of the information depends on the manner in which it was analysed and the degree to which various filters were dealt with. It is therefore important to note that while there may be a specific physical distinction in the information sources available resulting in our dealing with different types of datasets, there are furthermore distinct methodological differences in the way these different datasets were recovered, sampled and analysed and in the specific problems these differences yield.[9] One of the major factors again is the degree to which time and funding was available for and allocated to tackling these issues.

4.4.4.5 Implications for establishing site-function

Taking into account the considerations above, it becomes apparent that there are considerable differences in the (types of) data available at wetland and upland sites that result in a number of different methodological emphases in excavating and analysing information from these locations. As argued earlier it is therefore difficult to compare sites located in these different environments. Nevertheless, by focusing on other categories of information, such as for instance pottery or lithic remains (artefact spectrum, number of finds, distribution, raw material sources, use-wear), features, site locations choice etc., certain similarities and differences in site-use and site function may be recognized (see Chapter 5).

With respect to the position of sites in the process of Neolithisation in particular, it may be argued that the identification and quantification of cultigens and domesticates often pose problems of their own. The relative contribution of these novelties both to the diet as well as in daily life are, however, more important than their presence or absence (see also Chapter 3 and Chapters 7-8). To some extent, the often-encountered (taphonomic) difficulties with establishing the relative contribution of specific categories of food to the diet might partially be resolved or complemented by isotope analysis (*e.g.* Smits *et al.* 2010). Finally, it is important to be aware of the fact that while botanical and faunal indicators potentially provide an idea of the stage within the transition to agriculture, or in terms of Zvelebil (1986[a]), availability, substitution and consolidation, this does not directly translate into how (new) resources were dealt with, or to what extent a process of Neolithisation progressed. This will be further touched upon in Chapter 7.

4.4.5 A note on the limits and delimitation of sites

Apart from the general methodological considerations discussed above, the different geological situation and associated site formation processes in uplands and wetlands also influence the extent of sites that may be documented (*cf. supra*). Furthermore, it presents different opportunities and problems with respect to the delimitation of the site itself, its perimeter and the wider region.

With respect to site extent, a brief review of the sites in Appendix I indicates that the majority has not been excavated completely and that, except at some locations where augering or testpitting took place, the overall extent of the site is not known. It appears that site extents are somewhat better established for wetland sites, which of course predominantly relates to a more limited palimpsest effect and the preservation of intact occupation layers that may be delimited (*e.g.* Louwe Kooijmans/Verbruggen 2011), in combination with, for example, the physical extent of a river dune or levee.

Behavioural limits

Apart from site-formative issues it is also difficult to establish the delimitation of sites from a behavioural perspective. In the case of Mesolithic flint scatters, such as those at Brecht-Moordenaarsven (Vermeersch *et al.* 1992), refit analysis may attest to the contemporaneity of certain clusters or concentrations at a site, although it cannot be excluded that what is actually documented is the re-use of material that was discovered at a later moment after a cluster came into existence. Of course the blurring of patterns in this respect increases when sites have been subject to more intense spatio-temporal collapse and re-use of locations (Binford 1982; Conkey 1987). The same problems are to be found at wetland sites. For instance the supposed 'twin-site' relationship between Hardinxveld-Polderweg and De Bruin (see Louwe Kooijmans 2003) is a plausible educated guess, but hard to prove conclusively. In line with this, the occurrence of archaeological indicators next to well-excavated sites such as Bergschenhoek, Schipluiden, Hoge Vaart and Bergumermeer (see Appendix I) may perhaps not cast doubts upon the degree to which the core of these locations has been documented, but does raise the question to what extent it relates to similar, subordinate, or perhaps in the case of Bergschenhoek, larger activity areas in the vicinity.

As was already mentioned earlier, resource issues of time and money importantly influence the extent of what is known, as well as the difficulties that arise technically, as is for instance demonstrated by the relatively limited excavations at wetland sites, in relation to estimated site sizes (see table 4.7).

On the other hand specific research traditions may be an influence here as well. Crombé *et al.* (1999) for instance argue that the absence of hearthpits at most of the Belgian Mesolithic sites might be due to the limited area that is usually excavated. Such considerations are especially telling when it is realized that intersite refits and raw material from, in this case, the Early Mesolithic sites at Weelde-Voorheide, indicates that functional relations may exist between clusters located at a considerable distance from each other (possibly up to 300 m; Verbeek 1996).

Site	Extent excavation m²	Est. extent site m²	References
Hdx-Polderweg layer 1	448	4000	Hamburg/Louwe Kooijmans 2001
Hdx-Polderweg layer 2	448	1600	Hamburg/Louwe Kooijmans 2001
Hdx-De Bruin layer 1	345	1200	Nokkert/Louwe Kooijmans 2001
Hdx-De Bruin layer 2	345	1200	Nokkert/Louwe Kooijmans 2001
Swifterbant S3/5/6	400	600-760	De Roever 2004/Van der Waals 1977
Swifterbant S2	451	750	Raemaekers *et al.* 2005; De Roever 2004
Brandwijk L30	29	200 + top	Raemaekers 1999
Brandwijk L50	29	1500 + top	Raemaekers 1999
Brandwijk L60	29	1600 + top	Raemaekers 1999
Hazendonk Haz-1	±342	800	Raemaekers 1999; Verbruggen 1992[b]
Hazendonk Haz-2	±342	300	Raemaekers 1999; Verbruggen 1992[b]
Hazendonk Haz-3	±342	730	Raemaekers 1999; Verbruggen 1992[b]
Hazendonk-VL1b	±342	760	Raemaekers 1999; Verbruggen 1992[b]

Table 4.7 Excavated and estimated site surface of several wetland sites. Note that often only small samples have been excavated.

Nevertheless, as is demonstrated by excavations such as those at Hardinxveld, or from a different perspective Hoge Vaart, the limited sample of a high resolution excavation, or a part of it, may within certain limits be considered representative for the entire site (*e.g.* Louwe Kooijmans 2001[a]; Peeters 2007).

From site to region

On a related but larger scale the level of information on sites and settlement systems in the region is also dependent on local geomorphological circumstances and site formation processes. In general it may be postulated that upland sites are more easily detectable, since they are at or near the surface and may be documented by fieldwalking etc. Wetland sites on the other hand are often not visible at the surface. This means that they are only discovered by methods such as augering, or for instance construction work. Specifically telling in this respect is the quick increase in number of sites and information on the Swifterbant, Hazendonk group and Vlaardingen culture occupation of the Delfland area and the region around Rotterdam over the past decade (see Appendix I; Koot *et al.* 2008; Louwe Kooijmans 2006[a]; Meirsman/Moree 2005). This points to the fact that these days, despite the limited scope for surface surveys, wetland areas offer indirect opportunities to conduct regional research. Similar work has been conducted directly in the Alblasserwaard region by an extensive augering programme conducted by the Faculty of Archaeology (Leiden University; see Louwe Kooijmans/Verbruggen 2011; Verbruggen 1992[b]; Verbruggen in prep.), documenting the Mesolithic and Neolithic occupation of the donken area. Recently (Louwe Kooijmans 2009) it has been demonstrated for the Hazendonk occupation of the Delfland region that these regional perspectives throw an interesting light on the diversity within the settlement system and the behavioural choices made by contemporaneous communities (see also Chapter 6).

A cautionary note is called for as we have still only documented part of the potential of occupation locations that may have been present. For the area around Schipluiden an estimate was made of the total surface of (inhabitable) dunes in the area. This was based on the augering data gathered at Schipluiden (see Mol

2006, fig. 14.7). By measuring the total dune surface mapped by augering and its contribution to the overall area documented, an estimate of 12% was established, incorporating a certain correlation for less intensively investigated zones (*cf.* Mol 2006, 282; see fig. 4.12). Subsequently this number was extrapolated for the entire back-barrier area. This procedure is of course complex since the extents of the area documented and calculated are flexible, but it can serve as a rough estimate. For the coastal back-barrier area, measuring approximately 34 km^2, the total surface area of potentially inhabitable locations amounts to 4.1 km^2. Yet, only a total of approximately 10.000 m^2 (1 ha) has been archaeologically excavated, although a number of locations were investigated by augering etc. Overall it can, however, be suggested that approximately 0.25% of the inhabitable area has been investigated. Another example is formed by the Swifterbant area where only a mere 2% of the potential site surface has been excavated (see Devriendt 2013; Raemaekers 2006). Of course only a small percentage of the inhabitable area was actually used, but this serves to demonstrate how much *terra incognita* remains. In our interpretation of past settlement systems and site functions we should be aware of what we do not (yet) know and, regarding-the upland-wetland distinction discussed earlier, deal with the quantitative benefits and methodological limitations of the former, versus the qualitative character and spatio-temporal opportunities afforded by the latter.

4.4.6 Retaining a site approach?

The foregoing paragraphs have discussed various methodological repercussions of dealing with sites in different (upland and wetland) contexts. It should be apparent that sites in different geological and site-formative environments offer different opportunities and constraints for establishing site function and site delimitation (identification of what belongs to the site proper, to the site perimeter and to its direct surroundings (see also Bakels 1978)). Furthermore, the potential for regional and landscape-oriented investigations differs. In the past, especially some of the constraints of identifying sites have led to approaches that advocate a regional or landscape perspective on archaeological information instead of a site approach. This has contributed significantly to our understanding of settlement systems and landscape use, but it is argued here that the site should not be abandoned as a conceptual framework in archaeology.

Site criticism

Underlying a regional or landscape approach is the idea that, although in many archaeological studies the site is often the basic (spatial) unit of analysis, its value as a heuristic device is questionable. Foley (1981, 157) argues that the archaeological record is not punctuated but spatially continuous. Within the overall dispersion of artefacts localized densities occur, or, according to Isaac, patches within a scatter (1981, 136). We usually refer to these concentrations as sites, but they come into existence for different reasons related to various syn- and postdepositional events. In this respect Dunnell (1992, 26-29) refers to them as accretionary phenomena. According to Dunnell sites are often perceived as things that can be observed, rather than units that are constructed by observation at a particular point in time (*ibid.* 26). While the contemporary nature of the archaeological record is generally accepted, Dunnell proceeds from this point and argues that sites should therefore not be used as units of observation, association, counting and interpretation.[10]

For the Mesolithic and Neolithic of the LRA Peeters (2007, 23-27) documents similar problems regarding the delimitation of Stone Age sites. Should the distribution of lithic remains be documented, or perhaps that of bone or charcoal? Drawing on the arguments put forward by Foley (1981) and Dunnell (1992), Peeters opts to abandon the site concept in favour of a landscape approach. According to him the site-approach is an actualistic approach by which inferences are drawn with regard to settlement systems as an expression of landscape use. His criticism is levelled at the idea that the evidence for dimensions of land-use is not restricted to points and that in this way many aspects of behaviour are not studied (*ibid.* 25). This, however, seems a semantic discussion. Binford (1992, 50-51), for example, defines sites as '*conceptual generalizations about the spatial distribution of artifacts*' but he also stresses the importance of '*scalar variability, which is differentially accessible in the landscape*' and responsible for the variability in patterning. While Binford emphasises scale, Peeters (2007, 26) argues it is not about scale.

The notion site is understood to be problematic. Much more than spatially and chronologically integrated *loci* of functionally coherent artefacts and features, they (archaeologically) are the material amalgamations of (mainly) disposal and abandonment activities. Moreover, the occurrence and specific constellation of these static and mobile phenomena at locations referred to as sites, is to be imputed to a considerable variety of factors, including anthropogenic behaviour as well as natural processes. Peeters (2007, 26) argues that there are many activities with little or no archaeological output (for instance a discarded scraper or a palynological signal) that are of equal importance. Arguing whether or not they are 'covered' by a site approach is, however, strongly dependent on what one defines as such. From an analytical perspective the concept of site is indeed insufficient since it is only a clustering of archaeologically detectable, material manifestations of the archaeological record. On the other hand one might wonder to what extent the informative value of archaeological data *not* covered by the concept of site *sensu lato*, can be contextualized, characterized and attributed to the archaeological and cultural object of investigation (*e.g.* Jeunesse 2003). From an interpretative viewpoint, however, the concept of site is very much an ontological categorization. It has value for the contemporary archaeologist working at a site or with the information excavated or documented. It has documented or inferred boundaries and the information acquired serves as a contrast or comparison to other sites or isolated finds and patterning. Whether or not in concordance with this contemporary perspective, sites in a past reality would have been equally relevant as the locations of some form of past human activity of singular, repetitive or interspersed nature. Sites in this sense might have had no specific meaning to 'occupants' in the past, but may also have been a form of niche construction (*e.g.* a bountiful hunting location), a field or fishing weir, a home or a sacred place.

Dealing with sites

It seems that abandoning the site-concept is unnecessary. Considering the archaeological record from a different scale such as a landscape or artefact approach might lead to new insights and is therefore recommendable. However, the essential problem, explaining the observed patterning and finding methodological means to do so, remains the same (*cf.* Binford 1992, 55). Apart from this, abandoning sites as units of *interpretation* overlooks the fact that they are meaningful on two different levels. First of all sites, apart from being distorted accretionary phenomena, do have an intrinsic functional value. With appropriate techniques most sites, to some extent, can spatially or stratigraphically be broken down into chronologically and/or functionally autonomous or related components. Apart from an adequate cover this is mainly dependent on the level of redundancy and whether or not activities were more or less spatially bound (see also Sommer 1991). The presence and re-occurrence of built environment and activities at a certain place are thus purposeful and provide meaningful insight into past societies. Secondly, from an *emic* perspective the site concept is of value since it provides the means to translate *space* into *place*. Whereas the former is a physical concept, the latter is meaningfully constituted and of actual (albeit variable) significance to past societies (see also Casey 1996; Ingold 2000; Feld/Basso 1996; Jones 2007; Verhoeven 1999). The sites studied here were often ordered and structured by their initial users. They often formed fixed points in daily routines and seasonal or annual cycles of mobility. There is ample evidence of the development of certain locations into 'persistent places' that witnessed repeated occupation and use over many decades and even centuries (*e.g.* Barton *et al.* 1995; Schlanger 1992). Even if they only represent isolated singular activities, their location and structuring will usually have been more than purely coincidental. Abandoning the site-concept is thus also partly abandoning a search for classification. For these reasons it is valuable to retain the site concept and wield it as a basic unit of analysis and interpretation as is done in this study. Sites and especially excavated sites thus remain the archaeologist's bread and butter as was stated by Binford (2002, 109).[11] However, for a better understanding of the dynamics of past systems, especially within a coherent regional context, it is obvious that an integrated approach incorporating landscape and artefact perspectives is both necessary and of great value. Sites remain in need of contextualization.

4.4.7 Current Dutch situation

The overview above has singled out several common methodological problems ranging from perspectives regarding the implications of Neolithic and Mesolithic, through sampling procedure, to the role of sites and the limits of our interpretations. As has been argued, issues of time, money and resources have often formed and still form a crucial factor regarding the quality and quantity of the information that is excavated. Over the past two decades much has changed in the archaeological field in the Netherlands. The most important development was the introduction of a commercial market for excavation next to the research conducted by universities and the Cultural Heritage Agency of the Netherlands (RCE).

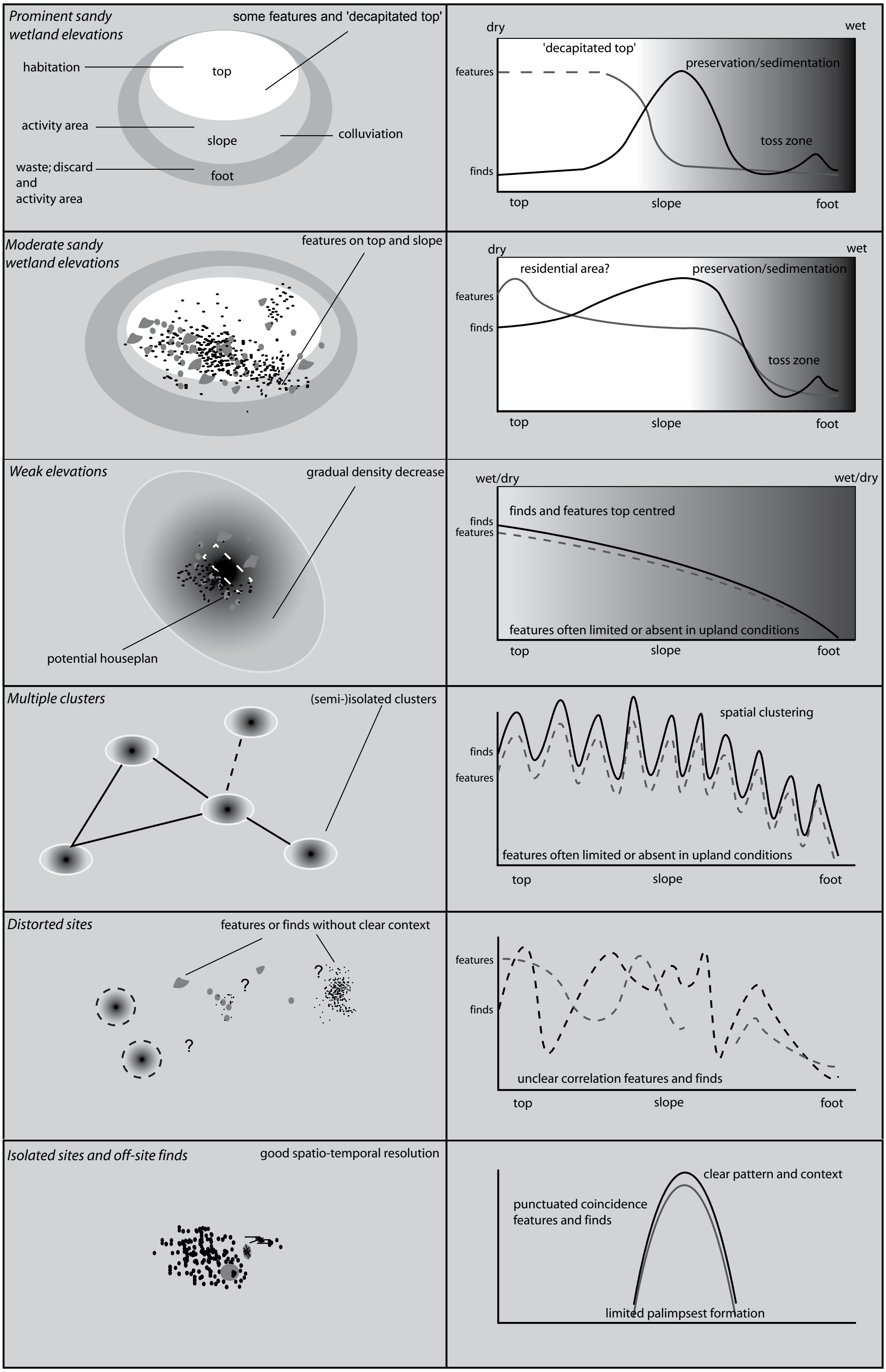
Because of the implementation of the Treaty of Valetta in Dutch law (the 'Malta law') we are currently faced with an archaeology predominantly characterized by cultural resource management, commercially operating companies, building plans, time schedules and often strictly limited budgets. This has on the one hand opened previously closed doors, enabling intensive and expensive excavations such as performed at Hardinxveld, Schipluiden and Hoge Vaart, although one may debate to what extent these large-scale projects are representative of the average research conducted. On the other hand Malta archaeology also limits the (academic) freedom of deciding which direction new research should take and, for instance, what new quintessences should be defined in studying the process of Neolithisation. Hodder (1999, 31) argues that '*…in recent decades it often seems as if the recording process has come to determine the digging process*' as well as that '*…as recording systems have become more formalized, excavation often seems to proceed as if the ground was being looked at through the recording system. Rather than the recording system serving the interests of knowledge acquisition, the relationship is inversed and we dig in order to record.*' The limited manoeuvring space within commercial archaeology for surpassing the level of basic documentation and reporting in favour of investing in interpretation, as well as the restrictions with regard to where and how to excavate, might, in time, result in our looking through a 'Malta-filter'. Although this may be too bleak a picture, two general conclusions might be drawn from the methodological analysis above. The first one is the need for sites to be excavated completely. Much more information can be gained from integrally excavating qualitatively potential sites, than having an elaborate collection of much less informative 'postage stamps'. While in many cases this will not be possible, it is necessary to invest in contextualization. This might involve as widely diverse activities as augering or surveying for site extents, sampling nearby wet locations to establish the impact of a site on the landscape, or studying grey literature to better place a site within its regional context. This indicates that the means available are ideally distributed according to what is academically most interesting leading to an informative balance between 'parts' and 'wholes'. Therefore a constant dialogue between commercial archaeology and the academic field is very important as well as a consistent update and discussion of documents such as the NOaA.[12,13]

A second conclusion can be linked to the previous one and involves the benefits of a non-dogmatic approach in fieldwork and subsequent analysis. Since every excavation will be different because its subject matter is unique and the procedure of knowledge acquirement is not replicable, the field is not availed by rigid standard procedures. A certain level of flexibility and freedom is required to maximize the potential of information available. Another term would be 'fluidity' (*cf.* Hodder 1999, 93) in research procedures. It is felt here that the future of (Stone Age) archaeology would ideally benefit from a commercial focus on the contextualization and embedding of the information that it excavates as well as a commercial practice with enough elbow room to shift emphases 'along the way' from a methodological and interpretative perspective.

4.5 An archaeological site typology

The previous sections have demonstrated how sites in the LRA are affected by various behavioural and taphonomic syn- and postdepositional processes and that their interpretation is strongly dependent on the scope for and approach chosen in methodology. While these factors of course differ per site and context the combined overview of sites that have been documented for the period and region studied allows for a categorization mainly based on non-functional aspects.

In view of the landscape and regional perspectives that have arisen on archaeological patterning (De Loecker 2006; Dunnell 1992; Foley 1981; Peeters 2007) it is argued here that sites as a classificatory tool of analysis and


Prominent sandy wetland elevations
some features and 'decapitated top'
habitation
top
activity area
slope
colluviation
waste; discard and activity area
foot
dry
wet
'decapitated top'
features
preservation/sedimentation
toss zone
finds
top
slope
foot
Moderate sandy wetland elevations
features on top and slope
dry
wet
residential area?
preservation/sedimentation
features
finds
toss zone
top
slope
foot
Weak elevations
gradual density decrease
potential houseplan
wet/dry
wet/dry
finds and features top centred
finds
features
features often limited or absent in upland conditions
top
slope
foot
Multiple clusters
(semi-)isolated clusters
spatial clustering
finds
features
features often limited or absent in upland conditions
top
slope
foot
Distorted sites
features or finds without clear context
?
?
?
features
finds
unclear correlation features and finds
top
slope
foot
Isolated sites and off-site finds
good spatio-temporal resolution
clear pattern and context
punctuated coincidence features and finds
limited palimpsest formation

interpretation remain valuable (see Binford 1992). A distinction can be drawn, however, between the functional aspects of sites within a settlement system (*e.g.* Binford 1980; Flannery 1976) and an archaeological site typology, both based on archaeological site parameters. An example of a functional, interpretative classification is given by Peeters *et al.* (2002, table 5, pp. 110). The problem with this approach and its definition of site types in relation to resolution is that it does not incorporate taphonomic disturbance and re-use of locations. It focuses on rare pristine sites. An archaeological or descriptive typology is directly related to the various processes and alterations described above. For the sites studied here and located in the LRA, specific sets of syn- and postdepositional processes can be defined. There are also similarities in site location and there is a basic subdivision between upland and wetland locations. Since the groups of hunter-gatherers and early farmers responsible for the deposition of archaeological remains in the substrate operated in all these environments a basic site classification based on the combination of their material output and general processes of taphonomy and site formation might be useful. Based on this a number of general 'site templates' can be proposed that are based on geomorphological characteristics, in combination with specific taphonomic or spatial particularities. These should not be regarded as absolute standards or categories, since they are strongly dependent on the local situation, in relation to post-depositional taphonomic processes and human behaviour. From this perspective some sites may be assigned to more than one category. The site templates may, however, be of a general indicative value, implying that various intermediate situations exist. Below six sketches of site templates are presented (see fig. 4.12) followed by a brief description of their particularities and informative value.

4.5.1 Prominent wetland sandy elevations (river dunes)

Overall, sites located on *donken* (river dunes) are situated on relatively high and pronounced geomorphological elevations. They therefore demonstrate a prominently zoned preservation, consisting of three zones; the top (often partially preserved, see below), the slope and the foot. Dependent on the local geomorphological situation, occupation history and sedimentation processes these form the backdrop to a complex interaction between cultural and natural formation processes. The archaeological signature of these sites often indicates a discontinuous long-term use of the same location.

Finds - Most finds are found on the slope and at the foot. Several processes are responsible for this. First of all the gradient of the dune in combination with erosion of the top and sides and colluviation is responsible for a downward movement of artefacts. Concentrations of finds as for example attested at Polderweg might thus have a natural origin. Secondly the wet conditions at the foot of the dune limit the area available for habitation and activities. This might lead to a sort of barrier effect, which would be less or non-existent at upland sites. Thirdly anthropogenic structuring of the area available on the donk probably resulted in an activity area on the lower slope and at the foot of the dune. The proximity of water might have been useful for many activities while the slope higher up on the dune might have been inconvenient due to its gradient and was perhaps used as a residential area.

Fig. 4.12 Site templates depicting archaeological sites types from a post-systemic perspective.

The existence of this structuring of activities can, for instance, be found in the existence of toss and dropzones (Binford 1978[b]) as identified, for instance at the sites of Polderweg and De Bruin (*e.g.* Louwe Kooijmans 2003).

Features - Features are often found on the slope of the dune. This may, however, be a remnant pattern since structures and features on the top often have eroded due to the more extensive exposure of these areas to the elements and subsequent activities. Overall it is suggested that the top was the main habitation area (see for example the donk of Brandwijk, Appendix I).

Potential - Sites located on *donken* are extremely informative due to the preservation of organic remains and other sources of information related to, for example, subsistence, environment and seasonality. In the case of regular and adequate sedimentation, preservation of spatial patterning in a chronostratigraphic context is possible. Nevertheless, sites on donken suffer from specific problems. Often the information from the top of the donk can be considered a palimpsest or is completely absent due to postdepositional processes. This may even lead to a 'decapitated' profile. That part of the site can therefore be more or less characterized as of an upland nature. Due to the same and other processes there is a complex interaction between natural and anthropogenic agents responsible for spatial patterning of artefacts and other debris on the slopes and at the foot of the dune. This pattern contrasts with the organic and anorganic artefact pattern at wetland sites suggested by Groenewoudt (1994, 128-129 as well as fig. 46, pp. 133). Based mainly on an analysis of the TRB-site of Slootdorp-Bouwlust it is suggested there that the proportion of organic remains is higher at the centre of the site. The donken sites indicate exactly the opposite. Virtually all organic information from the top is lost and most anorganic finds also cluster on the slope. Unfortunately this difference in preservation often poses a difficult problem in interpretation, since it is very difficult to correlate the stratified information from the slope and foot with activities and features that occurred on the top.

Site function - No clear information on the character of sites on donken and wetland dunes is available, yet it is noteworthy that, until now, all sites have yielded a distinct amount of domestic evidence, either in the form of pottery, faunal remains, grinding stones etc., that points in the direction of a shorter or more elaborate domestic function. It is probable that the dry situation of these locations in a wetland environment leads some form of investment and permanency, although other site functions may have operated coevally.

Examples - Hardinxveld-Polderweg, Hardinxveld-De Bruin, Brandwijk, the Hazendonk, Urk-E4.

4.5.2 Moderate wetland sandy elevations (coastal dunes and barriers up to c. 1m)

The tripartite division existing for *donken* sites can also be made for coastal dunes and barriers. The difference is that the overall available area existing for habitation is more extensive while the gradient of the elevation is often less steep. On the other hand the dynamic environment of the coastal area might lead to large-scale erosion of parts of sites. On larger coastal ridges wetland preservation may be largely absent. This means more of an upland character for sites in these areas.

Finds - The slopes of the dunes again form the background for most finds, although the quantitative and qualitative aspects of the faunal remains of Wateringen IV indicate that the tops of these elevations also harbour important activity and dump areas. Dependent on the local geomorphological situation and the location of the excavation, the number of finds may range from several dozen (as at Haamstede-Brabers) to many thousands (Schipluiden). Furthermore sites such as Wateringen and Schipluiden demonstrate that the spatial distribution of finds and the existing concentrations are much more a reflection of anthropogenic activity than of taphonomic processes (as was the case for the donken sites).

Features - Features mainly cluster on the top and sides of the elevation, although in some cases such as at Ypenburg entire parts of the top were also lost. In most cases the features that survived much more represent intra-site structuring than the remnant distribution of features that survived intensive postdepositional processes as at many donken sites. Apart from this the actual length of occupation of the site in combination with the rate of coverage might lead to intangible clusters of features, such as documented at Schipluiden. On the other hand clear site plans were found at Ypenburg, Wateringen IV and Haamstede-Brabers.

Potential - Overall, sites on coastal dunes and barriers seem less affected by postdepositional processes in relation to slopes than, for example, donken. This implies that while marine transgressions and related phenomena may destroy large parts of sites integrally, the intrasite patterning in many cases will be informative. Sometimes a clear relationship might even be attested between finds and features as, for instance, at Schipluiden.

Site function - Most characteristic site information stemming from coastal dunes is of a domestic, residential nature. This can be of a more permanent and community character as at Schipluiden, or more singular as at Wateringen IV. Important is the presence of house plans or indications thereof at most sites. A site such as Ypenburg may in this respect be interpreted as a 'multiplied version' of Wateringen IV (see Louwe Kooijmans 2009), or it may be attributed to the category 'multiple clusters' (see below).

Examples - Haamstede-Brabers, Leidschendam, Schipluiden, Wateringen IV, (Ypenburg).

4.5.3 Low elevations (levees and low sandy elevations)

Another type of site is mainly different with respect to the distribution of finds and features. Although a basic tripartite subdivision as postulated above can also be applied here, the distribution and preservation of both finds and features is much more uniform. This may related to the height of the elevation and the rate of coverage, in combination with the (spatial) character of occupation (see also multiple clusters). These sites occur in upland and wetland locations, such as levees and low sandy features.

Finds - The distribution of finds (flint, pottery and organics) is oriented on the centre of the site. Concentrations do exist yet overall the quantity decreases towards the edges of the elevation.

Features - Features mainly cluster on the top and sides of the elevation and generally coincide with the distribution of finds. Dependent on the intensity and character of re-occupation in combination with postdepositional processes structures may (Vlaardingen, Swifterbant-S3), or may not (the Hoge Vaart, Bergumermeer) be visible. In upland locations or under upland conditions the feature information may be severely restricted or absent.

Potential - Accumulative sites have a distinct centre which recurrently formed the location of occupation. This is also where finds and features cluster. The reason for this patterning with a clear fall-off curve is not known. It may be related to the limited amount of space that was probably available at, for instance, sites such as Vlaardingen and Swifterbant-S3. In the case of activities executed in the vicinity of a dwelling structure or house this may generate a centred pattern. On the other hand a similar pattern is visible at Hoge Vaart where space is less limited. The existence of this kind of patterning is also strongly dependent on the area that is excavated as well as the preservation of the highest parts of an elevation. Other elements at a site such as another elevation or a channel may have formed the focus of other structures and activities. The combination of sites and finds may yield potential information on activities related to structures (*e.g.* Raemaekers *et al.* 1997; De Roever 2004).

Site function - The site function of accumulative sites seems varied. On the one hand it may involve semi-permanent and domestic sites such as, for example, Swifterbant-S3 and Vlaardingen. On the other hand the occupation may be more residentially mobile and repetitive as at Bergumermeer. The characteristics are of course also strongly influenced by the settlement system type of the occupants. The fall-off curve of artefacts and features is induced both by the nature of the location and the recurrent focus on a centre of occupation. Both domestic sites and camps of hunter-gatherers fall within this category.

Examples wetland - Bergschenhoek, Hoge Vaart, Slootdorp-Bouwlust, Swifterbant-S3, Vlaardingen.

Examples upland - Bergumermeer-S64B, Gassel.

4.5.4 Multiple clusters

This type of site occurs both in uplands and in wetlands and consists of two or more clusters which are spatially separated. Upland sites are mostly of Mesolithic age while Middle Neolithic counterparts occur in the wetlands. The individual clusters are of different shape and extent, but their size is usually limited up to approximately 200 m^2. The intermediate area between the clusters is not empty, isolated finds and structures might be located there and the individual clusters may also overlap to a certain extent. The clusters are usually found on the top and slope of an elevation, although lower locations are also possible, especially on upland sites.

Finds - Upland Mesolithic flint scatters consist of concentrations of flint, often oval in shape. Within these concentrations clusters might be visible (as for instance at Brecht-Moordenaarsven 2). Refit lines either indicate the contemporaneity of the formation different clusters or their visibility on the surface during occupation (and hence re-use of material). At wetlands sites sherds and organic remains can also be found within the clusters.

Features - At some upland sites the remains of hearths or singular pits coincide with the concentration of artefacts (for instance at Opglabbeek Ruiterskuil, Weelde-Paardsrank, or Merselo-Haag). At other Mesolithic upland sites clusters of hearthpits, that to some extent may be structured chronologically, usually occur away from the artefact distribution (see Chapter 5). At wetland sites the remains of structures and hearths have been documented (see for example Hekelingen III and Liège-Place St.-Lambert).

Analysis - Sites with multiple clusters are interesting because they are indicative of a specific use of a certain feature in the landscape. There may be an overlap in time and space of activities and structures as certain concentrations are renewed and structures rebuilt (see for instance Hekelingen III). The existence of multiple clusters may point to the long-term use of and perhaps movement along a certain landscape feature in the landscape such as a dune (see for instance the site of Lommel-Molse Nete) as well as to the contemporaneity of certain concentrations (Merselo-Haag, Hekelingen III). These observations should subsequently be translated into hypotheses about mobility cycles, households and internal site structuring. Overall these sites indicate a non-permanent use of the same locations in a landscape, often over extended periods of time. In this respect they form small-scale, interrelated versions of accumulative sites. The degree of clustering of activities may inversely point to the duration of occupation (see Schiffer 1972)

Site function - The multiple nature of these sites indicates several contemporary or subsequent foci of activity. Due to their often limited size these more or less fall either within a range of hunting camps (Weelde-Paardsdrank), or can be classified as domestic sites occupied for a limited time period (Hekelingen III).

Examples wetland - Hekelingen I, Hekelingen III, Liège-Place St.-Lambert.

Examples upland - Brecht-Moordenaarsven 2, Mariënberg, Meeuwen in den Damp I, Merselo-Haag, Opglabbeek-Ruiterkuil, Weelde-Paardsdrank.

4.5.5 Distorted sites

This is an additional category comprising the large variability existing in predominantly post-Mesolithic upland sites, or sites in wetland areas that are largely characterized by upland conditions. This variability is to a significant extent induced by postdepositional processes, indicating that some of the sites within this category may have originally fitted another category.

Finds - At many sites finds have to a large extent been dislocated or displaced completely due to bioturbation and erosion of the covering layers. Most sites thus can be considered palimpsests (Swifterbant S22-24, Helden-Panningen-Industrieterrein, St.-Odiliënberg-Neliske). Organic remains are, furthermore, scarce due to the acidic conditions of the soil. Pottery may be affected as well. In some cases pottery and other finds are preserved more or less in situ in pits or natural features such as depressions (*e.g.* Grave-Pater Bertierstraat, Nijmegen-'t Klumke, Wijchen-het Vormer).

Features - Features are partially present or wholly absent, dependent on the negative effects of erosion. Often the absence of finds within the features in combination with poorly associated ^{14}C samples makes it difficult to attribute features to a certain period. This way virtually no or only questionable structures can be defined (*e.g.* St.-Odiliënberg-Neliske, Helden-Panningen-industrieterrein).

Potential - The variability in this category of upland sites makes it difficult to describe them as a whole. In general they are characterized by the fact that either features or finds suffer considerably from postdepositional processes and surface exposure and in some cases both. This makes it extremely difficult to interpret these categories for themselves, let alone combine both into the analysis of a settlement or other type of site.

Site function - Because of severe taphonomic disturbance these locations harbour sites of different character. Both hunting locations as well as domestic sites might be represented, but identification of site function is often impossible.

Examples wetland - Swifterbant S22-24, S11-13, Swifterbant-S61.

Examples upland - Helden-Panningen-Industrieterrein, Meeuwen-Donderslagheide, Nijmegen-'t Klumke, St.-Odiliënberg-Neliske, Wijchen-Het Vormer.

4.5.6 Isolated sites and off-site finds

This category consists of small-scale sites and finds that are often situated rather isolatedly in the landscape. They occur both on the uplands and in wetlands and are the material reflection of singular short-term activities, transitory camps, depositions etc.

Finds - The finds at these types of sites are usually very limited (see for instance the flint assemblage of Jardinga). Other remains such as bones might be more numerous, but of course this also strongly relates to the function of the place and to postdepositional processes. The limited number of lithics, however, demonstrates that the visibility of these sites in an upland context might be extremely limited.

Features - In general features are not to be expected since these locations were only used for short periods of time. Structures or other installations related to the specific use of a site as well as hearths form an exception however.

Potential - Isolated sites and finds might yield qualitatively detailed insights into the short-term special activity sites employed by hunter-gatherers and early farmers. These sites are, however, notoriously difficult to identify, especially in upland conditions. Furthermore the information they might generate is strongly dependent on good conditions of preservation and the absence of subsequent occupations blurring the available resolution due to the palimpsest effect.

Site function - Sites within this category are often marked by a spatially and chronologically limited congruence of finds and features. This indicates that in most cases these sites may be interpreted as short-term camps, hunting or fishing stands, butchering sites or intentional depositions.

Examples – Bergschenhoek (also fits the accumulative site category), Bronneger, Jardinga, isolated axes, isolated antlers, hoards, pot burials or other intentional depositions.

4.5.7 Using site templates

The introduction of site templates is not so much informative with respect to the actual prehistoric site functions as that it reflects the ways we as archaeologists may encounter sites and the information preserved there. Within the latter perspective site templates form reflections of the way the material derivatives of human behaviour interact with the conditions generated by the environment and shape use or occupation types. This approach may, in some situations be more informative than, for example, the site resolution approach (see Peeters *et al.* 2002, table 5, pp. 110), since the categories defined above are both descriptive and fluid. It should be realised that under certain conditions similar sites will develop differently and generate a different material reflection. Furthermore, as argued earlier, and depending on the characteristics preserved, sites may fit more than one category. These templates therefore are not intended as an absolute subdivision. It is our task to try and define what types of sites are at the basis of the variability described above and how these fit into a system. The main difficulty we thereby face is the contrast between qualitatively highly informative wetland sites as opposed to different degrees of far less informative sites, often located in the uplands. How to deal with this discrepancy will now be discussed.

4.6 Representativeness

In Chapter 2 it was argued that the study of the process of Neolithisation on a European scale had to some extent drifted further away from the material reality of the archaeological record. Instead of a top-down theoretical approach in which data is molded to fit internalist or externalist argumentation it was argued that the mosaic character of the transition to agriculture in Europe required an open minded, bottom-up approach within a regional perspective (see also Amkreutz/ Vanmontfort 2007; Arnoldussen 2008). An important contribution to such an approach was formed by a thorough analysis of the inferential power and constraints of the archaeological record in the study area, involving a taphonomic reconsideration of the 'building blocks' of our 'Neolithisation story', the sites. Within this analysis the archaeological record of communities in transition to agriculture within the LRA was reconsidered both from a methodological as well as a formative perspective, addressing such diverse issues as excavation strategy, sampling traditions, theoretical paradigm, geographical diversity, bioturbation, permanency, duration and spatiotemporal collapse. This analysis, based on a number of sites described in the catalogue, demonstrated the existence of huge qualitative and quantitative contrasts within our dataset. The *Leitmotiv* of these diverging results centred on the upland-wetland bias. This bias is problematic because it means that we study the transition to agriculture and understand the process of Neolithisation through a largely unbalanced dataset.

4.6.1 Qualitative potential

From a geographical and archaeological perspective we see and understand more of the 'receiving end' of the process of Neolithisation, the wetland reflection and subsequent wetland implementation of contacts and developments that also took place elsewhere. The importance of these wetland sites for our understanding of the transition to agriculture is evident (see also Nicholas 1998[a,b]; Van der Noort/

O'Sullivan 2006) as they are able to provide more and better answers to many issues and questions surrounding Mesolithic and Neolithic sites and the process of Neolithisation. An estimate of this difference in potential has been visualized in fig. 4.13, based on the information drawn from sites in Appendix I.

The attribution and subdivisions visualized in fig. 4.13 are an approximation of reality and will be different per site studied. Nevertheless, the overall implications are clear and are further illustrated by the cumulative pie charts in fig. 4.14. These visualize that, especially with respect to medium and high levels of information, wetlands and uplands contrast.

What these figures indicate is that much of our most valuable information for studying the transition to agriculture in the LRA will derive from wetland sites. On the other hand it is also clear that this contrast may be problematic in our understanding of this same process, because of the danger of a singular wetland perspective on the transition.[14] For example one of the major issues in the debate on Neolithisation is the introduction of cereals and the growing of crops. Geographically one might assume that the first introduction of cereals and the experimental phase of agriculture would have taken place in the contact zone between the Neolithic farmers of the LBK on the one hand and the Rössen culture on the loess and adjacent hunter-gatherers on the sandy soils on the other hand. Taphonomically, however, this is precisely the area where organic remains such as cereals and chaff and to a certain extent even pottery are not or only very poorly preserved, pollen diagrams are regional in perspective and suffer from hiatuses (with some exceptions, see Bakker 2003[a]), ^{14}C dating is often inaccurate, features dissipate, use wear analysis is regularly ineffective, and spatio-temporal control is lost due to a stable surface, re-use and the absence of a cover. The evidence probably was there but is not anymore. What we do see is a geographically and chronologically specific version of this process. A wetland reflection, adaptation and implementation of something that, presumably, initially took shape elsewhere. This is a unique situation that not only differs from the upland counterpart to which it is related, but is also different from other wetland situations. For Switzerland the prehistoric lake villages form the main source of information, also for the Neolithic. In Britain and Ireland, wetlands rather form isolated datasets, such as the Fenlands or Glastonbury lake village. Apart from these examples valley floor locations form additional wetland settings, often of a smaller scale such as Noyen in France. The best reference for the LRA wetlands may be found in Schleswig-Holstein and Denmark, however, it is mainly the Mesolithic that is found there in wet contexts (pers. comm. Louwe Kooijmans 2005). The LRA wetlands therefore should be studied in their own right as a specific regional phenomenon.

4.6.2 'They do things differently there?'

In L.P. Hartley's novel 'The Go-Between' (1958) the past is a foreign country where they do things differently. In a way one may assume that wetlands have the same denotation since they often have been and still are perceived as inhospitable wastelands (see Louwe Kooijmans 1997, 10-11). To what extent could this be true? Before we enter into this discussion some comments on the general division between upland and wetland sites are in order. From a taxonomic point of view both terms are used to pigeonhole sites, which might intrinsically be very different. For instance the sites of Schokland-P14 and Hoge Vaart are not

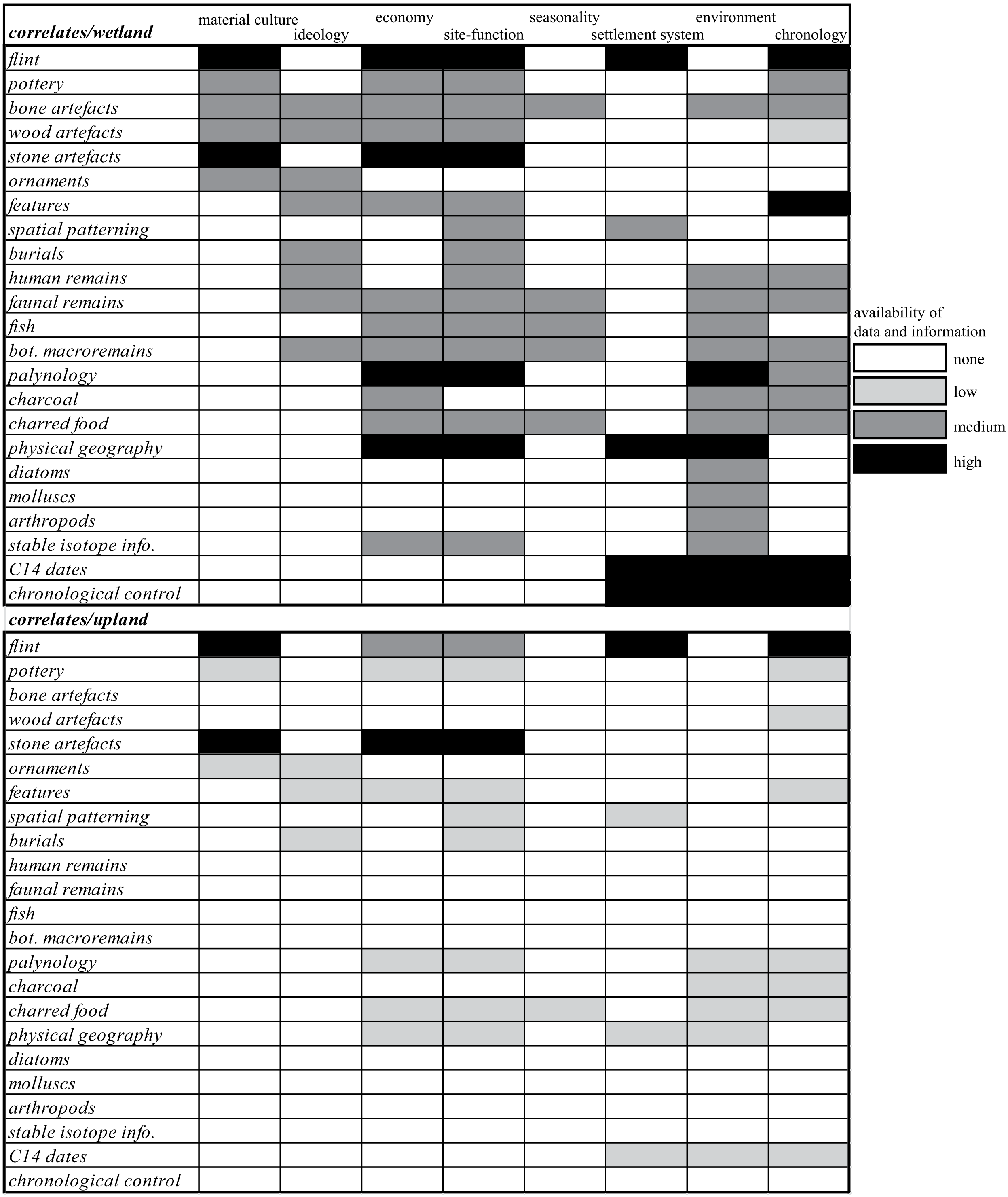


Fig. 4.13 Availability and quality of archaeological correlates for upland and wetland sites with respect to topics of importance in understanding the process of Neolithisation.

entirely comparable to donken-sites such as Hardinxveld-Polderweg or Brandwijk (see Appendix I). During a large part of their occupation, both of the former sites were located much more in an upland environment adjacent to a wetland with extensive areas of 'dry land' in their direct vicinity. This strongly contrasts with the latter sites which were located in the middle of a wetland. Nevertheless,

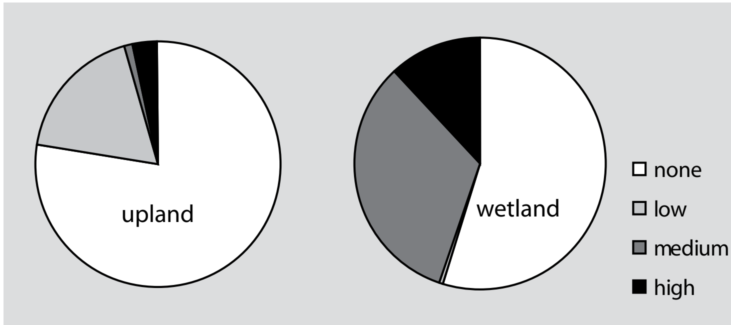


Fig. 4.14 Cumulative pie-chart counts of fig. 4.13 illustrating the informative contrast between wetlands and uplands.

all would usually be classified as 'wetland' sites, because of their conditions of preservation and adjacency to considerable bodies of water. It should thus be noted that the distinction upland-wetland often most unambiguously is a distinction between conditions of preservation (*cf. supra*). The archaeological, ecological and interpretative applications, although equally valid, are often far less obvious and positioned on a sliding scale.

Wetlands as uplands?

For some authors the same agents that led to the excellent preservation of sites in these areas are also indicative of a prehistoric situation that was distinctly different from any upland situation. In their view this dichotomy must have resulted in considerable socio-economic differences to the extent that uplands and wetlands should be perceived as largely incompatible entities (see for example Groenewoudt 1994, 53; Nicholas 1998[a], 720). In this light it is thus not useful to embark upon a comparative study of wetland and upland sites.

Others have, on the other hand, argued that the upland-wetland distinction is mainly a creation of our modern ethnocentric attitude and geological erudition (Louwe Kooijmans 1999, 111). The current subdivision into upland and wetland sites, to some extent, is definitely an artificial segregation in which often no clear distinction is made between past environment and preservation conditions (*cf. supra*). In this perspective the difference between wetlands and uplands is much more gradual with a moderate distribution between wet and dry elements (Louwe Kooijmans 1997, 15). Clearly there are also large bodies of water (lakes, streams, fens) in upland contexts. The argument that prehistoric communities did not submit or adjust to the whims of the environment but instead were governed in their choices and patterns of land use by social relations and human culture (see also Brandt 1988; Gamble 1986[b]) substantiates the claim that an upland-wetland divergence should not be treated as an absolute categorization. From this perspective wetland sites, to some extent, may serve as a high resolution version of what happened at upland sites.

The question is how to deal with this seemingly diverging perception of the role of wetlands in relation to past behaviour? Are wetlands absolutely non-representative or, on the other hand, if not illustrative, do they represent at least part of the wet side of a range of acceptable lifestyles (Louwe Kooijmans 1999, 111).

Approaching wetlands

Both interpretations have their shortcomings in addressing the issue of representativeness. Wetlands certainly cannot be seen as backward fringe areas where habitation could only have had a very specialist and irregular character (*e.g.* Louwe Kooijmans 1997; Nicholas 1998[a,b]; 2007[a,b]; Van de Noort/O'Sullivan 2006). On the other hand nor should they be perceived of as only gradually different from what was common on the upland, since their conditions would demand a rather different use of the environment. In the last case the specific accents of wetland occupation might distinctly deviate from elsewhere. A difference of degree may still be a considerable difference when studied qualitatively.

This study sets out to study communities in the LRA wetlands in the process of Neolithisation from a flexible perspective, both with respect to the occupation history of wetlands as well as in relation to upland developments.[15] A context for this was offered earlier in Chapter 3, where it was argued that the debate concerning the transition to agriculture should be injected with historicity. In the LRA as well as elsewhere in Europe, we are dealing with a spatial as well as chronological mosaic (*cf.* Tringham 2000[a]) of transitions and especially for the LRA wetlands no clear or simple universal or evolutionary trend is definable. Although there are distinct developments towards an agricultural economy, the process is gradual and the occupation history is characterized by continuity in behaviour rooted in the hunter-gatherer world and diversity in dealing with the environment and resources. Different choices and combinations seem to have existed side by side. While this will be further discussed later on (Chapters 7-9), it means that a research perspective should not only focus on the adaptive qualities of these communities adjusting to the optimal use of their environment. It should also deal with the long-term relationship between communities and environment and the way this over time shapes types of habitation and practices characteristic of both these communities and the area.

The main point to be made is that wetland developments may be studied for the light they shed upon (archaeological patterning of) occupation elsewhere, but simultaneously deserve an analysis and interpretation of their own, based on the geographically and ecologically specific qualities they harbour and the way in which they influence regionally specific behaviour, choices, habitation and identities.

4.6.3 Wetlands as active agents?

Within the approach sketched above wetlands (both from a landscape and environmental perspective) are ascribed distinct qualities, which provide certain regionally specific structural conditions (see Barrett 2000 and Chapter 6). These in turn and over time confront and interact with the communities living in these areas and will contribute in shaping community choice and cultural characteristics. Although we can only guess, or approach ethnographically, how this may have taken place this perspective is based on the idea that wetlands are attributed certain formative qualities (Coles/Coles 1989). These are of importance in the organisation of groups living completely or partially in these landscapes and the way in which they negotiate and transmit community identity (Van de Noort/O'Sullivan 2006, 68). This approach will be theoretically anchored and further implemented in Chapters 6-9. These chapters will specifically focus on the communities in the wetlands and wetland margins. The next chapter will provide an archaeological basis for this through a comparative study of the available contextual and artefactual evidence regarding Late Mesolithic communities in the LRA. The chapter will deal with the degree to which these groups may have operated differently in different areas and to what extent this may have provided a heterogeneous substrate for the transition to agriculture.

Notes

1 The actual situation is more complex and also depends on the acidity or alkalinity of waterlogged environments. For example acidic peat bogs preserve wood and plant remains, but may eventually destroy bone and even pottery. Alkaline environments on the other hand are less conducive to the preservation of wood, plants, leather and pollen and more so to the preservation of bone and shell (see for example Coles/Coles 1989; Groenewoudt 1994; Renfrew/Bahn 1996).

2 Many processes influence the preservation of features. Apart from cultural factors such as backfilling and secondary use, bioturbation, soil formation and erosion have a significant impact. They obscure the extents and outline of features and often only a decapitated profile or section is preserved. These considerations warn against an uncritical interpretation of finds within features for functional or dating purposes (see also Schiffer 1987, 218-220).

3 This term was originally used in a different context, referring to the dangers involved with thinking in and with chronological units in the Palaeolithic (see Conkey 1985; 1987).

4 Lucas (2005, 34-36) argues that at another level the archaeological record is never static. In fact it is always dynamic and part of a systemic context, whether below or above the ground. If it is visible and tangible humans will have to deal with it, *i.e.* interact with, accept, or ignore it. It is therefore also related to people's perception of the past.

5 This was also practised at recent excavations conducted by the RCE at Rijckholt-Sint-Geertruid. Personal information, author.

6 There is evidence of severe taphonomic disturbance of features dating to this period (*e.g.* Burnez-Lanotte *et al.* 1996; Groenewoudt 1994; Vanmontfort 2004; see also below). Groenewoudt (1994, 113) mentions the disturbing effects of bioturbation and soil formation processes leading to the gradual disappearance of features, especially on well-drained sandy soils. Features have often disappeared or are only visible at a lower level and thus easily missed. Apart from these considerations, the total number of Neolithic upland excavations, excluding the LBK, is limited (*ibid.* 112), indicating that these sites are not easily detected.

7 The cause is mainly found in the consumption of non-terrestrial food such as fish and shellfish of marine and freshwater origin. This can be traced by measuring the levels of the stable isotopes $\delta^{13}C$ and $\delta^{15}N$ in the bone collagen. The latter is often not measured (Lanting/Van der Plicht 1995-1996).

8 It must be realized that the reservoir and hard water effects affect sites in the wetlands not only because of their preservation of organic remains, but also because wetland resources often formed an essential contribution to wetland subsistence and technology.

9 See for instance the different quantitative results for the hand-picked and sieved remains of fish at Schipluiden (Brinkhuizen 2006).

10 Where Foley (1981, 165-166) opts for introducing 'off-site' archaeology as a conceptual counterpart for a site approach, Dunnell (1992, 36-37) proposes to reject the archaeological concept of the site altogether. Instead he argues for a bottom-up approach using artefacts and their attributes as the smallest units of (spatial) analysis. The same approach is advocated by De Loecker (2006, 8; see also Roebroeks *et al.* 1992) when he methodologically 'discards' the site-concept in favour of a spatial distribution of artefacts along a continuum from individual artefact to high density pattern.

11 Binford (2002, 132) adds to this: *'…archaeology's basic unit is the individual site, but its goal is to employ these units to study past human behavior; and in order to accomplish this task, we need to develop an appropriate methodology for identifying the role of single sites within an overall system.'*

12 NOaA is the abbreviation of Nationale Onderzoeksagenda Archeologie, or National Research Agenda for Archaeology (for more information see http://www.noaa.nl/). The agenda is intended to spearhead and define the important goals of Dutch archaeology per time period and function as a guideline for commercial archaeology. One of the dangers of documents like these is that they are not continually updated and eventually function in a dogmatic way achieving precisely the opposite of what they were invented for in the first place.

13 In relation to this it should be stressed that the public goals of disseminating information to a wider lay audience, as is laid down in the Malta law, is crucial for creating an increased understanding of the importance of archaeology for our cultural heritage in general. At the same time the role of this audience and investors in determining the course of research or even emphases in heritage

management on a local or regional level should be limited. Recently there have been questionable initiatives in the commercial sector (especially within the branch of advisory companies), such as 'Reverse archaeology' that propose a stronger influence of the public and other stakeholders, such as construction companies and municipalities, in deciding on the emphases in archaeological fieldwork and interpretation.

14 Bailey (2007) argues that within the remnant settlement patterns we reconstruct, sites representing cumulative palimpsests (*i.e.* the wetland sites in the LRA), achieve prominence and visibility for reasons less related to their significance to the original occupants than to the frequency of revisiting and re-use. This underlines that issues of visibility, preservation, re-use and importance operate independently from each other.

15 From an archaeological perspective we find ourselves in a somewhat paradoxical situation. On the one hand wetland sites are our most important sources of information on the development of the transition to agriculture. Without them we would actually have hardly any information at all. On the other hand we should not regard them as either representative or completely divergent (*cf. supra*). They cannot form a template for what was going on elsewhere in upland situations. A further argument in this respect was brought to the fore by Binford (1992, 49) when he stressed that focusing on 'good sites' alone is a 'let's-look-through-different-glasses' approach. This way we are bound to observe new things, but will not be able solve the relationship between these and our old problems. How to proceed?

One way forward could be to abandon the strict distinction between 'good sites' and 'bad sites' and accept that most sites within the available dataset have to some extent suffered from the same taphonomic distortions (see Binford 1987[b] where he argues that deposits and excavated sites do not differ that much from surface sites since both have been subject to palimpsest effects. Excavated sites are in fact buried surface collections). In this respect there are only different degrees of 'ugly' sites. If then, from a site-formative perspective there is no insuperable contrast, we might use the best sites available to form a well-informed background to compare less informative sites to. For the LRA this will result in a situation whereby wetland sites are used to study upland sites. The beneficial aspects of this approach are thus not to be found in the informative value of sites *sensu stricto*, but in the similarities and divergences between them. In using a comparative approach the wetland sites form real 'sites for sore eyes'. This perspective should, however, not interfere with analyses that approach and interpret the wetlands, their conditions and the occupational behaviour it generates from a regionally specific perspective. Whereas one approach uses wetland data in order to understand similar or diverging upland patterns from an archaeological and formative perspective, the other stresses the behavioural character of communities from a regional perspective wherein geographical and ecological conditions actively influence behaviour.

Chapter 5

The Late Mesolithic – diversity in uniformity?

' The distinct regional variation which emerges in the Neolithic has its roots in the historical traditions of regionally-based Mesolithic communities.' (Armit/Finlayson 1992, 672).

'…one cannot understand the transition without understanding the state of hunter-gatherer adaptations that preceded it…' (Zvelebil/Rowley-Conwy 1984, 104).

5.1 Introduction

In order to understand the process of Neolithisation in the LRA it is important to gain better insight into the preceding Late Mesolithic, since the last communities of hunter-gatherers living in this area formed the socio-cultural context in relation to which the transition to agriculture took place. These groups should not be seen as the uniform hunting and gathering 'background' to the changes taking place with the introduction of agriculture. In fact, the diversity existing within Late Mesolithic groups in relation to the various landscapes they inhabited and exploited formed a variable and heterogeneous 'backdrop' to the process of Neolithisation. This chapter discusses different aspects of Late Mesolithic communities, based mainly on the evidence from excavated sites and in relation to their setting in the landscape. The aim is to analyse whether differences and similarities observed may be interpreted as meaningful with respect to Late Mesolithic diversity and therefore of importance to our understanding of Neolithisation in the area. This chapter first presents a brief introduction of the Late Mesolithic chronological and material framework, followed by the introduction of the site-based dataset. Subsequently analysis focuses on several 'scaled' aspects of Late Mesolithic sites in the landscape. Finally the results will be compared and interpreted in terms of settlement systems and repercussions for Neolithisation.

5.2 Chronological and cultural context

As a period, the Late Mesolithic has received little attention. It is generally studied from the perspective of the preceding earlier Mesolithic phases. Little is known of Mesolithic settlement systems and mobility (Crombé/Cauwe 2001, 55), although these are of importance for understanding Neolithisation. The lack of attention is caused in part by problems of identification related to taphonomy and limited dating resolution (see Chapter 4). Recent publications of several sites with distinct Late Mesolithic occupation phases have greatly contributed to the corpus of information (*e.g.* Louwe Kooijmans 2001[a,b]; Peeters 2007; Verhart 2000; Verlinde/Newell 2006) providing new opportunities to enhance our understanding of this phase.

5.2.1 Mesolithic chronology

The chronological subdivision of the Mesolithic has been subject to many changes (Lanting/Van der Plicht 1997/1998, 105-112; Verhart/Groenendijk 2005, 163-165), mainly relating to problems in obtaining associated ^{14}C dates and issues of taphonomy, such as a lack of stratified sites. This is why typo-chronology, with its coarse-grained resolution, remains one of the main tools for the identification and dating of Mesolithic occupations (see Crombé/Cauwe 2001, 51).

Previous subdivisions based on point types defined five stages of the Mesolithic in the study area (Newell 1973; Arts 1989). However, the proposed cultural groups within these stages (*e.g.* the De Leijen Wartena complex) are no longer recognized. Moreover, some implements originally regarded as chronologically limited proved to be in use for much longer (*e.g.* Arts 1989, fig. 8; Crombé 1998; 1999). Finally, not all diagnostic artefact types are omnipresent. The recognition of these problems ultimately led to a subdivision into three phases only (Verhart/Groenendijk 2005; Verhart 2008; see also Peeters/Niekus 221). While some (Lanting/Van der Plicht 1997/1998, 136) argue that the Mesolithic may solely be divided in an early and late phase based on the absence or presence of trapezes, the subdivision of Verhart and Groenendijk (2005, 163-165) will be followed here. It is based on a north-south distinction between a Scandinavian-oriented Northwest group and a Rhine-Basin group (Gob 1985; Heinen 2006; see also Newell 1973). Chronologically, Verhart and Groenendijk (2005) distinguish between an Early, Middle and Late Mesolithic. The Early Mesolithic (*c.* 9200-7500 cal BC) in the south is mainly characterised by the A-point and the occasional use of Hesbaye-type flint. In the North B-points and triangular implements are also common. The Middle Mesolithic (*c.* 7500-6500 cal BC) is characterised by C-points in the north and by C-points and implements with surface retouch (*e.g. feuille de gui*) in the south. The Middle Mesolithic also sees the initial exploitation of Wommersom quartzite as a favoured raw material (see also Gendel 1984). The Late Mesolithic (*c.* 6500-5300/4400 cal BC) is characterised by trapezes in both the north and the south and by the use of Wommersom quartzite in the south.

According to Verhart and Groenendijk (2005, 163-164) the adjacent Rhineland sequence (*cf.* Arora 1976) and the Belgian subdivision (Gob 1981) largely overlap with their sequence (see *e.g.* Arora 1976; Ducroq 2001; Gob 1981; Vanmontfort 2008[a]).

While the tripartite division and general north-south distinction retain their value as a framework, it should be mentioned that a number of factors may influence our perception, both chronologically and regionally. These include the longevity of certain tool types, regional typological groups with a specific material expression, functional choices and stylistic variation as well as social aspects such as identity markers (*e.g.* Crombé 1998; 1999; 2002; Fischer 1989; Lovis *et al.* 2006[b]; Perdaen *et al.* 2008; Vermeersch 1984; Wiessner 1983).[1]

5.2.2 Lithic characteristics

From a lithic and material perspective the Late Mesolithic is characterised by the use of trapezes. In the southern part of the LRA, points with surface retouch remain in use (see Huyge/Vermeersch 1982; Heinen 2006), a regular blade-based technology is used (*Montbani*-style) and part of the tools are made of Wommersom quartzite. The northern variant is mainly characterised by broad blades and trapezes, narrow triangles, the absence of surface retouch and Wommersom quartzite, and the occurrence of *Geröllkeulen* (albeit rarely in closed assemblages).

Since trapezes first occurred between 7000 and 6500 cal BC and in the Low Countries from *c.* 6500 cal BC onwards (Verhart 2008, 172) their temporal significance is limited. Newell (1973) and Groenendijk (1997) suggested that broad trapezes may be younger than narrow trapezes, but separating them metrically has proven unsuccessful (Peeters *et al.* 2001; but see Niekus 2005/2006, 81).

Another possible distinction (at least in the south of the LRA) is that between unretouched trapezes and (assymetrical) trapezes or triangles with retouched bases or flat inverse retouch (*retouche inverse plate* or 'RIP'). Gehlen (2006) argues that these points may be indicative of La Hoguette assemblages. Others (Heinen 2006, 79-80; Manen/Mazurié de Keroualin 2003, 124) argue that RIP points are predominantly present in the area of the *Rechtsflügler* (*cf.* Löhr 1994) west of the Rhine and Meuse, an area associated with the Limburg group. The RIP technique seems to have developed shortly after 6000 cal BC among the local Rhine-Meuse-Scheldt (RMS) groups, although its origins may lie with the left-lateralized trapezoids of southern France (Heinen 2006, 80; see also Lanting/Van der Plicht 1997/1998). Within the LRA, assemblages exhibiting the RIP technique have incidentally been classified as the Ruiterskuil group (Crombé 1998). Around the middle of the 6th millennium (cal BC), the RMS groups produced a new form of assymetrical point, known as Danubian style or LBK-like points (*sensu* Löhr 1994), falling within the larger group of *pointes* or *armatures evoluées* (see Heinen 2006, 80). These point types may be indicative of contacts with the LBK (see Huyge/Vermeersch 1982; Löhr 1994; Heinen 2006; Vanmontfort 2007). A typical site with such an evolved assemblage is Weelde-Paardsdrank (Huyge/Vermeersch 1982). This type of point may also have been recovered at the site of Polderweg (Louwe Kooijmans 2003), apart from at least one 'classical' LBK point (see De Grooth 2008, 225). It is not clear whether the LBK-like points evolved out of trapezes with RIP or out of other asymmetrical points such as Bavans points (Heinen 2006). Similarly, it is not known whether the slightly larger points of the LBK itself were an inspiration for or a result of this development. The sometimes striking resemblance and contemporaneous dates of both seem to indicate some form of contact between the LBK and local Mesolithic groups (see Robinson 2008; 2010). Heinen (2006) even argues that the later RMS groups were the producers of Limburg ware (*cf. infra*). The evidence for this is however unconvincing, mainly because of problems of association (see also Otte/Noiret 2006, 98; Vermeersch 2006).

Although the typo-chronological developments of the Late Mesolithic are still poorly understood, it is clear that with the advent of the LBK farmers in the area some changes took place (see Vanmontfort 2008[a]). There may have been differences between earlier Late Mesolithic groups and those in contact with farmers. The RIP technique seems emblematic for this contact phase. It should thus be considered to which extent a further subdivision of the Late Mesolithic (analogous to French and German chronologies) in a Late Mesolithic and a Final Mesolithic would be an appropriate improvement.[2]

5.2.3 The end of the Late Mesolithic

While the Late Mesolithic may generally be described as characterised by a trapeze-based industry and starting around 6500 cal BC, its end date, 5300/4400 cal BC (Verhart 2008; Verhart/Groenendijk 2005), offers a range of approximately a thousand years. This period is characterised by a number of (partly synchronous) developments that are geographically distinct, yet not entirely exclusive. These will be briefly introduced below.

It is important to note that our classification of developments strongly depends on our definition of Mesolithic, Neolithic and Neolithisation (see Chapters 2 and 3). While the economic contribution (of domesticates and cultigens) has become an important factor in distinguishing between Mesolithic and Neolithic (*cf.* Zvelebil/Rowley-Conwy 1984), it was argued earlier (Chapter 3) that multiple factors may determine to what extent we are dealing with Mesolithic or Neolithic communities in a social and developmental sense. This should be viewed against the backdrop of a regional ecological context and in relation to the geographical diversity existing within the settlement system (see also Chapters 7-8) and differs from the chronological discussion. A good example is the fact that in the Dutch chronology the first use of pottery around 5100 cal BC is recognized as marking the start of the Swifterbant culture, which later on also sees the introduction of domesticates and cultigens. The early part of this culture is however best characterised as a ceramic Mesolithic (Louwe Kooijmans 2001[a], 445; 2007[a], 296). This would be similar to the earlier use of this terminology for the ceramic phase of the Ertebølle culture and in line with the interpretation of Swifterbant as a 'Final Mesolithic' in Belgium (Crombé/Vanmontfort 2007, fig. 10). Economically, an important distinction is the appearance of domesticates in the Swifterbant faunal spectra, occurring between 4700 and 4450 cal BC in the southern part of the LRA and around 4200 further north (Louwe Kooijmans 2007[a], 297) and the degree to which domesticates and cultigens contribute to subsistence. We are therefore dealing with a shifting and multi-dimensional transition between the Mesolithic and Neolithic (see Van den Broeke *et al.* 2005, 30; see Chapter 3), the intrinsic aspects of which should be clearly defined. A general framework may be sketched from south to north.

5.2.3.1 Early Neolithic developments in the loess zone (5300-4900 cal BC)

The Neolithic in the LRA begins with the appearance of the LBK in the Rhineland and adjacent Belgian loess area, from *c.* 5300 cal BC onwards (Lanting/Van der Plicht 1999/2000, 13-14). Evidence of interaction between these farming communities and indigenous hunter-gatherers exists in the form of contact-finds (*e.g.* Louwe Kooijmans 2003). This suggests that an availability phase (*cf.* Zvelebil 1986[a]) started. Although the direct impact of the appearance of LBK farmers on the regional Late Mesolithic population remains unknown, it is plausible that the *Siedlungskammer* along the southern limits of the LRA over time, although perhaps not initially (see Vanmontfort 2008[a]), acted as hubs around which the process of Neolithisation evolved and intensified.

Both the material records of the LBK and Late Mesolithic (if present) do not testify to important changes. Perhaps some of the developments taking place at the end of the LBK, such as the less rigid approach to settlement location choice (Amkreutz 2010[a]), testify to increased forager-farmer interaction. Others, such as Golitko and Keeley (2007) argue that the increase in fortifications (*Erdwerke*) and burial traumata at the end of the LBK also distinctly relate to conflicts with indigenous hunter-gatherers.[3]

Forager-farmer interaction may also have helped to shape the transformations taking place at the end of and after the LBK. For the east a development may be sketched that involves a transformation of LBK into Grossgartach and later Rössen communities, entailing distinct changes in settlement pattern, site location choice, distribution networks, house traditions, crops etc. (Dohrn-Ihmig 1983; Stehli 1989). In the west the Blicquy group points to similar albeit less marked changes (*e.g.* Jadin 2003; see also Robinson 2010). It should be noted though that evidence is meagre. In the LRA currently only an evolved Rössen settlement at Maastricht-Randwijck is known. There is also evidence of hiatuses both in the Rhineland and the Belgian Hainaut loess area between the LBK and subsequent groups which contrasts with the continuity witnessed in their respective source areas in the Upper Rhine Plain and Paris Basin (Villeneuve-Saint-Germain culture). This may imply that instead of developments taking place in relation to interaction, areas were probably also temporarily abandoned.

Limburg and La Hoguette ware

Apart from the developments outlined above there are two additional phenomena, that may represent 'actors' in the transition between the Late Mesolithic and Neolithic in the southern part of the LRA. These are groups with Limburg and La Hoguette ware. Both have been hypothesized to be spatially and temporally related aspects of indigenous traditions in contact with the LBK (Constantin *et al.* 2010; Louwe Kooijmans 1998[a]; Raemaekers 1999, 138). A related phenomenon is *Begleitkeramik* of La Hoguette which is found both in isolation and in relation to La Hoguette ware (Brounen/Hauzeur 2010).

Over time our knowledge regarding these groups and the degree to which they may be regarded as independent entities has increased, especially with respect to the La Hoguette group (*e.g.* Manen/Mazurié de Keroualin 2003), for which an independent nature and even a pastoral economy have been suggested (Kalis *et al.* 2001). However, at the moment it not possible to further define the exact role of these groups in relation to both the LBK and Late Mesolithic. The presence of these groups suggests that the characteristics of the period in the southern part of the LRA were not exclusively the result of interaction and developments between the LBK and its successors (Grossgartach, Blicquy, Rössen) and an indigenous Late Mesolithic population but that other actors were involved as well (Amkreutz *et al.* 2009).[4]

5.2.3.2 Neolithic developments on the coversand and in the Meuse valley (5300-4200 cal BC)

While evidence for interaction and change in the Late Mesolithic remains limited, the evidence of contact finds such as points, adzes and later *Breitkeile* suggests increased interaction between foragers and farmers in the early fifth millennium. For the zone north of the loess a distribution of LBK finds up to 30 km from the settlement area has been documented (Van der Graaf 1987). A number of sites yielding Limburg, La Hoguette and *Begleitkeramik* pottery has been documented in the Meuse valley and coversand area. For Limburg ware the most indicative site is Kesseleik (Modderman 1974). For La Hoguette and *Begleitkeramik* a number of sites has been discovered away from the loess (*e.g.* Venlo-Ossenberg; Ittervoort-Damszand; Gassel-Over de Voort), along the Meuse valley, into the riverine district and beyond (Ede-Frankeneng; see Brounen/Hauzeur 2010; Brounen *et al.* 2010). The later distribution of *Breitkeile* shows an expansion which ranges much farther north and cannot be attributed to expeditions alone (Raemaekers *et al.* 2011; Verhart 2012; Van der Waals 1972). The paucity of finds further to the west is remarkable in this respect (Vanmontfort 2008[b]; Verhart 2003), and probably relates to source areas and networks of transport and distribution. While these objects signal contact and interaction with farmers of the Rössen culture in and around the Rhineland loess area, their impact upon these communities and with respect to Neolithisation remains difficult to establish. Since evidence for the first domestic animals at Hardinxveld dates between 4700 and 4450 cal BC (Louwe Kooijmans 2007[a]), it is plausible that, in terms of the availability and substitution phases as modelled by Zvelebil and Rowley-Conwy (1984), this shifting frontier (see also Zvelebil 1998[a]) should be 'interpolated' at an earlier date for the southern coversand area and Meuse valley (see also Vanmontfort 2008[b], 91).

The nature of the developments with respect to Neolithisation in the coversand area and Meuse valley is difficult to establish. It is not known to what extent the offspring of the first farmers in the loess zone directly shaped the character of the Neolithisation of the coverand area further north, or whether there were hiatuses in occupation after which subsequent Neolithic groups (of Grossgartach, Blicquy or later affinity) re-settled the area, nor to what extent the indigenous Mesolithic population played an active role. The developments between 4900 and 4200 cal BC are largely unknown for the southern part of the LRA. What is known is that from *c.* 4200 cal BC, in the Rhineland, Belgian loess region and over large parts of the coversand area up to the riverine district, sites of the Michelsberg culture appear (Louwe Kooijmans 1976[a]; Schreurs 2005; Vanmontfort 2004; Verhart 2000). The characteristics of this culture are different from those of the LBK, in terms of material (pottery, flint), houses, its largely ephemeral settlement system, which, however, did include flint mines and enclosures, and to some extent its economy (new emphases in crops types, use of different soil types). Based on these characteristics it has been proposed that the MK economy and settlement system was more versatile and less rigid than that of the preceding Early Neolithic LBK. It might have been easier for indigenous hunter-gatherers to adopt this system (see also Crombé/Vanmontfort 2007; Thomas 1988; Vanmontfort 2004; 2007). For the southern part of the LRA we are clearly dealing with both Rhineland Michelsberg influences for the east and developments originating in the French Chasséen in the west (Louwe Kooijmans 1976[a]; Vanmontfort 2004; Schreurs

2005), it is argued that the indigenous population may have formed an important factor in the formation of regional variants of both, such as the Spiere Group in western Flanders (Vanmontfort 2007; 2008[b], 93). The MK in the southern part of the LRA may then represent a 'melting pot' outcome of Neolithisation.

5.2.3.3 The Swifterbant culture in the wetlands and wetland margins (5100-3700 cal BC)

A third development is of a more indigenous nature and involves the development of Late Mesolithic communities into the early Swifterbant culture. As a starting date the first appearance of indigenous pottery is recorded at Polderweg and slightly later at Hoge Vaart between 5100 and 5000 cal BC (Louwe Kooijmans 2001[a]; 2010[a]; Peeters 2007). Swifterbant sites have been documented in the wetland areas of the LRA, including the central river district, the current central Dutch polders (Raemaekers 1999), the Scheldt Basin (Crombé (ed.) 2005[a]) and around Lake Dümmer in Lower Saxony (Kampffmeyer 1991). It is difficult to estimate to what extent the adjacent wetland margins and coversand area were part of its residential occupation as well (see Niekus 2009) due to taphonomic factors (see Chapter 4), but it may be argued that the majority of the evidence points to wetland-oriented communities.

As argued above, the appearance of pottery forms only a material change. We are in fact dealing with a ceramic Mesolithic (Louwe Kooijmans 2001[a], 445). Pottery traditions should not be seen as a derivate of agriculture, but as an indicator of changed habits in food preparation, independent of the introduction of domesticates (Louwe Kooijmans/Vanmontfort 2010, 209). Within the LRA the introduction of pottery technology in Late Mesolithic communities, in addition to imports of flint and adzes, formed the first step of a specific Swifterbant trajectory of Neolithisation which, in a later stage, would incorporate domesticates and cultigens. Between 4700 and 4450 cal BC the first domesticated animals appear at Hardinxveld-De Bruin, while the evidence for crop plants (consumption and possible cultivation) dates to the middle phase of the Swifterbant culture, at Swifterbant-S3, between *c.* 4300 and 4100 cal BC (Out 2009; Raemaekers 1999).

5.2.3.4 Simultaneous developments

The three developments sketched above indicate that the process of Neolithisation in the LRA is diverse. These were not isolated processes, but interconnected trajectories. Examples include the early appearance of an LBK arrowhead at Hardinxveld-Polderweg, and Blicquy-like pottery at Hardinxveld-De Bruin (Louwe Kooijmans 2003). Louwe Kooijmans (2010[a]) also argues for a southern inspiration in explaining the origins of Swifterbant pottery. Others have pointed out the existence of imports and even *bricolage* in the material repertoire of the Swifterbant culture (Raemaekers 1999). Similarly, recent excavations at sites such as Doel-Deurganckdok and Bazel-de Sluis (see Appendix I) in the Scheldt valley demonstrate a spatial convergence of Mesolithic, Early and Middle Neolithic elements, including Swifterbant ware at Doel. At this moment, however, many of the processes behind the material derivates of interaction that took place in the early 5th millennium remain obscure.

Despite the limitations, two broad trends may be sketched. A first one developed in the loess area and involves a relatively quick appearance of the Neolithic through the arrival of the LBK. The degree of continuity of this tradition into the first centuries of the fifth millennium and the nature of interaction with the Late Mesolithic is not well determined. However, around 4200 cal BC the Middle Neolithic MK may be interpreted as largely representing the completion of Neolithisation in the loess area, the adjacent coversand landscape, the Meuse valley and several locations in the Scheldt valley (*e.g.* Vanmontfort 2008[b], 91). The other trend involves the largely indigenous development of the Swifterbant culture and subsequent Hazendonk group and Vlaardingen culture, rooted in the Late Mesolithic (see also Louwe Kooijmans 1998[a]) and mainly oriented on the wetlands and wetland margins between the Scheldt valley and the Elbe.

One of the keys to understanding the differences in the developments in Neolithisation is a better understanding of the Late Mesolithic substrate. This, in combination with the specific constraints and possibilities offered by the natural environment and distance to the 'Neolithic source areas', may explain part of the trajectories of Neolithisation in the LRA. The remainder of this chapter is aimed at broadening our understanding of these communities by studying a number of interrelated aspects of Late Mesolithic sites.

5.3 Late Mesolithic sites in the LRA

In total 41 Late Mesolithic sites have been selected. These are presented in table 5.1 and in fig. 5.1. The selection is not exhaustive. The main focus is on excavated sites with sufficient contextual information to isolate a Late Mesolithic phase of occupation and/or assemblage. Other sites have only been included if they provided sufficient indications for a Late Mesolithic attribution in combination with additional information, for instance regarding geographical distribution. Sites with a distinct early Neolithic La Hoguette, Limburg or *Begleitkeramik* component have not been included in the list (*e.g.* Bracht-Brüggen, Echt-Annendaal-HVR 183, Ede-Frankeneng, Gassel-Over de Voort, Kesseleik-Keuperheide, Koningsbosch, Linne-Mortelshof-HVR 16, Posterholt-Vinke-HVR 39, Sweikhuizen-de Hei). Although these are potentially contemporaneous with (part of) the Late Mesolithic distribution of sites, there is little qualitative information regarding their role. For more detailed information see Appendix I.

In the light of the palimpsest problem (Bailey 2007; Chapter 4) the choice for excavated sites is evident. While this does not rule out material admixture of other periods - most excavated sites are of course also time-averaged surface collections - it does limit these effects considerably when compared to surface sites. It also offers more control over the spatial dimensions of the settlement and the composition of the lithic assemblage. On the other hand, as may be seen in fig. 5.1, the focus on excavated sites does provide a geographically skewed dataset. This relates to different factors. The paucity of Late Mesolithic sites in the loess area, for instance, may both be a reflection of actual settlement patterns (the Holocene oak-lime forest being largely unattractive for hunting game), as well as relate to problems of identification, such as erosion of the terrace edges (*e.g.* Vanmontfort 2008[a]; Verhart/Groenendijk 2005, 237, 244). The large number of sites in the southern coversand landscape and the Meuse valley on the other hand is the result of their occurrence at or near the surface, facilitating discovery,

Table 5.1. Alphabetical list of selected Late Mesolithic sites (and abbreviations) in combination with year, extent of excavation (e) or documentation (d; usually survey) and geomorphological site location. Site numbers correspond with fig. 5.1. Group attributions and exceptions are discussed in text. General abbreviations for multi-period sites: LM = Late Mesolithic; EN = Early Neolithic; MN = Middle Neolithic; SWB = Swifterbant.

site + abbreviation	chrono-cultural attribution	excavation year	excavated (e)/documented (d) m²	location/group
southern coversand landscape				
1. Brecht-Moordenaarsven 1 (B-M1)	LM	1981-1982	63	coversand dune
2. Brecht-Moordenaarsven 2 (B-M2)	LM	1981-1982	172	coversand dune
3. Brecht-Moordenaarsven 3 (B-M3)	LM	1981-1982	(d) unknown	coversand dune
4. Brecht-Overbroek (I-III) (B-O1-3)	LM	*c.* 1960-70	*c.* 129 (e) + (d)	coversand dune
5. Brecht-Thomas-Heyveld (B-TH)	LM	1980	*c.* 100	coversand dune
6. Dilsen-Dilserheide III (D-DIII)	LM	1991	146	coversand ridge
7. Helmond Stiphoutsbroek (H-SB)	LM/EN	1989	2115 (e) + (d)	coversand ridge
8. Lommel-Molse Nete	LM	2003	85	coversand ridge
9. Lommel-Vosvijvers 3	LM	1982	48	coversand ridge
10. Meeuwen-In den Damp (M-ID)	LM	1986	684	coversand dune
11. Merselo-Haag (M-H)	LM	1988	409	coversand ridge
12. Opglabbeek-Ruiterskuil (O-R)	LM	1971	134	coversand dune
13. Tilburg-Kraaiven	LM	1957-	unknown	coversand ridge
14. Turnhout-Zwarte Heide (T-ZH)	LM	*c.* 1970-80	2300 (d)	coversand ridge
15. Weelde-Paardsdrank (W-P1/4/5)	LM/EN	1976-1977	337	coversand dune
16. Weelde-Voorheide 3	LM	1995	156	coversand ridge
northern coversand landscape				
17. Bergumermeer-S64B (B-S64B)	LM	1971-1972	1200	coversand ridge
18. Havelte-De Doeze(H-DD-H1-I-II)	LM	1970-1972	765	coversand ridge
19. Mariënberg-Schaapskooi (M-S)	LM	1975-1983	2110	coversand ridge
20. Menstede-Coldinne	LM	1982	102	coversand ridge
21. Nieuw-Schoonebeek (N-S)	LM	1989	243	coversand dune
22. Staphorst-Olde-Meppelerdiep	LM/SWB	unknown	unknown	river dune
23. Tietjerk-Lytse Geast I (T-LG1)	LM	*c.* 1959-70	*c.* 140 (e) +d	coversand dune
w. wetlands and wetland margin				
24. Hardinxveld-De Bruin (Hdx-DB)	LM/SWB	1997	345	river dune/donk
25. Hardinxveld-Polderweg (Hdx-PW)	LM/SWB	1997	448	river dune/donk
26. 's-Hertogenbosch-Maaspoort	LM	1989-1990	*c.* 106	river dune/donk
27. Hoge Vaart (HV-A27)	LM/SWB	1994-1996	1684	coversand ridge
28. Melsele-Hof ten Damme	LM/SWB/MN	1984-1986	100	river dune/donk
29. Oudenaarde-Donk	LM/MN	1984-1987	unknown	river dune
30. Swifterbant-S11/12/13 (SWB-S11-13)	LM/SWB	unknown	unknown	river dune
31. Swifterbant-S21 (SWB-S21)	LM/SWB	1961-1976	385	river dune
32. Swifterbant-S22/23/24 (SWB-S22; S23)	LM/SWB	1961-1976	417	river dune
33. Swifterbant-S61	LM/SWB	1978	75	river dune
34. Swifterbant-S81/82/83/84 (SWB-S83)	LM/SWB	2002	8/ *c.* 300 (d)	river dune
35. Urk-E4	LM-SWB	1997	880	river dune
36. Willemstad-Volkerak	LM	1966	unknown	sand ridge
river valley/valley floor sites				
37. Jardinga-Johannahoeve (J-J)	LM/SWB	1981;02/3	295	valley floor
38. Liège-Place St.-Lambert (LPS-SDT; DDD)	LM	1990-2000	330	valley floor
39. Namur-Grognon	LM	1994-1995	*c.* 82.5	valley floor
40. Nijlen-Varenheuvel	LM/SWB	2007	unknown	valley floor
41. Remouchamps-Station LeDuc (RSD)	LM	1980-1983	65	valley floor

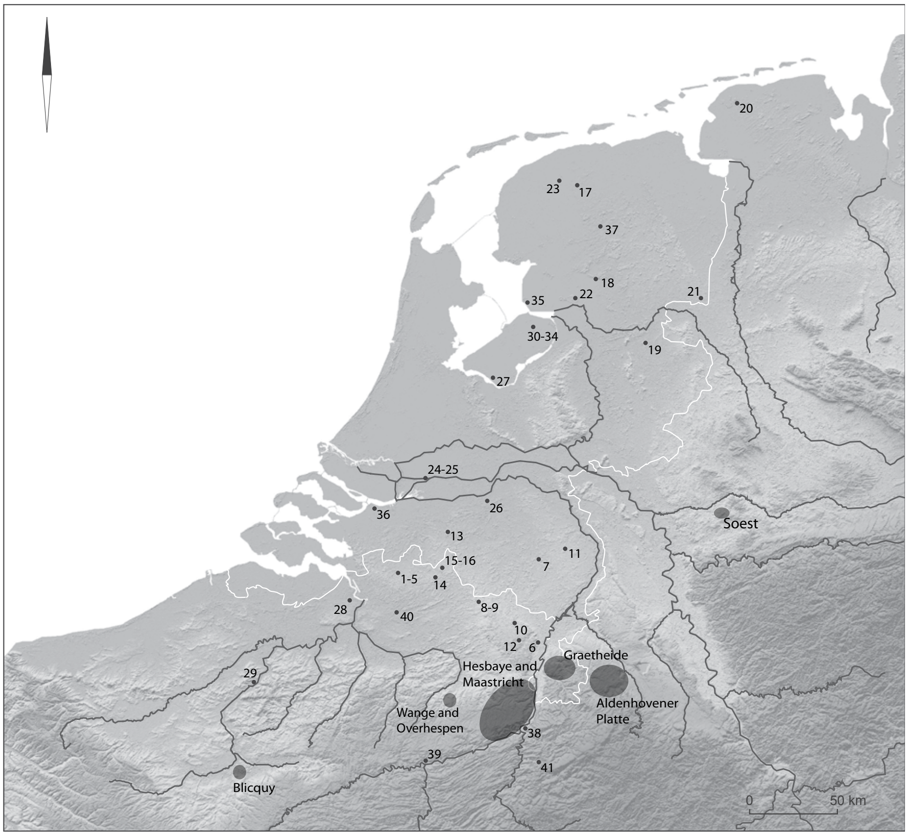


Fig. 5.1 Map of the LRA with the Late Mesolithic sites presented in table 5.1. The main LBK settlement clusters are shown by shading.

in combination with intensive research programmes such as the Meuse valley project (Verhart 2000) and Leuven University's intensive focus on the Campine area (Verhart/Groenendijk 2005, 236). The limited number of sites situated in wetland areas is mostly the result of limited access, due their burial beneath thick layers of sediment, sites such as Hardinxveld-Polderweg and De Bruin forming rare exceptions that also accentuate the absence of an organic component at the other locations (Louwe Kooijmans 2003). Processes of sedimentation, in combination with erosion, also limited the chance of discovery of sites in the 'Holocene' parts of North Holland, Friesland and Groningen (Peeters/Niekus 2005, 204). Another reason is the dynamic coastline obscuring evidence of habitation (see also Raemaekers 2003).

Unfortunately the available dataset cannot be considered representative for the whole of the Late Mesolithic occupation in the LRA. Nonetheless, it is the best we have and the distribution of sites does, to a certain extent, allow for comparison between sites and groups of sites. It should be noted that the results should be interpreted as tentative indications of the characteristics of Late Mesolithic occupation that may change as more excavated sites become available. This is especially the case in areas for which only a limited number of sites is available.

5.3.1 Geographical and ecological background

In order to compare the similarities and differences of the sites selected and documented, also in relation to their attribution to groups (see below), it is necessary to briefly sketch the regional geographical and ecological characteristics and context.

5.3.1.1 Southern coversand landscape

The southern Pleistocene upland coversand landscape group incorporates the Belgian and Dutch Campine area, where most sites are situated. The landscape is characterised by a sand-blown topography. Deposition dates to the Saalian and mainly Weichselian glacials (see Van Gijssel/Van der Valk 2005, 54-58; see also Vos *et al.* (eds) 2011, maps 9000 and 5500 cal BC), often with dune complexes or ridges that are bordered by meres (Dutch: *vennen* or peat fens). These are wet depressions (*e.g.* Vanmontfort *et al.* 2010[b], 33) that are mainly *ombrogenous* (rain fed), which contrasts with the meres in the more western sandy Flanders regions which are *geogenous*, receiving most water from the regional water table and additional sources (see Robinson 2010, 36). The Younger Dryas was a period of major dune formation (Vermeersch/Huyge 1982). These dune complexes are often situated on top of Pleistocene gravels and sands (*e.g.* Creemers/Vermeersch 1986; Luypaert *et al.* 1993; Vermeersch *et al.* 1974) with height differences of several meters (see Appendix I). The landscape is further characterised by brook valleys and bordered to the east by the Meuse valley.

Vegetation development at the onset of the Holocene saw a reappearance of dry forest dominated by birch and later pine and hazel in the Preboreal. Hazel expanded rapidly in the Boreal, followed by deciduous trees such as oak (*Quercus*) and elm (*Ulmus*) (Crombé *et al.* 2011[b], 456). Of importance for the Late Mesolithic is the development of an Atlantic climax vegetation (*Quercetum mixtum*) from *c.* 7000 cal BC on drier grounds with alder in the wetter parts (*ibid.*; Van Gijssel/Van der Valk 2005, fig. 3.11). At that time, the Early Atlantic, the forest was already relatively dense. At Meeuwen, for instance, palynological data from the mere indicates that there was a heavily forested environment upon the transition to the Atlantic. This mainly consisted of pine (*Pinus*), birch (*Betula*) and hazel (*Corylus*). Also present were lime (*Tilia*), elm and oak. Herbaceous plant pollen and spores of ferns point to wetter parts. Alder (*Alnus*) and lime appeared and increased from the Boreal-Atlantic transition (Bubel, 2002/2003, 318). At Opglabbeek pollen samples taken from under clusters of hearthstones are indicative of an Early or Mid-Atlantic forested environment (Vermeersch *et al.* 1974, 99-100). The developments that started during the early Atlantic continued throughout the Atlantic period. In the course of the Atlantic species such as oak, lime, elm and hazel increasingly formed the most important components of the upland forests (see Van Gijssel/Van der Valk 2005, fig. 3.12). Alder and herbaceous plants grew in the wetter parts.

There is slight evidence for some open areas. Huyge and Vermeersch (1982, 143, 189) for instance indicate the existence of an open lime woodland with hazel and ivy for Weelde at the end of the Atlantic (see also Munaut 1967, 51). Furthermore, a large-scale study by Svenning (2002, 137) in northwestern Europe points to the existence of heath and grassland in more infertile areas such as on poor sandy soils. While the former example may point to Neolithic agricultural intervention, Svenning also points to large herbivores and fire as ways of managing open areas, but concludes that in most of northwestern Europe closed forests would have dominated. While the possible existence of some open areas, for instance created by wind falls (gap theory) and the role of herbivores should not be ignored in interpreting the composition and diversity of this forested region, the overall archaeological and palaeo-ecological evidence points to a forested environment (see Louwe Kooijmans 2012[a]; see also Van den Bremt *et al.* 1998; Sommer *et al.* 2011). It is plausible that zones with increased bio-diversity – in this type of landscape the meres and brook valleys – would form the most attractive areas, hosting resources such as wildlife, flora and water. This is substantiated by the idea that the closed canopy forests of the Atlantic were relatively unattractive to larger mammals and species such as aurochs, roe deer, red deer and wild boar, due to, among others, a lack of undergrowth (see Groenendijk 1997; Svenning 2002; Verhart/Groenendijk 2005, 237). This would make more open zones such as forest edges and places with open water attractive (see Crombé *et al.* 2011[b], 467 and references).

5.3.1.2 Northern coversand landscape

The northern upland coversand and southern coversand landscape are comparable, in that they are shaped to a significant extent by coversand deposition. The systems of the Hunze, Tjonger, IJssel, Overijsselse Vecht and Eem form the major watercourses (Peeters/Niekus 2005, 202). A difference is the presence of moraine deposits in the subsoil, particularly of the Frisian-Drenthe boulder clay plateau where most sites are situated. The Saalian ice advance covering the area resulted in the formation of the plateau and boulder clay outcrops. The occurrence of peri-glacial phenomena such as lakes and the many pingo scars on the Drenth plateau date to the Weichselien (Van Gijssel/Van der Valk 2005, 54-57).

The impermeable qualities of the subsoil already led to some peat formation in the Preboreal, but in the course of the Atlantic the rise in sea level further influenced the landscape and groundwater levels of the northern Netherlands. This may have led to peat formation and an increasing wettening of the landscape (Peeters/Niekus 2005, 202-203). It should, however, be noted that this took place mainly from the Middle Atlantic period onwards (between *c.* 6000 and 5000 cal BC) and predominantly affected the coastal areas and water systems, although it also encroached on the coversand area (Berendsen 2005, 73-82, Groenendijk 1997). To what extent areas such as the Drenthe-Frisian boulder clay plateau were affected is not well known (Peeters/Niekus 2005, 203; see also Van Gijssel/Van der Valk 2005, 62, 63 and 68). If we compare the northern coversand area to its southern counterpart (see for example the palaeogeographical map '5500 cal BC'; Vos *et al.*(eds) 2011, 43) then a considerable part of the northern coversand landscape is low-lying, making it susceptible to changes in groundwater level as a result of the rise in sea level (-9 m below NAP around 5500 cal BC; pers. comm. Louwe Kooijmans 2012).The area as a whole is characterised more by small stream valleys and incipient peat formation. It is, however, likely that these are differences of degree, since the southern coversand landscape is characterised by peat fens or meres and small stream valleys as well.

The Atlantic vegetation history and development of the northern coversand landscape is largely comparable to that of the southern coversand area (*cf. supra*), with forests consisting of oak and hazel and other tree types such as elm and ash and alder in the wetter parts (see also Arts 1989, fig. 5; Niekus 2005/2006, 43). It is not clear to what extent the rising sea levels and increase in peat formation (and the development of *sphagnum*) affected occupation further inland. Earlier (see Newell 1973; Arts 1989) it has been suggested that the loss of land due to marine transgression would have led to an (up to threefold) increase in Mesolithic bands that were being 'pushed' inland. Recent research based on radiocarbon dates, sea level curves and coastlines reveals no indications for an increase in population during the later Mesolithic (Niekus 2005/2006, 80).[5] There does, however, appear to be a shift in the Early Atlantic from the higher Pleistocene sandy soils (most notably the Veenkoloniën area) towards the wetter parts of the landscape, predominantly the stream valleys. This may (partially) relate to the development of climax vegetation that was relatively unattractive to large game, although this may have been relatively small-scale and additional factors may have been influential as well (Niekus 2005/2006, 80-82). Similar developments have been put forward by Crombé *et al.* (2011[b]) with regard to Mesolithic and Final Mesolithic land-use and environmental change in northwest Belgium (see also Vanacker *et al.* 2001).

5.3.1.3 Western wetlands and wetland margin

Compared to the coversand landscapes, the wetland area is of a different nature. The Late Mesolithic sites located in these wetland contexts are situated in the Scheldt-Basin, the Alblasserwaard region, the Swifterbant area and in the wetland-upland border region. This indicates that they are situated in or adjacent to (developing) wetlands. Around 10.000 BP (9000 cal BC) the sea level was still 40-50 meters below NAP. A large part of the North Sea basin lay dry. At the start of the Atlantic, 2000 years later, the present coastline came into existence as the sea encroached ever further inland (*cf.* De Mulder *et al.* 2003, 216-217; Van Gijssel/Van der Valk 2005, 66-68). This transgression of the North Sea and the related rise of the groundwater level mainly affected the lower lying areas such as the central river district, the IJsselmeer Basin and the northern parts of the provinces of Friesland and Groningen. These areas may be characterised as sedimentation basins under influence from both the sea and river systems from the hinterland (De Mulder *et al.* 2003, 16; Zagwijn 1986, 27). A number of coastal and fluvial wetland landscapes came into existence that were buried or eroded again as the influence of the sea expanded, shifting the entire system further to the east (Berendsen 1997, 153-180; Louwe Kooijmans 1985, 25-28; Van Gijssel/Van der Valk 2005, 66-68). These gradients became more or less fixed as sea levels decreased at the onset of the Subboreal (*c.* 4050 cal BC; Gehasse 1995, 194).

The character of the wetlands differed from east to west. The riverine area formed a dynamic environment of deposition and erosion contrasting with extensive bodies of Pleistocene upland to the north and south. West of this area, wetlands comprising riverine elements as well as lakes are characterised by a freshwater peat environment, while further west brackish estuarine conditions existed and even further west a landscape characterised by salt marshes and tidal flats (see map '5500 BC', in Vos *et al.*(eds) 2011; Van Gijssel/Van der Valk 2005). In the IJsselmeer basin and the Scheldt valley similar conditions existed with water and peat formation forming an increasingly important feature of the landscape. The landscape of the Swifterbant area can be characterised as a tidal area with creeks, levees and backswamps (Ente 1976; Hacquebord 1976; De Roever 2004). The Scheldt valley becomes increasingly characterised by alder carr and peat growth during the Atlantic, turning the area next to the river into a peat fen (Crombé 2005[b]; Louwagie/Langohr 2005). Occupation in or near these (developing) wetlands usually occurred on higher elevations such as river dunes. In the Alblasserwaard area these are named 'donken' and some 80 have been documented. These are the outcropping tips of river dunes of Pleistocene origin forming the dry elements in what must have appeared an archipelagic setting (see Verbruggen 1992[b], 119; see also Louwe Kooijmans/Verbruggen 2011). River dunes were also occupied in the Swifterbant area, while the landscape bordering the Scheldt is characterised as coversand with Late Glacial dunes (Louwagie/Langohr 2005). Other raised landscape elements in the wetland margin include coversand ridges (see for instance Hoge Vaart or Maaspoort, Appendix I).

The ecological characteristics of the wetland area differ distinctly from the coversand landscape. For the central river area a variety of ecotones and plant communities in mosaic-like patterns is postulated (Out 2009, 50). The drier parts featured deciduous lime/oak woodland, while the wetter areas were characterised by softwood alluvial woodland vegetation, alder carr, marsh and river bank vegetation. As water levels increased the dunes became smaller and the oak lime vegetation gradually became replaced by a typical marsh forest (*ibid.*, Bakels/Van Beurden 2001). Similar developments may be postulated for the Swifterbant area with a rough distinction between more deciduous woodland in the higher area and an alder carr vegetation in the wetter areas (for more details: Casparie et al.1977; Van Zeist-Palfenier-Vegter 1981; Out 2009, 177). In the Scheldt valley around Doel the wetter parts are also characterised by an alder and sedge vegetation, developing into a fen carr in the Late Atlantic (DeForce *et al.* 2005, 121, 124-126; DeForce *et al.* 2013).

These wetlands provide a rich habitat for flora and wildlife (*e.g.* Bakels 2005; Louwe Kooijmans 2003; Nicholas 1998[a,b]; 2007[a,b]; Out 2009; Van der Noort/O'Sullivan 2006). This includes specific wetland species such as waternut and tubers of (white) lily, as well as otters, beavers, fish and waterfowl (*e.g.* Louwe Kooijmans 1993[a]; Zeiler 1997). It is evident that the importance of these aquatic resources should not be underestimated. From an economical and functional perspective these were very rich environments that differed from upland environments both quantitatively and qualitatively (*e.g.* Nicholas 2007[a]; Van der Noort/O'Sullivan 2006). Despite their internal dynamics they offered a relatively stable and bountiful environment for occupation.

5.3.1.4 River valley/valley floor

River valleys form a final category that is partially regionally defined as well as geographically. It includes four sites with a riverside or stream valley setting. These locations are directly associated with a stream or river (instead of being located on a higher feature in the landscape as is often the case in the group of wetland sites). In two cases this involved the larger valley of the Meuse at or near Liège, in one case the nearby tributary of the Amblève and in another Jardinga on the banks of the Tjonger. Although the valleys have older origins, the sediments mainly consist of Holocene deposits of gravels, loam and sandy loam (see Appendix I).

Recently, archaeological attention has re-focused on river and stream valley locations, both in the Netherlands and abroad (Bell *et al.* 2006; Rensink 2004; Stoepker 1997). It is evident that potential past motivations for settling next to rivers and streams focused in part on the advantages this offered with respect to the diversity of wildlife, botanical resources and water. In this respect these zones are comparable to the wetlands (see Crombé/Cauwe 2001, 50), their floodplains, and especially the riparian areas forming the more important ecotones in the landscape (see also Brown 1997, Chapter 4). For the Atlantic period in particular the river valley environment and associated flora forms a diversification within the (loess and coversand) landscape (see Bakels 1978). This not only concerns the wide range of plant and animals typical for these types of aquatic or riverside settings, but in particular also other animals that are drawn to it. River valleys are thus elements of diversification in the landscape whose richness may provide a buffer function. As with the wetland and wetland margin settings mentioned earlier the importance of aquatic resources and transport should not be underestimated (Ames 2002; Louwe Kooijmans/Verhart 2007).

The rationale behind this category is mainly based on the notion that the occupation of locations adjacent to running water form a characteristic choice in occupation location and potentially a logical complementary counterpart in a regional settlement system. This is governed by the presence of running water and the possibilities it offers. These sites are located in energetic environments, which may impede discovery, either because of complete or partial erosion or subsequent sedimentation (*e.g.* Brown 1997; Gifford 1978; Schiffer 1987; Sommer 1991).

From a geological and ecological point of view these locations should not be treated as *partes pro toto*. Their development, character and scale might differ per river floodplain and stream valley.

5.3.2 Sites and groups

Having introduced the selected sites (fig. 5.1) and the regional geographical and ecological context, the former may be categorized in four groups and a number of exceptions to these. The groups are of a regional character (and hence related to the geographical and ecological context provided above). This does not mean that all site location settings are comparable, only that there are similarities in their mutual backgrounds.

The division in groups is not used as an absolute distinction, but as a framework for comparison. This can only be done when the internal variation within the groups and the exceptions are taken into account. The validity of the groups is therefore variable and this implies that there are also sites that do not fit the profile exactly.

The 'southern coversand landscape group' is quantitatively and qualitatively the most coherent and consistent, with seventeen sites, two consisting of multiple locations, in largely comparable settings. The 'northern coversand landscape group' has a quantitatively smaller data-set, comprising six sites situated in diverse site settings with one consisting of multiple locations. The 'western wetlands and wetland margin' is formed by twelve sites, including some with multiple locations. Sites in this group are situated in a distinct wetland setting such as both Hardinxveld locations, but also include the Swifterbant river dune sites and Hoge Vaart, locations that are situated in a landscape that is gradually becoming more wet. The valley floor or river valley group consists of three sites in the Ardennes-Meuse area with a comparable river valley setting. Additionally the special activity site of Jardinga was placed in this group because of its brook valley setting.

The division in groups is based on regional arguments and, in one case, the river valley group Jardinga site. Below a brief summary of the group characteristics is presented, followed by a discussion of the exceptions or difficult attributions per group.

5.3.2.1 Group 1: southern coversand

This group is characterised by sites situated on elevations such as coversand dunes and ridges on the southern Pleistocene coversand landscape. These sites are often located in the vicinity of meres or peat fens (Dutch: *vennen*) or small streams. All of the sites selected for this group generally fit this classification. Although there are of course internal differences in site size, duration and composition of features and finds, the overall characteristics are homogeneous and comparable.

5.3.2.2 Group 2: northern coversand

Sites in this group are situated on dunes, ridges and other outcrops (*e.g.* boulder clay) in the northern coversand landscape. Most known sites are situated on the Frisian-Drenth boulder clay plateau. There is some difference in the site settings that will be discussed below. Since the number of sites in this group is much more limited the resulting image is more heterogeneous compared to that of the southern coversand landscape, although differences between occupation in both types of landscape may be more of degree rather than kind (see also landscape characterisation description above).

Mariënberg-Schaapskooi

This site is part of the group of sites on the northern coversand landscape. The site, characterised by hearthpits (Verlinde/Newell 2006), is not situated on the Frisian-Drenth boulder clay plateau, but further south at the edge of the wide (*c.* 1 km) Vecht valley. Although it is not known whether the nearby meander of the Vecht was active at that time, the site location appears to be associated with the river valley and the high vantage point it offers over it (see Appendix I). Since it is not situated in the river valley next to the stream itself, it is not attributed to the group of river valley sites. In fact its position on a coversand ridge and overall characteristics do not preclude its placement in the group of northern coversand sites.

5.3.2.3 Group 3: wetlands and wetland margin

This group is a generic category formed by sites situated mainly on river dunes in the delta (Alblasserwaard region), the Scheldt valley, the Swifterbant area and the wetland margins of the current Noordoost Polder and southern coversand landscape. For this group it is important to understand that sites attributed to it are situated in 'different degrees'of a wetland setting, as argued above. There is thus a distinction between sites that are situated in a complete wetland environment and those that are characterised by dry elements in their hinterland or developing wetland conditions. These differences also define some of the exceptions relevant to this group.

Melsele-Hof ten Damme and Oudenaarde-Donk

Both Melsele and Oudenaarde are attributed to the wetland group (see table 5.1). Based on their geographical location this is not problematic, but it is questionable to what extent a wetland situation existed or was present nearby during occupation. Melsele is situated in the Lower Scheldt Basin on a Late Glacial dune in the wetland margin (Van Roeyen *et al.* 1992, 41). A radiocarbon date around 5300 BP (*c.* 4100 cal BC) indicates deposition of brackish sediments. Palynological evidence also points to a brackish environment (*Chenopodiaceae* and algae) with tidal influences. Pollen from these sediments indicate a heavily wooded environment comprising, among others, alder (40%), oak (20%) and lime (10%) as well as herbaceous plants. This points to a wet environment. From 3100 cal BC, the dune is covered with peat. Palynologically this situation may also date to the Atlantic, although actual deposition at the dune only took place in the Subboreal (*ibid.* 45-46). It is thus difficult to estimate to what extent the wetland conditions also characterised the nearby environment during the Late Mesolithic, but the site was at least situated in an area that was increasingly becoming a wetland.[6]

Oudenaarde is situated on a Pleistocene point-bar system of the Scheldt River in the Middle Scheldt Basin (Belgium). During occupation the area became increasingly wet before being covered with peat and clay in protohistoric and Roman times (Parent *et al.* 1987[a], 7-8). The site is situated in the Scheldt valley but the width of this valley may be estimated at *c.* 2 km. It is therefore not appropriate to attribute the site to the river valley group. The site is in fact located between two Late Glacial depressions. In between these there is an area of interspersed 1.5 m high ridges belonging to a fossil point bar system of the Scheldt. Due to the rising groundwater table in the Holocene the depressions were gradually filled up.[7] Palynological information from the fossil channel indicates a forest consisting of oak, hazel, lime and elm for the Atlantic and Subboreal part of the sequence. In the wetter parts alder (*Alnus*) replaced willow (*Salix*). Macrobotanical remains indicate a wet, riparian environment as well as more ruderal vegetation (Parent *et al.* 1987[a],10-13; De Ceunynck *et al.* 1985).

Based on the geological and ecological information it is difficult to establish to what extent the site was situated in or near a wetland area during its Late Mesolithic occupation. It is evident that this was the case during the Neolithic occupation. An interpretation as a site situated in a (developing) wetland or wetland margin seems most appropriate.

Hoge Vaart-A27 and Urk-E4

Similar problems of interpretation arise in the attribution of two other wetland margin sites: Hoge Vaart and Urk. The latter site is located on a river dune along an earlier course of the Vecht (Peeters 2007, 209). Until *c.* 4500 cal BC the site was located in an increasingly wet environment with both open water and peat growth. Around 4100 marine influence increased and in part of the area a freshwater tidal regime developed. From 3450 cal BC onwards marine influence decreased again and extensive peat growth took place. This continued until around 3400 cal BC when the entire dune was covered (Peters/Peeters 2001, 17-22, 112, 117). Evidently the site became a genuine wetland location during the 5th millennium (see also Out 2009, 196), which postdates the Late Mesolithic phase with hearthpits dating between 7000 and 5000 cal BC. While this would potentially allow an attribution to a group of northern coversand sites, its location around 5500 cal BC (see map '5500 cal BC' in Vos *et al.* (eds) 2011, 42) accentuates its proximity to the wider wetland area, while the later developments confirm this position as a wetland margin site.

Hoge Vaart is situated on a coversand ridge, which forms a foothill of higher positioned sandy soils connected with the Gooi and Veluwe areas. To the west the ridge slopes into a flat landscape. To the east an old channel - most likely of the Eem - forms a low-lying area. Early in the Holocene peat formation took place. On top of the peat a colluvial layer of sand, originating from the dune, was deposited in the Boreal or early Atlantic. Clastic, organic and sandy deposits from 5400 cal BC subsequently covered this layer. This indicates that the area became increasingly wet because of the rise in sea level and concomitantly groundwater table. Between 5100 and 4900 cal BC aquatic sediments were deposited. Over time the site became covered with Holocene sediments. After 4500 cal BC habitation was impossible. The vegetation on the dune is characterised by a lime and hazel forest during the Boreal and the Early Atlantic (3BC-horizon).

Unfortunately information on the vegetation of the low-lying area is missing for the Boreal and the Early Atlantic, but alder probably grew in the wetter parts. During the Atlantic, oak increased and the vegetation on the dune opened up, consisting of species such as alder, ash, willow, garden sorrel and ferns. In the low-lying wet area there was marsh and reed vegetation (Peeters/Hogestijn 2001, 27-28; Spek *et al.* 2001[a,b]). Based on these developments it can be stated that at least during the latter part of its Late Mesolithic hearthpit occupation (*c.* 5500-4850 cal BC; Peeters 2004; Peeters *et al.* 2001, 15) the site was situated in a wetland environment. Before that the area became increasingly wet, indicating a position in a developing wetland, or as a wetland margin site (see Peeters 2007, fig. 3.12).

Willemstad and 's-Hertogenbosch-Maaspoort

Two other wetland sites should briefly be mentioned: Willemstad and Maaspoort. Maaspoort is situated on the edge of the North-Brabant coversand area, bordering on the wetlands of the central Dutch river area (see Verhart/Wansleeben 1991). Sites like this have been hypothesized to form possible summer counterparts for sites in the wetlands, like Hardinxveld. Unfortunately the artefactual and contextual information of the site is limited and no Late Mesolithic artefacts or faunal assemblage could be isolated (see Appendix I). The Willemstad site is known for the small wooden figurine that was found there, radiocarbon dated to *c.* 5400 cal BC. The site was situated on a sand ridge in a freshwater tidal estuary. Based on its position on the palaeo-geographical map (5500 cal BC; Vos *et al.* 2011, (eds) 43) the site is situated in the tidal area and may be classified as a wetland location. Unfortunately no further finds or contextual information are available for the site.

5.3.2.4 Group 4: river valley/valley floor

These sites are characterised by a common settlement location in the valley of a river, brook or stream. Their common denominator is therefore a settlement location choice that is directly and distinctly situated in a floodplain or riverine situation. In that respect these sites form potentially interesting counterparts for sites in settlement systems that also incorporate other environments. This makes them of complementary interest in relation to the other groups, most notably the southern and northern coversand landscape groups. Three of the sites in this group were situated next to the Meuse and its tributaries in the foothills of the Ardennes. They are therefore also of distinct regional value. The site of Jardinga on the banks of the Tjonger is clearly a special activity location and therefore of a different nature (see below). The site of Nijlen-Varenheuvel is a potential fifth candidate, but unfortunately has not yet yielded enough evidence for further interpretation (see Appendix I).[8]

Jardinga

Jardinga is part of the group of river valley sites, but is a case in and of itself. It should be considered a special activity site since it represents an aurochs butchering location (Prummel *et al.* 2002). Although the group as a whole is small, this site is functionally different and should not be interpreted as typical for a residential river valley occupation (*cf. supra*). Furthermore it is situated far north, while the other sites are of a general (domestic) nature and located far to the south, along the Meuse and its tributaries.

5.3.2.5 Partial patterns

It is obvious that in the formation of these groups a lot of ground is 'literally' not covered. This includes the loess zone in the south, large parts of Flanders outside the Campine area, the central part of the Netherlands (Veluwe area, Gelderland, large parts of Overijssel) and the western part of the Netherlands including the coastal area. A number of reasons for this have been given above (see section 5.3; see also Verhart/Groenendijk 2005). Currently the scarcity of excavated sites with a distinct Late Mesolithic signature in these areas forms a research bias. The sites that are available and their regional connotations may provide an idea of the original variability that may have been present and may yet, at least to some extent, be uncovered.

5.4 The Late Mesolithic – settlement 'grammar'

Having introduced the dataset and its limitations, attention will now focus on a comparison of the grouped sites with respect to a number of themes. These include a general approach focusing on what may be termed settlement 'grammar'(*cf.* Cribb 1991, 2), involving site location choice, site structure and features, and investment (in section 5.4), with the purpose of distinguishing similarities and differences between sites in the documented settings. This is followed (in section 5.5) by an analysis of the artefact assemblages and aspects of raw material choice. The object is to document whether there are perceivable differences in Mesolithic land-use, mobility and interaction in relation to the environment and between the distinguished regional groups. The reader is referred to Appendix I for further information at the level of the site.

This section focuses on the locations and characteristics of sites in the landscape. Since many details for comparison have become obscured by post-depositional and taphonomic factors (see Chapter 4; Sommer 1991) it is important to combine a number of perspectives in order to establish an idea of the types of sites and settlements that may have existed.

5.4.1 Historical aspects and perspective

Mesolithic settlement models may shed light on land-use and mobility patterns. Much research has been directed at analysing aspects of lithic distribution (Mellars 1976[a]), such as spatial and functional properties. For the LRA two general models have been made, based on site size and artefact counts (Newell 1973; Price 1978). These are presented in table 5.2 and fig. 5.2.

In both models site-functions are attributed to the classifications. In Newell's model types A and D are base camps, and B and C subordinate camps, in Price's model types 2,3 and 4 are base camps, 1 is an extraction camp and 5 an aggregation camp (based on the site of Rotsterhaule; Lanting/Van der Plicht 1997/1998, 107). Price also includes group size and duration of occupation (1978, 90-95).

Newell (1973, 402-404) also comments upon features. At type A sites there is a coincidence of the distribution of tools and features, while both find themselves within the distribution of waste. Within type B sites features and tools are located within the maximum distribution of waste. Type C sites might consist of up to three or more concentrations sometimes including a hearth.

The main critique of both models (*e.g.* Lanting/Van der Plicht 1997/1998, 108, 115-116; Niekus 2006, 45; Peeters/Niekus 2005, 222-223; Raemaekers 1999, 130; Verhart/Groenendijk 2005, 168; Verhart/Arts 2005, 240-241; Whallon 1978, 33) is that sites that are often incompletely excavated or analysed, and sites from different periods and regions are combined in an ethnographically inspired settlement model. Moreover, little attention is paid to the fact that sites were frequently reoccupied for different purposes (*cf.* Binford 1982; 2002; see Chapter 4). Artefact distribution and counts therefore also relate to factors such as time, group-size, re-use of locations and diversity of activities.

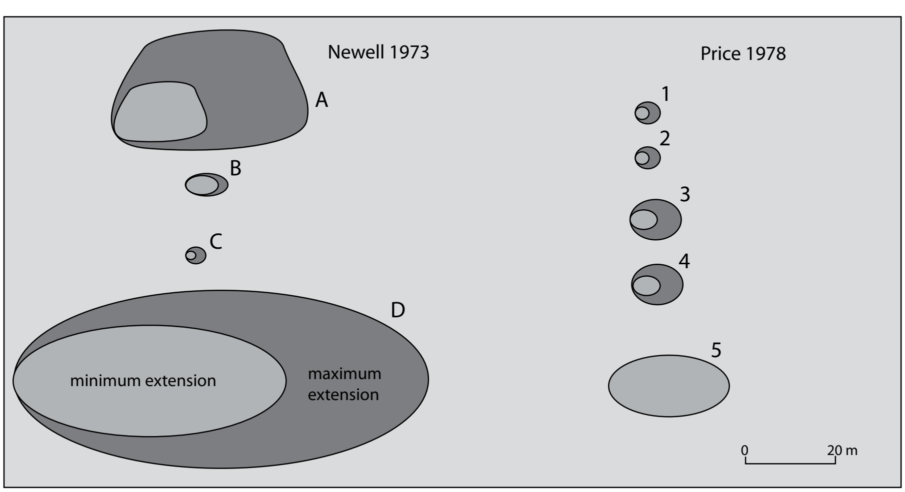


Fig. 5.2 Schematic representation of morphological categories of site types defined by Newell (1973) and Price (1978), including minimum and maximum extents per type.

Newell 1973							(based on 40 sites)
Type	L (m)	W (m)	Ø (m)	surface (m^2)	shape	N artefacts	N tools
A	20.5-40	13-26		266.5-1040	trapezoidal		153-400
B	7-9	4-5		28-45	oval		34-40
C	2-4.3	1.5-3.5		3-10.5	round		6-37
D	60-92	27.2-40		1632-3680	elliptic		5000-5500
Price 1978							(based on 17 sites)
1 (small site)			2-5		circular-oval	< 1000	< 25 tools, predominance of 1 type group
2 (small site)			2-5		circular-oval	< 1000	< 25 tools, low counts for major type groups
3 (medium sites)	5-10	4-8		30-100	elongated-oval	1500-2500	
4 (medium sites)	5-10	4-8		30-100	elongated-oval	2500-10000	fewer scrapers, more cores
5 (large sites)				300 (Rotsterhaule)	incorporating concentrations		

Table 5.2 Typological classification of Mesolithic sites by Newell (1973) and Price (1978).

On the positive side, hunter-gatherer landscape use is tethered to places, which is why a macro-analysis of sites, including artefacts, features and dimensional aspects can be useful if distorting factors are taken into account and questions are aimed not at the level of site function, but at the (larger) scale of general similarities and differences between regional patterns and overall trends in site characteristics in relation to the landscape and environmental situation.

5.4.2 A settlement 'fabric' approach: texture, grain, redundancy

In order to compare the different (structural) aspects of Late Mesolithic sites and their internal relationship a combined and integrated approach is most useful. An appropriate framework for this might be based on the 'fabric' qualities of 'redundancy', 'grain' and 'texture' as introduced by Cribb (1991, 2). Redundancy in this respect reflects the intensity and investment at sites as evidenced, for instance, by features and artefact density. Zooming out, grain results from the (spatial) structuring or patterning ('the weave') of individual elements at sites with respect to one another. Texture finally forms the broadest, geographically oriented perspective and deals with the overall articulation and positioning of sites in the landscape.

Late-Mesolithic sites will be analysed using these concepts as a general framework. Although not all qualities may be recorded at every site, the aim is to understand more of the 'grammar' and variability underlying Late Mesolithic settlement organisation. To remain in the terminology proposed by Cribb (1991) an idea of the actual 'fabric' of Late Mesolithic settlement may be given. In the following these three different and interrelated aspects will be discussed, starting with the landscape scale and subsequently zooming in on site-related patterning.

5.4.3 Site location choice: the texture

The differences and similarities in site locations are informative with respect to the factors that govern settlement in a particular area. These include people's purpose and desires, as well as the possibilities offered and constraints imposed by the environment. Both determine the character of occupation. Ethnographic and archaeological studies have revealed that many factors impinge upon choices of site location, most notably the presence of resources such as water, raw materials, actual or anticipated biomass as well as archaeologically less visible factors, such as territoriality, mating networks and other socio-cultural aspects (*e.g.* Binford 1978[a];1980; 2002; Jefferies *et al.* 2005; Jochim 1991; Kent 1992; Kent/Vierich 1989; Politis 1996; Watanabe 1968; Wood 2006). These factors, often over prolonged periods of time, lead to a repeated frequentation of certain locations and to accumulation of debris. From an archaeological point of view these locations can be characterised as persistent places (Barton *et al.* 1995; Schlanger 1992). This does not, however, mean that the reason for their chronological depth remained the same through time. Most of the sites in the defined groups yielded evidence for frequent use throughout the Late Mesolithic. Their characteristics in combination with the regional context provide clues pertaining to the nature of occupation and potential differences.

5.4.3.1 Locational characteristics: southern coversand landscape

The majority of sites in group 1 (southern coversand landscape) is situated on the top or slope of Late Glacial coversand ridges or dunes. As argued above this micro-relief characterises much of the region. These elevations are all situated in the vicinity of water in the form of meres or peat fens and streams (see table 5.3).[9]

Most sites are slightly above the waterfront and almost all are exposed to the south. This type of location indicates a strong relation to the local topography which is typical for the Campine area in the Mesolithic (*e.g.* Arts 1989; Deeben/Arts 2005; Van Gils/De Bie 2006; 2008; Van Gils *et al.* 2009, 263; see also Vanmontfort *et al.* 2010[b]). Several factors may be mentioned that could be regarded as important for settlement location choice, including the presence of open water, both as a resource and for the biodiversity it creates. Another factor may have been formed by optimal (longest) exposure to sunlight and heat (Van Gils/De Bie 2008), or shelter against prevailing winds (see Deeben/Arts 2005, 151). While the elevations are low, the choice for a southern slope may also relate to the fact that water is usually found on this side. This often pertains to the general layout of the landscape (including dunes and meres or peat fens) and its formation by aeolian sedimentation processes.[10] Furthermore there is the potential presence of

Table 5.3 Geographical setting of Late Mesolithic sites on the southern coversand landscape (see Appendix I and references for additional information).

site	geom. setting	situation/orientation	water	location water	other
Brecht-Overbroek	SW-NE coversand ridge	top/slope, S?	fen/stream	S, (stream), vicinity	part of site complex
Brecht-Moordenaarsv. 2	E-W coversand dune	slope, S	fen	S, *c.* 50 m.	
Brecht-Thomas Heyveld	coversand dune	top/slope	large depression/fen?	E, 'associated'	
Dilsen-Dilserheide III	SW-NE coversand ridge	slope, S/SW	spring	SW, unknown	Neolithic occupation
Helmond-Stiphoutsbroek	S-N coversand dune	slope, SE	stream	W/SW, direct vicinity	Neolithic occupation
Lommel-Molse Nete	E-W valley slope	slope, S	stream	S, direct vicinity	
Lommel-Vosvijvers	SW-NE coversand dune	below top, S?	stream	S/SE?, *c.* 60 m.	
Meeuwen-In den Damp I	S-N coversand ridge	slope, W	stream/fen	W, *c.* 50 m?	
Merselo-Haag	E-W coversand ridge	top/slope, S	stream/fen	S, direct vicinity	
Opglabbeek-Ruiterskuil	SW-NE coversand ridge	top/slope, S	fen	S, *c.* 15 m.	
Turnhout-Zwarte Heide	coversand ridge	slope, S?	fen	S and SW	
Weelde-Paardsdrank	SW-NE coversand ridge	top/slope, SW?	fen	S/SW, *c.* 50 m.	pottery
Weelde-Voorheide	E-W coversand ridge	-	-	-	

raw material, specifically locally available rolled nodules, providing an important component of the lithic assemblage.[11] Light, water and resources therefore appear to have formed primary conditions for somewhat more extended stays of a more general character (*cf.* Binford 2002, 185-187).

The characteristics of site location choice in this region appear relatively homogenous and are comparable to (contemporaneous and earlier) Mesolithic occupation in neighbouring regions such as Sandy Flanders (compare Crombé *et al.* 2011[b]; Deeben/Arts 2005, 150-151; Van Gils *et al.* 2009, 263). A number of factors form the basis for a repetitive use of this landscape that result in similarities in archaeological patterning and are suggestive of continuity in behavioural aspects related to the positioning of sites in the landscape.

5.4.3.2 Locational characteristics: northern coversand landscape

Unfortunately the number of excavated Late Mesolithic sites in this group is low in comparison to the southern coversand landscape. Sites are situated in a variety of locations (see table 5.4).

Sites in the northern coversand landscape lack the distinct homogeneity in settlement location choice that was inferred for sites in the southern coversand landscape. Yet, although the limited numbers demonstrate some variability this does not mean that site location choice was different. As in the south, sites are situated on elevations such as coversand dunes on the foothills of a moraine ridge (Casparie in Beuker 1989), small and steep sandy hillocks (Huiskes 1988) forming the higher part of a belt of sand, or the circular 'blown' ridge of Havelte (Price *et al.* 1974). Water is usually found in the immediate vicinity of the site and is sometimes of considerable extent. East of Bergumermeer an extensive low-lying till zone formed a basin in which the later lakes Bergumermeer and De Leyen developed, in relation to which the site was strategically situated in the Late Mesolithic (see Casparie/Bosch 1995, fig. 9). At Havelte the area enclosed by the 'blown-out ridge' became increasingly wet during the Atlantic as was demonstrated by the formation of *Sphagnum* peat. Water could also have accumulated there (Price *et al.* 1974, 14). The extensive site of Mariënberg is located on a ridge several meters above an old meander of the Vecht. Nieuw-Schoonebeek is bordered on both sides by wide valleys within which running fresh water could be found, while the Schoonebekerdiep provided another source of water (Casparie in Beuker 1989, 182-184). The sandy hillocks at Tietjerk were located south of open water, while N-S oriented creeks might have separated the different tops (Huiskes 1988). In contrast to the south, the northern sites do lack a distinct southern exposure.

Table 5.4 Geographical setting of Late Mesolithic sites in the northern coversand landscape (see Appendix I and references for additional information).

site	geom. setting	situation/orientation	water	location water	other
Bergumermeer-S64B	NW-SE, coversand ridge, southern shore	top, exposure, north, south, east	lake Bergumermeer/ De Leyen	NE-S, 100-150 m	nearby knoll occupied (*c.* 90 m); low till zone
Havelte-De Doeze	circular 'blown-out ridge'	top eastern part ridge	inner depression	SW, *c.* 50-100 m	push moraine SE; other localities ridge occupied
Mariënberg-De Schaapskooi	NE-SW, high coversand ridge	top ridge	valley of the Vecht	W, unknown, possibly immediate	nearby sites; located near valley
Nieuw-Schoonebeek	coversand dune S. extension Hondsrug	two plateaus on top ridge, sharp drop to the east	two wide gullies	N/E, *c.* 20 m?	ice pushed ridge 1 km S; Schonebeekerdiep
Tietjerk-Lytse Geast I	Steep sand hillock(s)	top and slopes	open water; creeks	immediate open water N; creeks W/E	hillocks occupied; peat-land, bog lake nearby

It might be argued that next to the diverse geomorphological settings and the vicinity of water, there is an overall focus on gradient-rich environments. All sites are situated at an ecotone, or the transition of two or more distinct ecological zones. Site location choice in the northern coversand landscape therefore appears less homogenous and perhaps focused on larger ecotones. In combination with the characteristics of the landscape (lakes, moraine subsoil, different drainage patterns and peat growth), it offers a somewhat different picture of Late Mesolithic occupation choice. It concerns a difference of degree, rather than kind, since essentially, comparable locations were sought after.

5.4.3.3 Locational characteristics: wetland and river valley locations

Site location choice in the wetland and wetland margin group as well as in the group of sites situated in river valleys is summarized below (see tables 5.5 and 5.6).

The site of Polderweg is located on the top and slopes of a river dune. The delimitation of the site extent (Mol 2001[a], fig. 2.5) shows a southern orientation, which may have been determined by exposure to the light and heat of the sun as well as the proximity of water (*ibid.* 51). During phase 1 the site was situated at the transition from an area with open water to a peat swamp (Mol 2003). The site was exposed to open water on at least one side (Bakels/Van Beurden 2001, 357). The situation around De Bruin is comparable (see Mol 2003). Crevasse channels linked the site to open water, which is confirmed by the presence of two canoes and a potential landing stage (Louwe Kooijmans/Nokkert 2001, fig. 4.27). The other sites are situated in what may best be termed an increasingly

Table 5.5 Geographical setting of Late Mesolithic sites in wetlands and wetland margins (see Appendix I and references for additional information).

site	geom. setting	situation/orientation	water	location water	other
Hdx-Polderweg (phase 0-1)	river dune (donk)	top/southern slope	lakes, marshes, channels	within wetland	De Bruin at *c.* 1 km; increasingly wet environment
Hdx-De Bruin (phase 1)	river dune (donk)	SE slope	lakes, marshes, channels	within wetland	Polderweg at *c.* 1 km; increasingly wet environment
Melsele-Hof ten Damme	coversand margin	E slope	floodplain Scheldt	nearby	
Hoge Vaart-A27	N-S oriented coversand ridge, foothill	top and eastern slope	palaeochannel of the Eem valley	E, immediate	dry forest, alder carr, reedlands and open water
Oudenaarde-Donk	ridge, point bar system		floodplain/channel Scheldt	(S), immediate	increasingly wet environment
Swifterbant-S11/12/13	river dune	NE/centre/W top	stream/creek	vicinity	increasingly wet environment (5500 cal BC)
Swifterbant-S21	river dune	N top	stream/creek	vicinity	increasingly wet environment (5500 cal BC)
Swifterbant-S22/23/24	river dune	N/W top/slope	stream/creek	vicinity	increasingly wet environment (5500 cal BC)
Swifterbant-S61	river dune	NW (top)/slope	stream/creek?	-	increasingly wet environment (5500 cal BC)
Swifterbant-S83	E-W, river dune	NE slope	stream/creek?	-	increasingly wet environment (5500 cal BC)
Urk-E4	river dune	SE slope	stream	(S) vicinity	increasingly wet environment until 4500 cal BC

wet environment. Melsele and Oudenaarde, as argued above, may best be termed wetland margin locations (see Van Berg *et al.* 1992; Van Roeyen *et al.* 1992; Van Strydonck *et al.* 1995, table 1). The situation for the Swifterbant river dune sites depended on their individual elevation and location. In general the effects of the sea-level rise in the basin of Lake IJssel, in the form of peat formation, only affected the Swifterbant area from 5400 cal BC onwards. This means that only the last Mesolithic hunter-gatherers would have experienced the formation of wetlands (Deckers *et al.* 1981, 142; De Roever 2004, 6-7). Peeters (2007, 62-64), however, argues that the development of wetlands and the transition to mosaic woodland already started from *c.* 6000 cal BC onwards. Since the Swifterbant sites are located near the main valley of the IJssel-Vecht system, this influence and increasing peat growth from *c.* 5500 cal BC will have been noticeable. These sites should therefore be interpreted as wetland margin locations, compared to wetland sites such as Hardinxveld. Similar changing conditions may be proposed for the site of Urk-E4, located on a river dune surrounded by developing wetlands and Hoge Vaart-A27, situated on a coversand ridge bordering a palaeochannel of the Eem in an increasingly wet environment (Peeters 2007; Peters/Peeters 2001, 17-22, 112-117).

It may be concluded that the Late Mesolithic sites in this group are mostly situated on higher elevations in a wetland or developing wetland area. These range from relatively low dunes or ridges (Melsele, Oudenaarde, Hoge Vaart) to more steep elevations (Hardinxveld river dunes, Urk-E4).

Although Jardinga has been classified as an exception within the group of river valley sites (see above), all sites are situated in the direct vicinity of a stream. The largely comparable Belgian sites are in fact situated in the floodplain of a larger stream or river, at some distance from the actual channel and next to, or bordering on, a fossil channel or small tributary.[12] Both LPS and RSD were positioned at the foot of a slope and are characterised by artificially raised platforms (Gob/Jacques 1985; Van der Sloot *et al.* 2003).

An important factor governing site location choice in the wetlands and river valleys must be the opportunities offered by the rich aquatic environment. This is attested as beneficial to intensive hunter-gatherer land-use, both through ethnographic as well as archaeological research (*e.g.* Kelly 1992; Nicholas 1998[a,b]; 2007[a,b]; Price/Brown 1985; Zvelebil 2003[b]). For the LRA, the rich organic evidence and seasonal information of sites such as Hardinxveld-Polderweg and De Bruin illustrate the sustainable qualities of these areas (see Louwe Kooijmans 2003). For the river valleys lithic raw material may have formed a further incentive (Bakels 1978; Brown 1997), while in both areas water and streams would have functioned

Table 5.6 Geographical setting of Late Mesolithic sites in river valley locations (see Appendix I and references for additional information).

site	geom. setting	situation/orientation	water	location water	other
Liège-Place St.-Lambert-SDT	floodplain, left bank of the Meuse	in between two fossil channels of the Légia	Meuse, Légia	nearby	located at foot northern slope
Liège-Place St.-Lambert -DDD	floodplain, left bank of the Meuse	bordering depression, possibly fossil channel Légia	Meuse, Légia	nearby	located at foot northern slope
Liège-Place St.-Lambert -Tivoli	floodplain, left bank of the Meuse	bank of fossil channel Légia	Meuse, Légia	nearby	located at foot northern slope
Remouchamps-Station LeDuc	floodplain, left bank of the Amblève	situated on large meander next to a smaller channel	Amblève, tributaries	nearby	foot northern valley slope
Namur	floodplain Meuse	confluence Meuse and Sambre	Meuse, Sambre	nearby	-
Jardinga	floodbasin Tjonger	bank	Tjonger	nearby	peat within boulder clay area/coversand

as corridors for contact and transport (*ibid.*; Ames 2002). These wetland and valley floor sites, as those in the other groups, should not be understood in isolation, but studied in relation to their function in the settlement system of mobile groups, covering other areas as well.

5.4.4 Settlement structure: the grain

Site location choice and topographical situation form a landscape perspective on the characteristics of sites. Zooming in, the (intra-site spatial) structuring of elements at sites with respect to each other (grain, *sensu* Cribb 1991) offers a different scope, related more to occupation behaviour. For the different groups defined a number of characteristics may be sketched. Comparison is unfortunately hampered by post-depositional processes and is quantitatively concentrated on the southern coversand (see Chapter 4).

5.4.4.1 The southern coversand landscape: concentrations, clusters and scatters

In the southern coversand landscape sites are characterised by lithic concentrations of various sizes. Over the past decades many methods have been used to identify these *structures latentes* (*sensu* Leroi-Gourhan/Brézillon 1972), comprising a variety of statistical techniques (*e.g.* Cziesla 1990[a], 8-40; Newell 1987; Whallon 1973; 1974). Critique of these approaches has been equally extensive (*e.g.* Kent 1987, 5-8; Stapert 1992, 12; De Bie/Caspar 2000, 29; Chapter 4), based on taphonomic considerations of both natural and anthropogenic character (*cf.* Schiffer 1995). This served to show that the assumptions required for many statistical analyses are often beyond archaeological resolution (Hodder/Orton 1976, 239) and that intricate statistical analyses rarely unravel the many complex processes underlying (lithic) spatial distribution (*cf.* De Bie/Caspar 2000, 29). Their success strongly depends on pristine preservation of the site and a high level of precision in excavation and documentation. With respect to the sites studied here one or more of the above criteria is often not met. Data were often not available digitally and grid- or point-based information was also often missing. The quality of the data and the considerations above have therefore primarily led to a 'visual approach', enhanced by a test case using MapInfo, Surfer and the moving average method.[13]

Moving averages at Merselo-Haag

To test the significance of delimiting spatial concentrations on the basis of distribution plans, the site of Merselo-Haag is used as a test case, based upon the combination of a detailed excavation strategy (25 x 25 cm squares), the considerable extent of the excavation (409 m^2) and the fact that most finds were found below the disturbed A horizon, which has been left out of the spatial analysis (see Verhart 2000, 68-72). The analysis was conducted with the aid of Milco Wansleeben (Faculty of Archaeology, Leiden).

Based upon the analysis executed by Verhart (2000, 115-127), a total of four (instead of five) concentrations were accepted as spatially significant for the Late Mesolithic.[14] Most important changes involved the recombination of clusters 3 and 4 (see also Verhart 2000, 126-127) and the rejection of cluster 5 (a possible composite tool) in favour of a cluster of burnt flint (6) associated with hearth 4. These units were subsequently measured using the distribution map (Verhart 2000,

Table 5.7 *Metric analysis of spatial units defined in the Late Mesolithic zone of Merselo-Haag.*

spatial unit	length m	width m	shape
concentration 1	2.4	2	semi-circular
concentration 2	1.2	1.2	circular
concentration 3/4	4.2	2.4	oval
concentration 6	1	0.9	semi-circular (2 units)
scatter	20	8	oval/elongated

fig. 2.25; see Appendix I). Furthermore the encompassing scatter was measured. This could be done tentatively in view of the absence of further concentrations in the testpits surrounding the excavation. This led to the subdivision presented in table 5.7.

Following this, the documented resolution from the excavation plan was generalized by combining the counts per square meter and subsequently 'blurred' to 5 m weighted intervals (using MapInfo and Surfer). The effects of the generalization and moving average method can be seen in fig. 5.3 B and C. The combined general counts per square meter projected in 5.3 B confirm and support the distribution and delimitation visible in the 25 x 25 cm units. Furthermore there seems to be a somewhat increased contrast between the western and eastern part of the spatial distribution, which adds value to the initial subdivision proposed by Verhart (2000, 71-78), indicating that the activities in the Early Mesolithic zone may have been of a different nature and intensity. Generalizing the distribution may thus enhance larger scale subdivisions present in the plan. Fig. 5.3 C takes this one step further by 'blurring' the distribution at a 5 x 5 m interval. This better visualizes the differentiation present and enables the pinpointing of isolated concentrations. Their density may form an indication of the intensity or frequency with which a site was used. It may also enhance the relationship between large- and small scale activities as well as intra-site place consistency. Of course it should be noted that since we are dealing with multi-period sites, further temporal distinction improves analysis, but this is often not possible.

The moving average results indicate a certain consistency in the size and delimitation of the individual concentrations. This argues against the idea that the dimensions of artefact clustering only result from the resolution achieved in excavation and documentation. Nevertheless – as is shown by the functionally related, yet spatially separate constituents of concentration 3/4 – adjacent phenomena blend into a single shape at a lower resolution. It is thus very likely that some recorded concentrations can be broken down into separate elements at a higher level of detail (see also Cziesla 1990[a], 20-37; 1990[b]).[15]

Metric analysis: an approach

The problems regarding the definition and delimitation of concentrations indicate that a comparative metric analysis of spatial clustering at Late Mesolithic sites can only reveal a very coarse pattern, but also that, to some extent, the concentrations provide information. Nine sites located in the Belgian Campine area and adjacent Dutch coversand landscape were selected. These yielded a total of 36 spatial units that could be delimited and measured. A first problem involved the aspect of delimitation. It was decided to try and incorporate the represented diversity. Three categories were defined for this purpose:

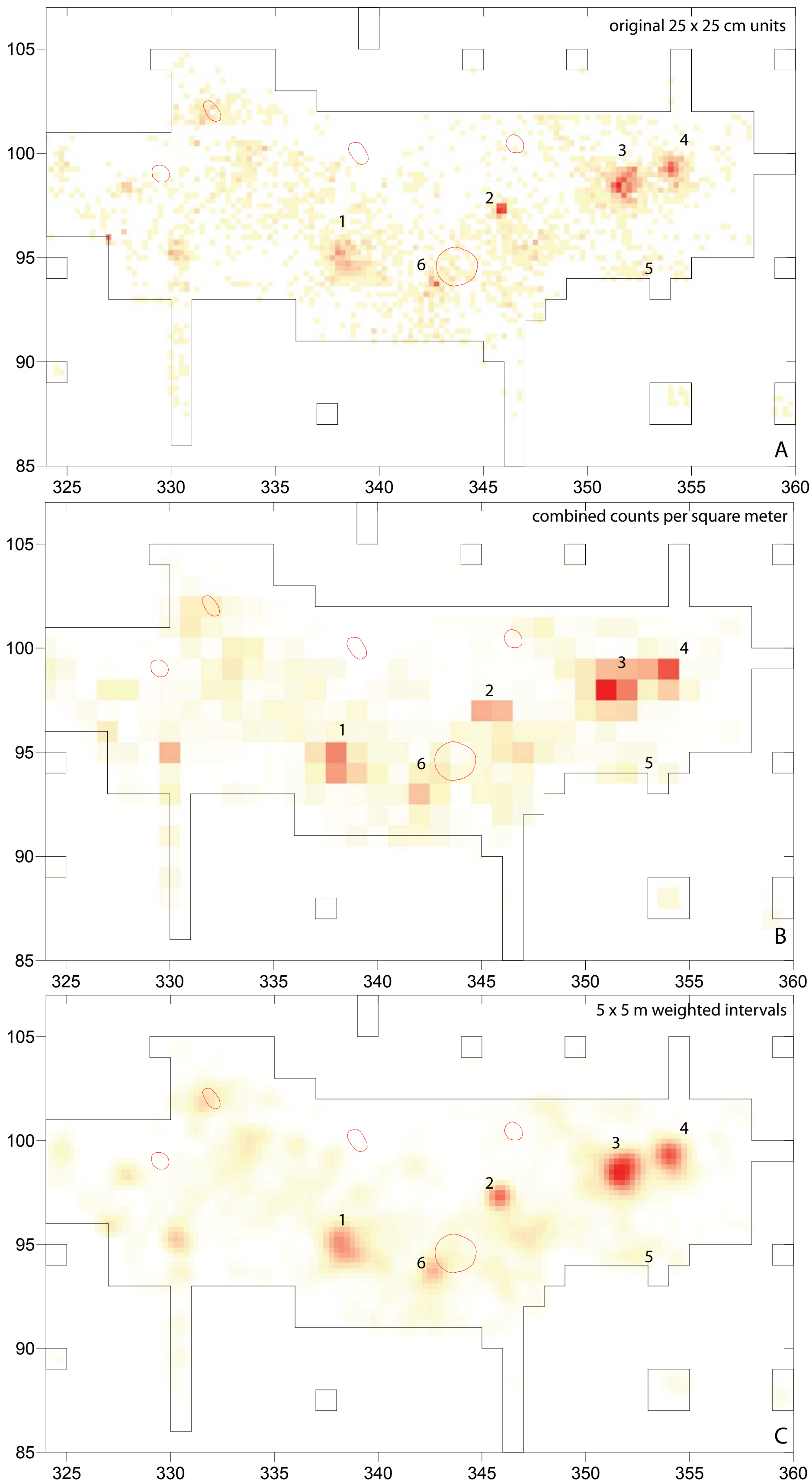


Fig. 5.3 A-C. (A) original 25 x 25 cm distribution of finds at Merselo-Haag. (B) combined counts per square meter, demonstrating general clustering. (C) 5 x 5 m weighted interval showing isolated clustering.

1. The first set of measurements focuses on the smallest spatial units observed within distribution plans of finds. These are termed concentrations.
2. The second set deals with larger more or less homogeneous concentrations of finds, often with one or more accumulations or 'cores' of higher density. These are defined as clusters.

site	spatial unit	length m	width m
Merselo-Haag	scatter	20	8
	concentration 1	2.4	2
	concentration 2	1.2	1.2
	concentration 3/4	4.2	2.4
	concentration 6	1	0.9
Weelde-Paardsdrank sector 1	concentration 1	2.5	1.6
	concentration 2	1.8	1.2
	concentration 3	2.5	2
Weelde-Paardsdrank sector 4	concentration 1	2	1.5
	concentration 2	3	2.5
	concentration 3	3.5	2.5
Weelde-Paardsdrank sector 5	cluster 1	7	3.3
Opglabbeek-Ruiterskuil	cluster H-G	7	3
	concentration H	2.8	2.5
	concentration G	3.6	2.5
	concentration M	4	2
Brecht-Moordenaarsven 2	scatter	14	6.5
	concentration south	4	2.5
	cluster centre	8	5.1
	concentration north	3.5	3.2
Dilsen-Dilserheide III	scatter (testpitted)	60	40
	cluster	8.8	5
	concentration N	2.5	1.25
	concentration south	3.5	2.8
Meeuwen-In den Damp 1	cluster N25E25/(Pilati 2)	10	6
	cluster N11E17/(Pilati 1-1b)	9	5.7
	concentration 1a in N11E17A	3.9	3.9
	concentration 1b	2	2
	cluster S12E8/(Pilati 3)	8	4
	cluster S21E5/(Pilati 4)	7	3.5
Lommel-Vosvijvers	concentration III	4.5	1.5
	concentration II	3	1.7
Lommel-Molse Nete	scatter < 2km (surface)		
Helmond-Stiphoutsbroek	scatter (surface)	300	150
	scatter (excavation)	13.5	7
	concentration	1.5	1

Table 5.8 Metric analysis of spatial units defined for a number of sites in the southern coversand landscape.

3. The final set of measurements incorporates both measured and estimated site sizes. This latter category is based upon data from excavations, augering, and survey campaigns and therefore has yielded highly diverse results with respect to site extent. This larger scale of clustering is defined as scatter.[16]

Of all units, length (longest axis) and width were measured or documented. A general margin of up to 1 m should be taken into account since the analysis is based upon a visual approach. The results are presented in table 5.8.

The three defined sets of measurements are not readily comparable since they focus on three different aspects of site extent, in some cases retrieved through different methods of documentation.[17] The larger spatial units are, however, often formed by several of the smaller spatial units, occasionally separated by empty zones (*cf. infra*). So there is a certain interrelationship in which the smaller spatial units form 'building blocks' for the larger spatial units. The different scales at which these sets of measurements have been documented are combined in fig. 5.4 to visualise these relations.

It is evident that there is a considerable scalar difference between the three groups of measurements, despite the inbuilt inaccuracy. Nineteen spatial units with a length-width ratio of up to 4.5 by 4 m represent the largest group. Demarcated by an evident interval, the next group of eight spatial units falls within a range of 7 x 3 up to 10 x 6 m. The last group starts at *c.* 13.5 x 7 m and includes two outliers of 60 x 40 and 300 x 150 m that are not plotted. These form the total site extent estimates for Dilsen-Dilserheide III and Helmond-Stiphoutsbroek (Luypaert et al.1993; Arts 1994).

Finally, the dimensions of the shape of the concentrations were also documented (see table 5.9).

Although no absolute trend is observable, circular and semi-circular shapes seem to be largely confined to the group with the smallest dimensions, while oval and elongated shapes tend to characterise groups B and C.

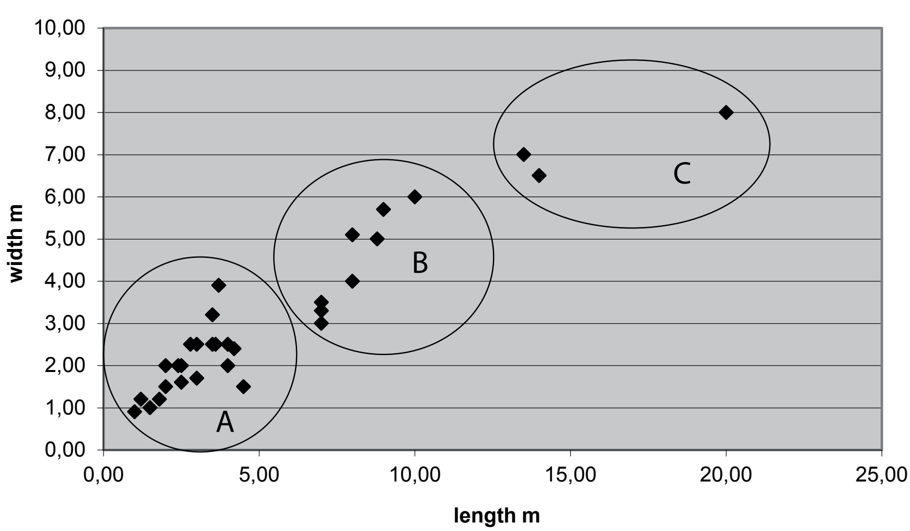


Fig. 5.4 Analysis of length and width of spatially delimited concentrations at sites in the southern coversand landscape. A: concentrations; B: clusters with cores; C: scatters. The two largest scatter measurements form outliers beyond the range of the graph.

Table 5.9 *Diversity of shapes per group of dimensions.*

shape/group	Group A	Group B	Group C	Total
(semi-)circular	11	1	-	12
semi-circular/U-shaped	1	-	-	1
U-shaped	1	1	-	2
oval	7	5	2	14
oval/U-shaped	-	1		1
oval-elongated	-	-	2	2
Total	20	8	4	32

5.4.4.2 Interpreting concentrations, clusters and scatters

It is clear that more sites with spatially delimited units are necessary to be able to further confirm the pattern and spatial characteristics presented here, yet the data do seem to reveal something of the structure underlying Late Mesolithic settlement in the southern coversand landscape. The constituent elements of this grammar, which are related yet not similar, will now be discussed.

Group A: concentrations

This group is formed by the basic 'building blocks' of Mesolithic sites, the individual concentrations of artefacts reflecting a variety of activities. Unfortunately the individual concentrations have only been functionally analysed at a few sites (in most cases this was done for the excavation as a whole or for separate trenches). The few informative sites (notably Meeuwen-In den Damp I, Merselo-Haag and Weelde-Paardsdrank) indicate maintenance, consumption and debitage activities.[18] The general dimensions of group 1 (up to 4.5 m) and its predominant circular shape seem to coincide with the distribution of debitage material in flint knapping experiments, in both sitting and standing positions (see Kvamme 1997, fig. 2, pp. 126). This is further substantiated by the fact that these concentrations also form the nodes of refitted artefacts (*e.g.* Pilati 2001, fig. 6.1; Verhart 2000, fig. 2.42; Vermeersch *et al.* 1992, fig. 32). There is even evidence of the size-sorting characteristics of flint knapping episodes, where the smallest finds cluster in the centre, while larger flakes and debris are found at a greater distance, for instance at Merselo-Haag (Verhart 2000, fig. 2.49-2.51; Kvamme 1997, 125-128). Cores are tossed away even further, as is tentatively demonstrated by the concentrations at Helmond-Stiphoutsbroek and Meeuwen-In den Damp I (Arts 1994, fig. 3; Pilati 2001; 2009).

Another activity underlying the formation of concentrations is waste behaviour. This involves the disposal of primary refuse, such as knapping debris and hearth fills, away from their location of initial use. The character of this secondary refuse (*sensu* Schiffer 1995) may differ (*e.g.* burnt flint, limited artefact size, ash dumps etc.). Unfortunately waste dumps and contemporaneous or anachronistic activity areas need not necessarily be spatially separate as was for example demonstrated at the Federmesser site of Rekem 16 (De Bie/Caspar 2000, 248-249).

The importance of detecting secondary refuse is related to one of the structuring laws defined by Schiffer (1995, 37) presupposing a correlation between an increase in intensity of occupation and a decrease of correlation between use and discard locations. While several sites yielded some evidence for secondary refuse behaviour, the overall image is one of more or less unstructured *ad hoc* deposition of debris and waste, *i.e.* relatively short-term occupation.[19]

It is furthermore remarkable that 11 out of 20 concentrations are associated with hearths or remnants of hearths. Although contemporaneity could not always be established the proximity of concentrations and hearths in general indicates a functional relationship characterised by activities and/or social interaction in need of light and heat. The hearths will be further discussed below.

Group B: clusters

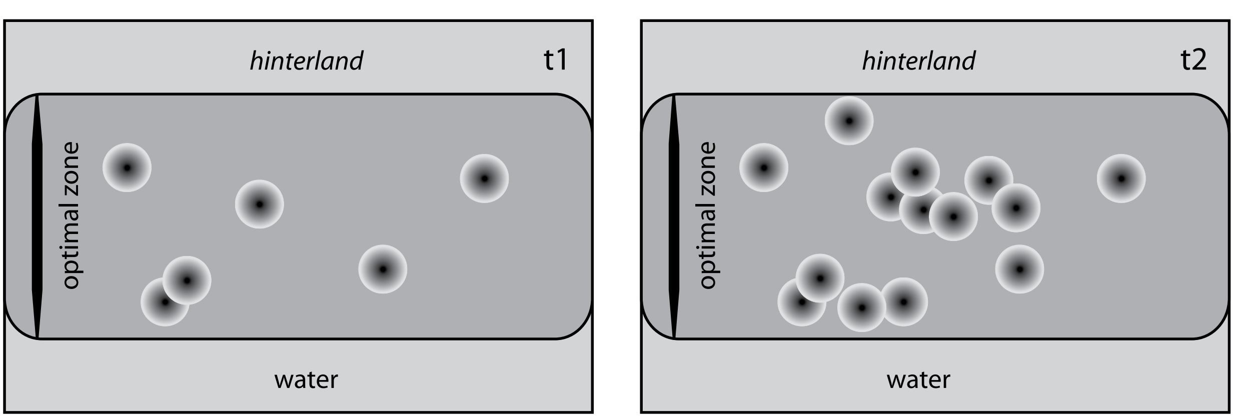
The second group consists of the spatial aggregations of the smaller concentrations discussed above. There is a difference in the extent to which the underlying individual concentrations can be recognized visually. At some sites the excavation strategy and graphic representation do not allow a detailed analysis of the number and size of concentrations. For instance, only two opposing circular concentrations can be made out at Dilsen-Dilserheide III (see Luypaert *et al.* 1993, fig. 5b). Other examples are Opglabbeek-Ruiterskuil (Vermeersch *et al.* 1974; fig. 4) and Brecht-Moordenaarsven 2 (Vermeersch *et al.* 1992, figs. 23 and 31). At other sites accumulations of lithics are visible (sector H-G at Opglabbeek and the central section of Brecht), which may be interpreted as individual concentrations or clusters of concentrations. This also explains why multiple hearths are associated with these clusters.

The dominance of oval shapes in this group may be explained as a result of the 'linking up' of partially overlapping concentrations (see fig. 5.5). This effect is enhanced by the local geography (often the slope or top of coversand dunes and ridges), their micro-topography and the functional orientation to bodies of water (streams and peat fens) at the foot of these locations, in combination with repeated visits over time. Through this repetitive behaviour sites develop into site complexes (see also Van Gils 2009, 263; Van Gils/De Bie 2006; 2008; Séara 2006, 279).

While the shape of clusters is based on the topographical and situational aspects of the site, these in themselves do not indicate the mechanisms responsible. Three scenarios may be sketched, most of which yield similar or indiscriminate results (see also Bailey 2007).

The first explanation is the most common and involves the interspersed use of the same location for similar or different activities. The intermixing of (predominantly) lithic artefacts of two different use moments leads to the formation

Fig. 5.5 Development of longitudinal clustering of circular concentrations over time.



of a palimpsest, the informative value of which is strongly dependent on similarities in the nature of the activities involved. Since most sites discussed here are located on stable surfaces there is often no information available on the time that elapsed between two separate use moments. A variant of this scenario includes clustering of a more premeditated nature, for instance as sites are recurrently visited because they developed into caches of re-usable lithics (see also Schlanger 1992; De Bie/ Caspar 2000, 280). Although a selection of the raw materials used in the southern coversand landscape could often be found in the direct vicinity of the sites (*cf. infra*), it is likely that these former surface collections, apart from other reasons for returning, such as site furniture (*sensu* Binford 1979; 1981[b]), formed an attractive additional incentive for revisiting a specific location.

A second scenario offers a more synchronic explanation. A sequence of activities centred for example on a hearth may have been responsible for the clustering of concentrations; there may have been an interruption in the debitage activities or the wind might have shifted (see Binford 2002, 159), leading to a repositioning of activities. This was one of the suggestions to explain the empty zone between concentrations 3 and 4 at Merselo (Verhart 2000, 126). Another important variant of this scenario is the hearth model (Binford 1978[b]; 2002). In this model people, seated around a hearth, dispose of the waste of their activities in a specific manner creating 'toss and dropzones'. In general light refuse will remain in place while heavier objects are placed or tossed away. This often creates a U-shaped pattern. Many specific and contingent activities may form variations on this template. The model is specifically characteristic for outside hearths. Disposal behaviour inside tents and other dwellings is structured differently (Binford 2002, 157; see also Stapert 1992, 43-44). Within the Late Mesolithic dataset, U-shaped patterns were found at both Merselo-Haag (concentration 1) and Meeuwen-In den Damp. The pattern at Merselo is rather small (2.4 x 2 m), and may be the result of the knapping activities of a single person. The (dispersed) U-shaped cluster at Meeuwen-In den Damp 1 (measuring *c.* 9 x 6 m) comprised a more detailed U-shaped concentration of *in situ* finds measuring *c.* 3.5 to 4 m. In an extensive intrasite study Pilati (2001) tested whether this concentration fitted Binford's hearth model (see Appendix I).

A final explanation for clustering suggests the presence of some sort of structure influencing the distribution of remains of activities. This has for example been suggested for Weelde-Paardsdrank sector 5 and for Meeuwen-In den Damp (Huyge/ Vermeersch 1982; Pilati 2001; 2009). This type of clustering is based upon so-called barrier effects characteristic for the bimodal distribution as demonstrated in the ring and sector model (Stapert 1992, 43-44). Contrasting with this Séara (2006, 280) has documented specific 'partitioning effects' related to an empty zone surrounding a hearth at the Early Mesolitic site of Choisey. He interpreted this empty zone as a shelter structure or sleeping area. Unfortunately no intact hearths have been found at Weelde-Paardsdrank sector 5, nor at Meeuwen-In den Damp.

An ethnographic perspective on clustering

An ethnographic observation by Binford at the Anaktiqtauk kill-site (Alaska) provides insight into the dynamics underlying site structuring and clustering of concentrations. It deals with the potential contingent use of multiple hearths (2002, fig. 90). The proposal by one of the individuals seated around the fire

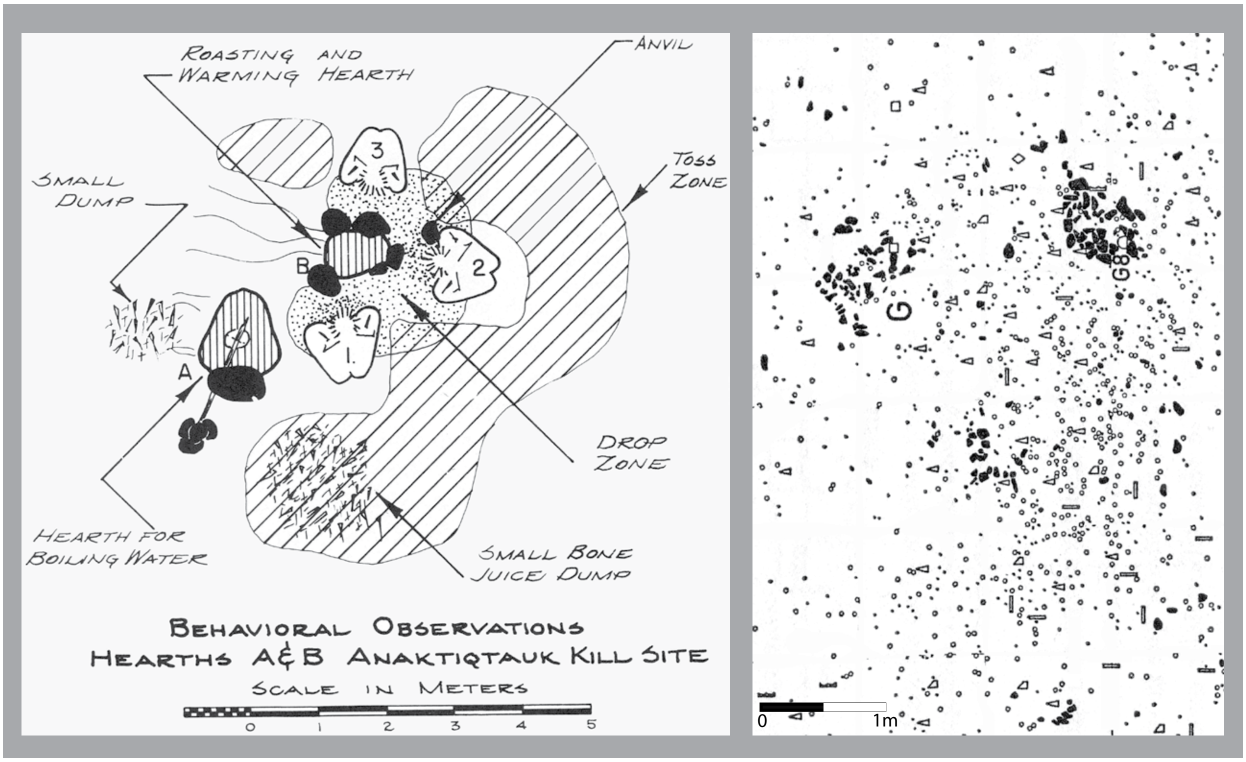


Fig. 5.6 *Hypothetical comparison between a short-term activity pattern at a Nunamiut kill-site (after Binford 2002, fig. 90, pp. 154) and sector G at Opglabbeek-Ruiterskuil. Note the similarity in distance between the hearths (black clusters of burnt sandstone) and the increased density of artefacts farther away.*

to make some broth resulted in starting another hearth. One could hypothesize that a similar situation existed at the site of Opglabbeek-Ruiterskuil (Vermeersch *et al.* 1974, fig. 4; see fig. 5.6). The remains of the hearths in sector G there are at the same distance from each other and one may even see some differentiation in the activities performed in the different densities of the debris. While marrow extraction as at Binford's site cannot be attested, the acuity of the pattern in sector G in any case suggests a similar short-term activity. The main point here is that apart from sequential developments, clustering of sites may also have involved both instantaneous decisions and short-term behaviour.

Group C: scatters

Scatters may be perceived of as part of the 'texture', the overall spread and composition of artefacts over the terrain (*cf. supra*). They may also include the excavated 'patches', the concentrations and clusters.

Perceived from a landscape perspective (see Foley 1981, 163; see also Chapter 4) scatters are part of the low density 'veil of stones' (see Isaac 1981; Roebroeks *et al.* 1992). Scatters, from this perspective, form concentrations in the overall veil of isolated or semi-isolated artefacts. In contrast to the landscape scale of the veil, scatters do have limits within which higher density patches of artefacts, the classic sites, are located. These patches may be related to the scatter yet they may also have been 'parachuted' on top of it (see Roebroeks *et al.* 1992, 9-14). Thus, there need not be any chronological or functional association between scatter and patch.

The scatters defined here appear to form a chronological and spatial phenomenon, which is largely dependent on the frequency with which sites have been used. The mechanism underlying the formation of this aspect of scatters is of a twofold character. The more important factor of the two relates to the maximum dispersal of material radiating out from the constellation of clusters and concentrations, during or after occupation. This can for example be seen at the site of Merselo-Haag in fig. 5.3 (note the lighter zone surrounding the concentrations). There are, on the other hand, also those activities, which take and took place in the vicinity of the site. Yellen (1977, cited in David/Kramer 2001, 259-261) for instance, observed a spatial differentiation between 'clean' and 'dirty' activities at !Kung San sites in Namibia. Dirty activities often required considerable space and took place in the periphery of the settlement. Binford (1978[a]; 1991; 2002) and Newell (1987) documented specific characteristics of spatial behaviour and social or ritual organisation at various Nunamiut/Inupiat sites.[20] Possible instances of such peripheral behaviour have also been documented archaeologically, although difficulties in identifying such production areas should be taken into account. At the Federmesser site of Rekem, for example, arrow point manufacture appears to have been spatially situated away from other localities and activities. This may be related to gender patterns or social rules (De Bie/Caspar 2000, 282-283). At Merselo-Haag (Verhart 2000, 123) a concentration of backed blades was also situated away from the main concentration.

Scatter, size, shape and development

The size and shape of scatters is also informative. They are usually of considerable dimensions, the smallest (Brecht-Moordenaarsven, 14 x 6 m), clearly being delimited by the size of the trench and postdepositional disturbance (Vermeersch *et al.* 1992, fig. 23). On other occasions their recorded extent has been determined by means of surveying or augering, for instance at Dilsen-Dilserheide III (60 x 40 m) and Helmond-Stiphoutsbroek (300 x 150 m). When interpreting scatter size, it should be realised that it is not the extent of an actual site or settlement that is measured, but rather the dimensions of (Mesolithic) site use of a certain feature or location in the landscape. An ethnographic example of this is given by Binford (2002, 118-119). He documented a temporary Nunamiut hunting camp in a stand of willow trees at Anavik Springs (Alaska). According to Binford the location at Anavik springs, from an archaeological point of view, consisted of a single site extending for half a kilometre across which an uninterrupted distribution of debris could be monitored. This represented the palimpsest refuse of at least 100 years of re-use of the same location. The complex of sites at Lommel-Molse Nete should be understood in a similar vein. The excavated Late Mesolithic concentrations there are part of a site complex extending over at least 2 km along the northern slope of the Molse Nete stream (see Van Gils/De Bie 2003; 2008), including the site of Lommel-Vosvijvers. Similarly the concentrations excavated at Opglabbeek form only a fraction of the recently established extent of the entire site (Van Gils/De Bie 2006, 23, 26).

What is actually documented, rather than a persistent use of a place is the occurrence of consistent conditions in the landscape that promote a certain use of a landscape feature over time (see Amkreutz 2009; Vanmontfort *et al.* 2010). It is thus important to be aware of the place of excavated Mesolithic sites in the overall pattern of land use, as illustrated in fig. 5.7. What is actually excavated is usually but a small fragment of a location, of which the functional use may have remained similar over the years (or even centuries).

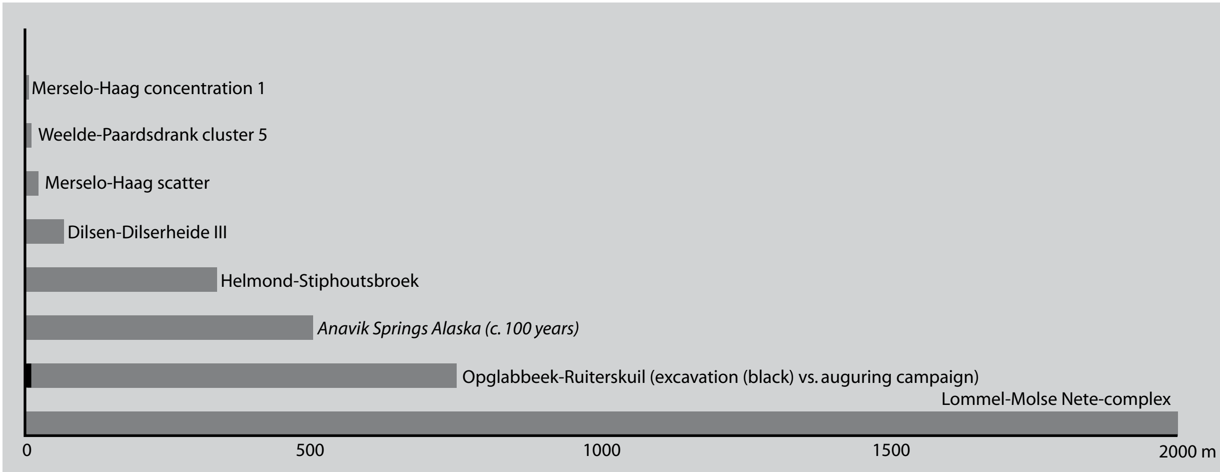


Fig. 5.7 Overall dimensions of recorded scatters (length) as well as one concentration (Merselo) and cluster (Weelde). Note the ethnographically documented Anavik site (Binford 2002, 118) with a recorded time depth of more than a century.

As with the formation of clusters, the shape of the scatter is importantly influenced by site location choice in relation to topography (*e.g.* Van Gils and De Bie 2008) and the specific conditions that were sought after. In this light, sites along streams or gullies (as at Merselo-Haag and Lommel-Molse Nete) will suffer less from palimpsest formation since similar conditions for settlement existed over considerable stretches. In contrast sites located for example around more or less isolated peat fens or on isolated outcrops may have a higher rate of overlap of chronologically unrelated activities. In any case, as argued above, it seems that groups were looking for similar conditions rather than a distinct place.

5.4.4.3 Concentrations, clusters and scatters: northern coversand, wetlands and river valley

The elaborate discussion regarding the clustering of lithics also applies to sites in the other groups, although the potential to obtain metric information on concentrations and clusters is often limited (see table 5.10).

For the northern coversand landscape preliminary investigations of Bergumermeer-S64B were only recently completed (NWO-Odyssey project) and no spatial information was available earlier (see Niekus 2012).[21] At Mariënberg-Schaapskooi nine zones (ranging from 8 x 6 to 90 x 10 m) are indicated within which most artefacts were collected before excavation (Verlinde/Newell 2006, fig. 49). There is no further metric information on them. At Havelte two Late Mesolithic concentrations may tentatively be identified, based on the presence of trapezes and the absence of triangles (Peeters/Niekus 2005; Price *et al.* 1974).[22] At Nieuw-Schoonebeek many of the identified concentrations within the overall distribution of artefacts could be related to treefall features (Beuker 1989, 140). Based on the distribution of certain trapezes and other types of artefacts, a chronological and spatial subdivision into two partially overlapping occupation zones was established (A and C; *ibid.* 179-182).[23] At Tietjerk many oval and round concentrations of artefacts were documented. Despite the fact that only 4.6% of the total assemblage of the site could be localized on the groundplan, Huiskes defined and analysed some twenty concentrations, the smallest of which numbers only two artefacts (see Huiskes 1988, table 1). It is evident that many of these concentrations are based on a skewed remnant of the original distribution (see Huiskes 1988, fig. 17). This calls into question both the true extent of most

site	spatial unit(s)	unit type	length (m)	width (m)	N artefacts	shape
Havelte-De Doeze	H1:I	cluster?	9.4	-	-	H1:I: irregular
	H1:II	cluster?	11.1	10.6	H1:II: 757	H1:II: semicircular
Nieuw-Schoonebeek	AB	LM zone	20	7.5	A: 2294 B: 3440	AB: elongated
	BC	LM zone	22.5	10	B: 3440 C: 1911	BC: elongated
Tietjerk-Lytse Geast I	20	concentrations	0.5-5	0.5-3.4	2-290	oval or round
Hdx-Polderweg (phase 1)	1	cluster 1	8	3	-	oval
	1	cluster 2	10	4	-	oval
	1	concentration 1	1	1	-	semi-circular
Hdx-De Bruin (phase 1)	1	concentration 1	2	2	-	-
	1	concentration 2	1.5	1.5	-	-
Swifterbant-S83	1	concentration 1	0.5	0.5	97	semi-circular
	1	concentration 2	0.5	0.5	(97)	semi-circular
	1(tr. 2)	concentration 3	1	0.5	28	semi-circular
Liège-PS-SDT	1	scatter	21	8	*c.* 10500	ovaloid
Liège-Place St.-Lambert-SDT east	1	cluster	8	4	-	ovaloid
	H50	concentration	1	1	-	circular
	G53	concentration	1	1	-	semi-circular
	H55	concentration	1.5	1.5	-	semi-circular
Liège-PS-SDT west	1	cluster	12	7	-	ovaloid
Liège-PS-S160	1	concentration	3	2	-	semi-circular/dense
Liège-PS-SDT/S160 east	1-5	concentrations	1	1	-	circular/vague
Liège-PS-DDD	1	cluster	5	4.5	1222	semi-circular
	F8	concentration	1	1	-	circular
	F10	concentration	1	1	-	circular
	F11	concentration	1	1	-	circular
	H9	concentration	1	1	-	circular
Liège-PS other	3-5	concentrations	1	1	-	circular/vague

Table 5.10. Metric information and artefact counts for concentrations and clusters in the northern coversand group (Havelte, Nieuw-Schoonebeek and Tietjerk), the wetland group (Hardinxveld and Swifterbant-S-83) and several sub-sites of the river valley site of LPS).

of the concentrations as well as their credibility. Only three concentrations yielded over 100 artefacts. It is furthermore remarkable that the contribution of tools is less than 30% in only four cases, which is an unusually high number (see Huiskes 1988, table 1). It is concluded here that several concentrations will have existed at Lytse Geast I, but that their exact number, extent and composition remain largely unknown.

For the wetland group only Hardinxveld and one of the Swifterbant sites yielded metric information. At Polderweg the distribution of flint during phase 1 (Van Gijn *et al.* 2001[a], figs. 6.2-6.4) yielded two vague clusters, the second of which contained a concentration of cores (*ibid.* fig. 6.6). De Bruin (see Van Gijn *et al.* 2001[c], fig. 6.1) yielded two small concentrations in squares 6 and 20. Within the excavation trenches of S83 three small concentrations of flint were documented (Jordanov 2005). For the river valley group, only the well-excavated Liège-Place St.-Lambert site yielded metric information (Van der Sloot *in prep.*,128, 164 fig. 2, fig. 20-22). Refit analysis indicated the contemporaneity of some of the concentrations in sector SDT (with refits up to 18 m) and there is an overall spatial association with clusters or pavements of stone.

Although the information is coarse-grained, it may be argued that similar principles determine lithic distribution and lithic clustering at different sites. Currently there is not enough detailed information to establish contemporaneity of clusters and concentrations or to determine what specific functional behaviour underlies their development. Such information would contribute importantly to understanding the dynamics behind the development of clustering and sites. For some sites, however, additional elements of settlement structure may be defined.

5.4.4.4 Alternative aspects of settlement structure

Apart from the aspects of lithic clustering discussed above, other aspects of internal settlement structuring may be mentioned. These include the (limited) evidence for spatial structuring at sites with zones of hearthpits as well as indications for a graded use of sites on elevations.

Sites with hearthpits

Several sites in the northern coversand landscape and within the group of wetland and wetland margin sites are characterised by considerable numbers of hearthpits, sometimes grouped in extensive zones (Mariënberg and Hoge Vaart, but also Urk-E4 and Swifterbant-S21 and S22-24). Although these are often the result of long-term repeated use of the site, in some cases spanning more than a millennium (*e.g.* Verlinde/Newell 2006, table 3), a number of interesting principles seem to apply to these sites. The first one concerns the fact that the hearthpits were probably special-purpose facilities for slow- combustion fires (*e.g.* Groenendijk/Smit 1990; Hamburg *et al.* 2001; Peeters/Niekus 2005; Perry 1999; 2002). Furthermore hearthpits rarely cut into each other, indicating that the location of previous pits may still have been known or visible and avoided (Groenendijk 1997; 2004). The clustering of some of the pits may furthermore indicate a restricted time-span of occupation for those areas (see Verlinde/Newell 2006, 208-229 and Peeters 2007). Finally, it has been suggested that at some hearthpit sites there is some spatial incongruence between the area where most of the hearthpits cluster and the main concentrations of lithics (see Peeters/Niekus 2005, 212). It indicates that different requirements and purposes may have spatially governed activities at these sites, although this has been difficult to establish due to problems of association and intermixing (see Chapter 4 and Peeters 2007, 216),

It has been argued that hearthpit sites may have functioned as a socio-cultural marker, since most are situated in the north of the Netherlands (see Peeters 2007, 228-230). This could explain their overall (yet not total) absence at contemporary sites in the south.[24] On the other hand their function strongly implies that presence or absence of hearthpits is based upon the spectrum of activities practised at a certain location, or at least the way in which these were executed. So they form an important marker for the Late Mesolithic in the north, compared to that in the south.

The main argument here is that sites with considerable numbers of hearthpits indicate the presence of an additional set of structuring rules or elements that define the layout and character of these sites. Tentatively they therefore differ from those locations where hearthpits are absent. This may be both within settlement systems including hearthpit sites as well as with respect to those areas where hearthpits are largely absent.

Graded use of space

A further element of spatial structuring is a distinctly graded use of space. This could only be properly documented at both Hardinxveld locations, but most likely applies to other prominent locations of limited extent that functioned in the same manner. This was also demonstrated in Chapter 4 in the discussion of archaeological site types. With respect to both Hardinxveld sites, a use of these locations, that entailed a threefold division, could be documented. The top and upper slopes of the dunes yielded most features, including possible sunken dwellings at Polderweg. This area may be distinguished as a habitation area. The lower slope and foot of the dune, bordering on the wetland, may be characterised as an activity area as demonstrated by (colluviated) debris and evidence for fire and dropped waste. This area perhaps saw most of the daily activities of artefact and food-preparation. Finally, the third zone, the wetland margin, also yielded artefacts, often of some size, which indicate the presence of a toss-zone (see Louwe Kooijmans 2003). It should be taken into account that the threefold division witnessed is to a significant degree determined by processes such as slope wash, colluviation and decay, in combination with a slope gradient of 20%. In this respect the patterning observed is of a secondary nature, although it does, indirectly, relate to site-use as well. It is not known whether a similar division was present at other sites: at Oudenaarde the vicinity of the river Scheldt to the site might have led to a similar situation, while the sites at Swifterbant show evidence of use of both the top and the slopes of the dunes.

It is evident that some graded use of space probably applies to all sites that are situated on an elevation, especially when these border on wet zones such as peat fens, or streams. The difference lies in the fact that at both Hardinxveld sites (and probably at similar sites) there is a repeated use of these locations according to the same rules for a period of several centuries. This is a distinct continuity that should be noted and that differs from the way in which sites and site complexes on the southern coversand develop.

5.4.5 Settlement 'investment': redundancy

A final element that may be informative about the characteristics of site structure and patterning is termed 'investment'. Apart from representing intentional investment in a site this also concerns the degree to which locations yield evidence for repeated visits or occupation of sites. In this sense 'investment' relates to the topic of redundancy mentioned earlier. The means to establish this are limited. Radiocarbon chronology is fraught with difficulties related to sampling quality and association of sampling location and material to the features and finds that should be dated (*e.g.* Van Strydonk *et al.* 1995; Crombé *et al.* 2012; see also Chapter 4). Furthermore the taphonomical differences between sites in different regions (Chapter 4) should be taken into account. Whereas the documentation of lithic artefacts will be influenced mainly by location and excavation methodology, the presence of features is strongly influenced by taphonomic processes and soil formation. The archaeological resolution is therefore necessarily low. As will be discussed below the limited visibility of features may predominantly form a problem at sites on the coversand.

Two perspectives may offer an idea of 'investment'. These include the number and type of features at a site as well as the quantity or density of artefacts. Investment in structures or facilities such as huts, pits, hearths, graves, windbreaks, or spatially delimited and distinct locations such as trash disposal areas etc., form an important indication for the permanency of occupation, or the length of stay at a certain site (see Chatters 1987, 369; Kelly *et al.* 2005, 403). It should be noted that the internal structuring of these elements, is regarded as an even more important indication for the length of stay (Kelly 1992). Furthermore the variability of features as an indicative aspect of site duration and use will be discussed.

The ambiguity of features and facilities as solid indications for permanency should be noted as well and is related to the cross-culturally attested fact that investment in sites is often related to the anticipated length of stay, instead of the actual length of occupation (Kent 1991, 56; Kent/Vierich 1989). Nevertheless, features, facilities and, to a lesser, more time-averaged extent, total amount and density of waste, form indications of 'energetic investment' in a certain location, whereas anticipated stay is also informative on the expected potential of a certain site.

5.4.5.1 Density and intensity

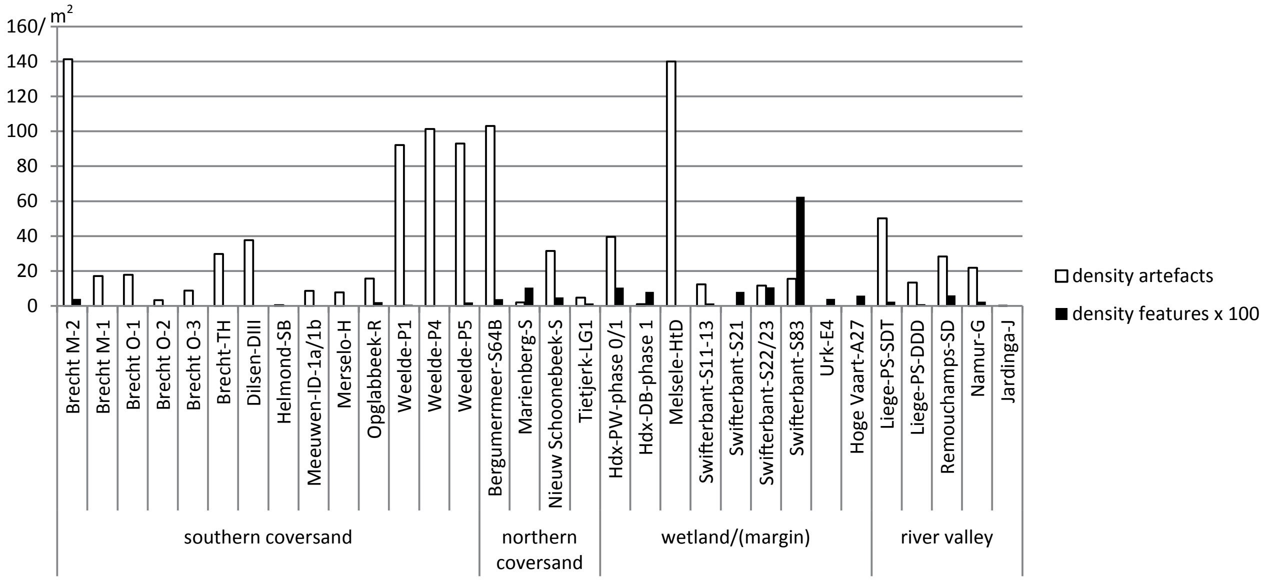
It was attempted to establish a site-bound indication of the relative density of artefacts and features, taking into account the many related difficulties. To this end all Late Mesolithic features and numbers of artefacts were positioned against the excavated or documented area of the site. Following this the overall differences in density were also calculated per group. The data and results are presented in table 5.11 and fig. 5.8.

Of course a number of taphonomic or excavation-related factors limit the extent to which sites are informative. At Brecht-Moordenaarsven 3 and Turnhout-Zwarte Heide no excavation took place (see Appendix I). At Havelte only two concentrations could be attributed to the Late Mesolithic, half of one of which was disturbed (Price *et al.* 1974, 32). Although the total extent of these concentrations (225 m^2) could be established, no artefact density could be established. Similarly, at Tietjerk not all concentrations were entirely excavated and most artefacts were found on the surface (Huiskes 1988, 46). Only those artefacts that could be traced to the groundplan could be used. At Hoge Vaart-A27 the similarities between the Late Mesolithic and Swifterbant lithic spectrum and the erosion of the Late Mesolithic surface prevented a reliable attribution of lithics to the Late Mesolithic (Peeters 2007, 89, 95-97; Peeters/Hogestijn 2001, 49). The excavated information is limited at sites such as Melsele and Oudenaarde. At the former location no distinct spatial information for the Late Mesolithic was available, while at Oudenaarde the extent of the Late Mesolithic MESO I site was based on charcoal and burnt bone (Parent *et al.* 1987[a], 13).

Taking the distortive factors into account, the observable trends are only general indications. The relatively high artefact density documented for the sites on the southern coversand contrasts with the low density of features and their relatively high density in the other groups. The low density registered for De Bruin and the high density at Melsele are influenced by problems of attribution (see Appendix I). The low density recorded for Helmond and for Jardinga, however, are most

Table 5.11 Excavated area, number of artefacts, and number and type of features per informative site.

sites	exc. area m2	N artefacts	N features	N structures	N graves	Nhearths	Nhearthpits	N pits	N postholes	N other
Brecht M-2	172	24185	7			7				
Brecht M-1	68	1165								
Brecht M-3		18								
Brecht O-1	67,5	1203								
Brecht O-2	298	1025								
Brecht O-3	61,6	542								
Brecht-TH	100	2982	1							1
Dilsen-DIII	146	5508								
Helmond-SB	2115	1048	1			1				
Meeuwen-ID-1a/1b	684	5890	1			1				
Merselo-H	409	3175	2			2				
Opglabbeek-R	134	2102	3			3				
Turnhout-ZH		2176								
Weelde-P1	129	11877				1				
Weelde-P4	90	9115								
Weelde-P5	100	9298	2							2
tot. southern coversand	**4574.1**	**81,309**	**17**							
Bergumermeer-S64B	1200	123,746	47				13	28		6
Havelte-DD-H1-I/II		>71/737	8			1	7			
Marienberg-S	2110	4502	222		6		216			
Nieuw Schoonebeek-S	243	7649	12				11			1
Tietjerk-LG1	140	653	2			2				
tot. northern coversand	**3693**	**137,253**	**291**							
Hdx-PW-phase 0/1	448	17,695	47	2	5		5	9	26	
Hdx-DB-phase 1	345	384	28	1	1		3	11	6	6
Melsele-HtD	100	14,000								
Swifterbant-S11-13	564	7000	8+			1	6	1		
Swifterbant-S21	385		31			1	31			
Swifterbant-S22/23	490	5690	52+			5	47			
Swifterbant-S83	8	125	5				5			
Urk-E4	880		36+			1	35			
Hoge Vaart-A27	1684.5		100				100			
tot. wetland/(margin)	**4904.5**	**44,894**	**307**							
Liège-PS-SDT	200	10,014	5	2		3				
Liège-PS-DDD	100	1338	1	1						
Remouchamps-SD	65	1842	4	1		2			1	
Namur-G	82,5	1800	2			2				
Jardinga-J	294	34								
tot. river valley	**741.5**	**15,028**	**12**							



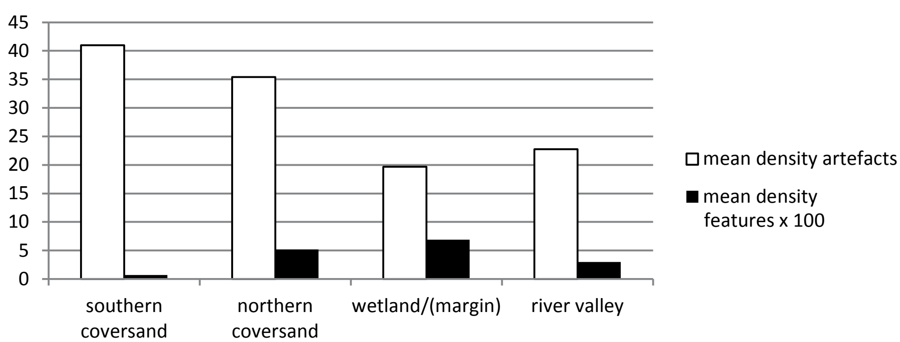


Fig. 5.8 Counts for the density of artefacts and features per m² as documented for informative sites within the four groups defined.

Fig. 5.9 Artefact and feature densities per group, not including the artefact counts for Melsele and De Bruin and the feature counts for S83 (total area excavated: southern coversand: 4574.1 m²; northern coversand: 3693 m²; wetland and wetland margin: 4804.5 m²; river valley: 741.5 m²).

likely related to the specific function the sites had within the settlement system. Jardinga has been interpreted as a kill and butchering site, while Helmond was located at some distance from the main concentration. The high feature density at Swifterbant-S83 is explained by the presence of five hearthpits within 8 m² (Jordanov 2005, 53).

In the counts, omitting outliers, the overall differences are accentuated (see fig. 5.9). The sites in the northern and southern coversand group are characterised by high densities of lithic artefacts, probably formed by chronologically distinct repetitive events (*e.g.* Crombé *et al.* 2006), while investment in features, especially for the southern coversand, is limited. Some surface hearths and pits may have been obscured by taphonomic processes, but the investments in features on the northern sandy soils, where similar post-depositional processes may be expected, is considerably higher. This is mainly caused by hearthpits which would also have been visible in the south. For Late Mesolithic sites in the wetland and valley floor locations there are less high densities of lithic artefacts and for the wetland sites more of a balance between features and artefacts. This also relates to a better preservation and therefore more precise attribution, but in the case of some wetland/(margin) sites it also appears to represent increased investment in frequently reused locations. The feature densities at the river valley sites are less intensive, but qualitatively of a structural or fixed nature (stone platforms, hearth bases).

5.4.5.2 Feature variability

While density only offers a coarse indication, the variability in features is perhaps less prone to taphonomic disturbance. To some extent a greater variability in features may correspond to a wider range of activities performed at a location and signal increased investment. This may be substantiated by ethnographic investigations where the variability in features forms an important correlate for the length of stay (Kelly 1992, 56; Kelly *et al.* 2005, 410). This is often related to subsistence orientation (Kent 1991, 41). Below (fig. 5.10) feature variability has been documented by scoring the number of features within each category per site (see also table 5.11). In fig. 5.10 the interpretation of six 'graves' at Mariënberg is plausible (see Appendix I; Louwe Kooijmans 2012[b]). Furthermore six groups of collected structural stones at Bergumermeer have been scored as such. The structural stones at Nieuw Schoonebeek have been scored as one group.

Feature variability on the southern coversand is low, comprising surface hearths and occasional concentrations of burnt bone or hazelnut. This contrasts with the other groups. Hearthpits form an important component on the northern coversand as well as in the wetlands. Furthermore hearths, pits, graves, structural stones (manuports) and concentrations are found in those groups, including postholes and structures in the wetland group. Structures also form a type of investment among the group of river valley sites in the vicinity of Liège. Again, a major factor in the contrasts witnessed is the combination of local taphonomy and excavation methodology, especially regarding the upland coversand areas (Groenewoudt 1994; Verhart 2000; Vermeersch 1989), yet the combination of both the density and variability differences also seem to indicate differences that may relate to differences in past behaviour and site use. It should thus be questioned

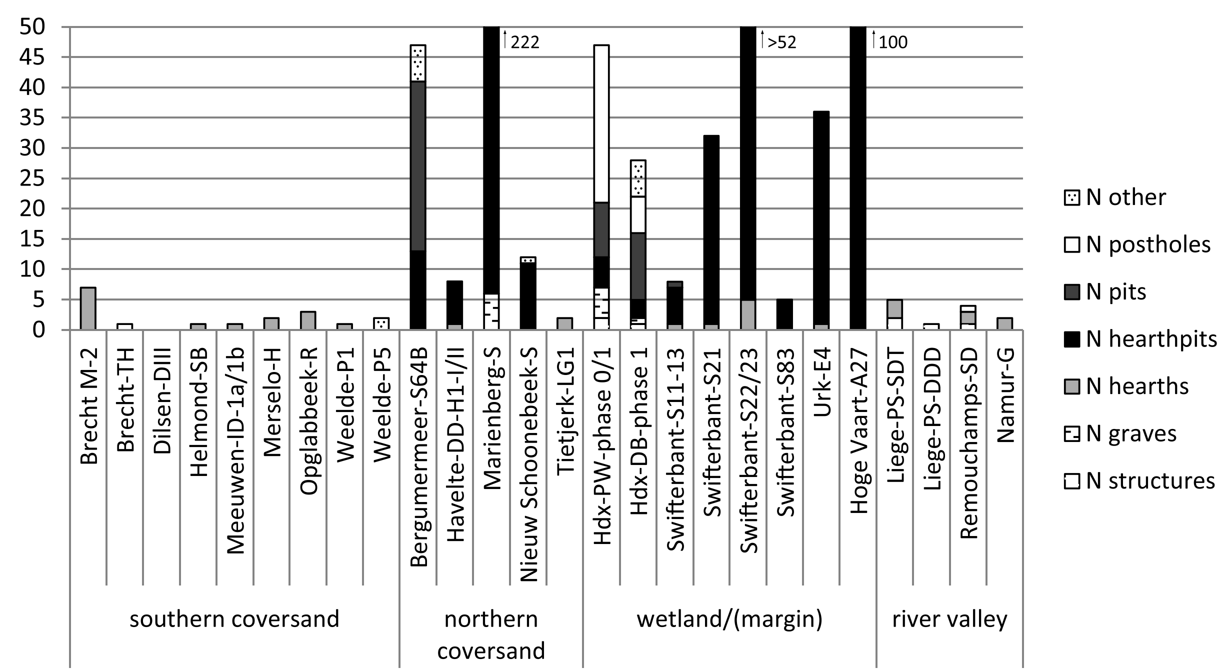


Fig. 5.10 Counts per site for features defined. Hearthpit counts for Hoge Vaart, Mariënberg and Swifterbant S22/23 are respectively 100, 216 and 47. Note that counts above 50 are not depicted.

to what extent 'absence of evidence' might indeed mean 'evidence of absence' at these sites. In order to provide more context for the elements that Binford (2002, 145) referred to as parts of the 'site framework' a number of features will now be discussed for sites in the different groups defined.

5.4.5.3 Hearths and hearthpits

Hearths form an obvious structuring element at sites. They are the locations around which a number of social and functional tasks are executed at all the sites studied. In this respect they act as hubs or anchor points around which an important part of site structuring may take place.

Coversand, wetlands and river valley: surface hearths

Surface or shallow hearths form a frequent phenomenon at sites in the southern coversand landscape, but they have also been documented for the sites studied on the northern coversand, as well as for the wetland and river valley sites. For the southern coversand group eleven sites yielded 21 hearths. Nine other sites also yielded evidence for the presence of hearths in the form of burnt artefacts, dispersed charcoal, concentrations of burnt fragments of hazelnut shells, burnt bone and burnt fragments of quartz, quartzite and sandstone (*e.g.* Weelde-Paardsdrank sector 4 or Meeuwen-In den Damp I).

Apart from the degree to which hearths may be recognized (Sergant *et al.* 2006), the association of hearths to the excavated concentrations and the difficulties in dating form a problem. As was noted previously (see Chapter 4, Crombé *et al.* 1999) many charcoal and other ^{14}C samples on the sandy soils yield aberrant dates due to infiltration, absorption, or apparently unjustified assumed association. Of the twelve dated hearths, four yielded a Late Mesolithic age, four date to the Early and Middle Mesolithic, and four yielded dates that were far too recent. At Brecht-Moordenaarsven even a stratigraphic difference between the hearths could not be confirmed by ^{14}C dates (see Vermeersch *et al.* 1992).

Three hearth types could be distinguished, but it should be realised that we only see those features that were deep enough to be preserved within the current soil stratigraphy. Most are 'surface hearths' or shallow hearths with a depth of up to 4 cm, containing ash and pieces and particles of charcoal. In some cases, however, notably at Merselo and Brecht-Moordenaarsven, 'hearthpits' were defined. In these instances depths cluster between 10-15 cm. The deepest hearth, measuring 34 cm was recorded at Merselo-Haag (Verhart 2000, 78). It should be taken into account that hearthpits were originally deeper than the remaining depth below the plough zone, making the contrast between 'surface hearths'and hearthpits less obvious. It is not known whether there were functional differences between the deeper hearths and the 'surface hearths'. Both sometimes contain some burnt and unburnt flint. One may argue that the deeper hearths are similar to the well-known deep hearthpits from the northern sandy soils, which seem to have been used for subsistence such as food processing or production-related activities (*e.g.* Groenendijk 2004, 22). These pits are, however, very uniform, cylindrical and often *c.* 50 cm deep, with a layer of charcoal at the base and regularly occurring in great numbers (Groenendijk 2004; Verlinde/Newell 2006). This differs from the more irregular to oval, shallow and isolated hearth pits of the southern sandy soils.

It is not clear whether the digging of deeper hearths took place prior to the initial firing, or is the result of the repeated cleaning out of the hearths.

A second hearth type consists of a stone structure or hearth base, on top of or within which a fire was burnt. Dispersed evidence of these types of hearths has been found at Meeuwen-In den Damp and Weelde-Paardsdrank sector 1. The site of Opglabbeek-Ruiterskuil, however, yielded two well-preserved examples of heavily burnt *in situ* hearthstones. According to the excavators the stones were embedded several centimetres in the sand (Vermeersch *et al.* 1974, 91). These stone-based hearths may have had a different function, or were perhaps intended as more permanent structures. The most distinct examples of these hearths are found in the group of valley floor sites at Liège-Place St.-Lambert where a number of cobble bases was constructed for the hearths (Van der Sloot *et al.* 2003, 96-97). Another stone-based hearth was found at Namur-Grognon as well as some indications for similar features at Remouchamps (see Appendix I).

A third variety is formed by secondary refuse as a result of the cleaning and dumping of hearth fills or trampling and blending and has been demonstrated at several sites. These processes resulted in more or less extensive patches of ash, charcoal and burnt artefacts. One of these was recorded at Merselo-Haag as hearth 4, measuring 4 m^2 and virtually no remaining depth. Some internal clustering was visible including pieces of charcoal. The origins and extent of these hearth dump locations may be related to the 'magnet' effect of a primary dump on future refuse (Binford 2002, 155). Merselo also yielded additional patches of burnt flint and charcoal, which could not be directly related to hearths (Verhart 2000, 79). Similarly at Hardinxveld-De Bruin, a number of concentrations have been interpreted as the remains of hearths or dumps related to activities at the water's edge (Nokkert/Louwe Kooijmans 2001, 81). Another outlier is formed by the dispersed remnants of a structured hearth in sector 1 of Weelde-Paardsdrank. One should be aware of the effects on hearths of so-called processes of smearing and blending described by Ascher (1968), as well as the preventive maintenance and clearing of activity areas (Binford 2002; Boaz 1998).

Northern coversand and wetland margin: hearthpits

Hearthpits have been discussed above in terms of their structuring properties. They appear at sites within the northern coversand group and the wetland (margin) group. Occasionally surface hearths are also found at these sites. The absence of hearthpits cannot be explained taphonomically: surface hearths could have been missed on the northern sandy soils, but hearthpits would probably have shown up in the south.

Sites with large numbers of hearthpits were often used over considerable time spans. As argued in 5.4.4.4 the limited intersection of pits indicates that their locations might still have been visible or known (Verlinde/Newell 2006; Peeters/Hogestijn 2001). The explanation may be that certain conditions for firing had to be met, requiring avoidance of old pit fills (see Groenendijk 2004) or locations with either too humid or dry and loose sand (Groenendijk/Smit 1990; Peeters 2007). The special character of hearthpits is further characterised by their standardized round shapes (40-80 cm) and an average depth of 40-50 cm (Niekus 2005/2006, 44). Micromorphological analysis has yielded evidence for both repeated cleaning and reuse of these features, as well as for a singular use after which the pit was filled again (Hamburg *et al.* 2001; Peeters/Niekus 2005). Overall there is evidence for long smouldering fires, although there are also indications for quick extinguishing of fires (Hamburg *et al.* 2001, 11). The charcoal in the predominantly dark pit fill often consists of oak, especially in the later phases of the Mesolithic (*e.g.* Verlinde/Newell 2006). The use of considerable blocks of wood indicates that the hearth pits were used for 'slow' fires with a slow combustion (Wandsnider 1997). These could be used for food preparation and industrial activities and were highly manageable (for ethnographic references *e.g.* Groenendijk/Smit 1990; Hamburg *et al.* 2001; Wandsnider 1997). Indications for the use of these pits were found at several sites. At Mariënberg-Schaapskooi eleven hearthpits yielded up to five cooking stones per pit (Verlinde/Newell 2006, table 7). At S22 at the bottom of hearth 4 a fragment of a *Geröllkeule* was discovered (De Roever 1976; 2004; Price 1981, 85). At Hoge-Vaart-A27 phosphate analysis indicated the presence of organic saps from meat, bones or faeces, whereby the latter two might also have been used as fuel (Hamburg *et al.* 2001, 13). Next to finds of burnt animal bones Perry distinguished various species of edible plants in pits at the site of NP3 (Perry 1999). The production of tar (pers. comm. T. Hamburg/ L. Kubiak 2012) is a very probable possible function of these pits (Peeters 2007, 189).

Hearth fills, use and spatial aspects

Burnt flint is only occasionally present within the fill of the hearths, in contrast with the rather high percentages of burnt artefacts at some of the sites studied (between 15% and 51%; however see Sergant *et al.* 2006). The fills mostly consist of charcoal particles and ash. Identification of charcoal at Brecht-Moordenaarsven yielded evidence for *Quercus*, *Pinus*, *Betula* and *Salix*. Charcoal analysis of Merselo-Haag indicated the use of evenly grown wood with hardly any branches (Verhart 2000; Vermeersch *et al.* 1992). This may be indicative of long-lived fires. A hearth at Helmond-Stiphoutsbroek yielded charred hazelnut shells and two pointed pieces of wood, possibly arrow shafts (Arts 1994). The hearth fills themselves are thus not very informative as to the use of the hearths, but several sites have yielded additional information. Apart from the already mentioned burnt flint several concentrations of charred hazelnut shell and burnt bone have been found, most notably at Weelde-Paardsdrank sector 5. Several hearths or dumps at De Bruin yielded concentrations consisting of combinations of burnt bone, charcoal, clay and fish remains (Nokkert/Louwe Kooijmans 2001, 81). It is plausible that hearths were used for tool manufacture and maintenance as well as various domestic purposes including food processing and cooking.

There is little spatial information available. Verhart (2000, 79) is convinced of the absence of any spatial relationship between hearths and clusters at Merselo-Haag and a similar conclusion has been drawn for the earlier Mesolithic by Crombé (1994). On the other hand many of the Late Mesolithic sites studied here yield evidence for a considerable proximity and overlap of hearths and lithic concentrations. At all sites where hearths are documented the main concentrations of flint are within less than 3 m of the hearths. At Weelde-Paardsdrank sector 1 and 5, Meeuwen-In den Damp and Opglabbeek-Ruiterskuil there is also evidence for activities such as flint working concentrating around the hearths (see Huyge/Vermeersch 1982; Pilati 2001; Vermeersch *et al.* 1974). Perhaps it should therefore be concluded that while the direct association between hearths and artefact clusters remains difficult to establish, they do seem to be at least a spatially integral part of the Late Mesolithic site structure (grain) in the southern coversand landscape.

For the hearthpit clusters it may be argued that the increased labour and time requirements involved in making and firing hearthpits (situating, excavating and cleaning of pits, gathering of fuel, preparing and managing the fire etc.) indicate that an increased investment in site structuring was made at these locations. This may also explain the sometimes suggested spatial distinction between areas with hearthpits and areas with artefacts. According to Schiffer (1995, 37) such a disparity might point to an increase in intensity of occupation.

5.4.5.4 Pits and postholes

Pits and postholes do not seem to occur at sites in the southern coversand landscape. Even in those instances where artefacts or even hearths are vertically situated in or near the C-horizon (as at Opglabbeek-Ruiterskuil and Brecht-Moordenaarsven 2), or where a possible palaeo-floor has been documented no features were found (see Vermeersch 1989, 289). On the northern sandy soils, pits and postholes are scarce. A number of other sites on the northern coversand yielded evidence for pits, although there too decapitation of the soil profile, erosion and soil formation processes will have obscured many features other than hearthpits (Beuker 1989, 128; Peeters 2007, 89). A number of pits at Mariënberg yielded evidence for burials as well as a pit at Dalfsen with cremated remains (Louwe Kooijmans 2012[b]; Peeters/Niekus 2005; Verlinde/Newell 2006). At Bergumermeer 28 features were defined as pits. Furthermore Newell (1980, 257, 280) defined so-called drainage ditches related to the presence of potential paths. These claims are currently under review (NWO-Odyssey project led by Marcel Niekus; Niekus 2012). At Havelte-H1 several elliptical and circular features were interpreted as pits. Price *et al.* (1974, 23) suggested a use as storage pits, but this is uncertain. At Mariënberg some smaller features were identified as postholes (Verlinde/Newell 2006, table 7 and 10). Based on these results it may in general be concluded that dug-in features, other than hearthpits, were not a recurrent element of the site framework in this area.

Within the group of wetland and wetland margin sites, Hoge Vaart yielded some features described as deep (hearth?) pits (Peeters 2007, fig. 4.7). Hardinxveld-Polderweg and de Bruin yielded several features that were interpreted as pits, two of which (K5 and K8) were interpreted as hut features (see below). A number of circular pits at both locations are probably hearth features (Hamburg/Louwe Kooijmans 2001, 79; Nokkert/Louwe Kooijmans 2001, 87). The function of the remaining pits at both sites is not clear. At De Bruin these were of variable size (50 x 66 to 274 x 268 m). Some contained loam, ochre or charcoal (*ibid.*). All pits were located near the 'wetland' contact zone at the foot of the dune at a distance of 1-3 m (to avoid water welling up; *ibid.* 89). Polderweg also yielded 26 small features interpreted as postholes or stakeholes (Ø 7-20 cm), one of which even contained the original stake. Some seem associated with the large pits (K5, K7 and K8) and may have served as some sort of superstructure related to either a shelter or hearth (Hamburg/Louwe Kooijmans 2001, 85). De Bruin also yielded quite a number of smaller postholes and stakeholes (Nokkert/Louwe Kooijmans 2001, 98). Four postholes, including two larger ones dating to phase 1, were located at the foot of the dune and might have formed some sort of structure. The others are found on top of the dune in a relatively flat area and seem to represent a palimpsest of rebuilt structures (*ibid.* 99). At Swifterbant-S11 (see Whallon/Price 1976) several moderately deep pits were found, spatially associated, but not overlapping with hearthpits and shallow hearths (*cf. infra*). It is possible that these pits can also be interpreted as hearthpits due to the variation in size and fill of these features (see Hamburg *et al.* 2001; Peeters/Niekus 2005). At Swifterbant-S21-24 some vague features were interpreted as pits, although it is not clear whether they date to the Late Mesolithic occupation (De Roever 2004, 27). Some of the pits found at Urk-E4 might have belonged to the Late Mesolithic occupation.

The river valley site of Remouchamps (RSD) also yielded some evidence for posts in relation to a dwelling structure (*cf. infra*).

In view of the taphonomic situation at many sites it is difficult to determine to what extent the presence and distribution of pits and postholes is a reflection of past reality. Based on the counts available this type of investment appears to be best represented in the group of wetland/(margin) sites.

5.4.5.5 Dwellings and other structures

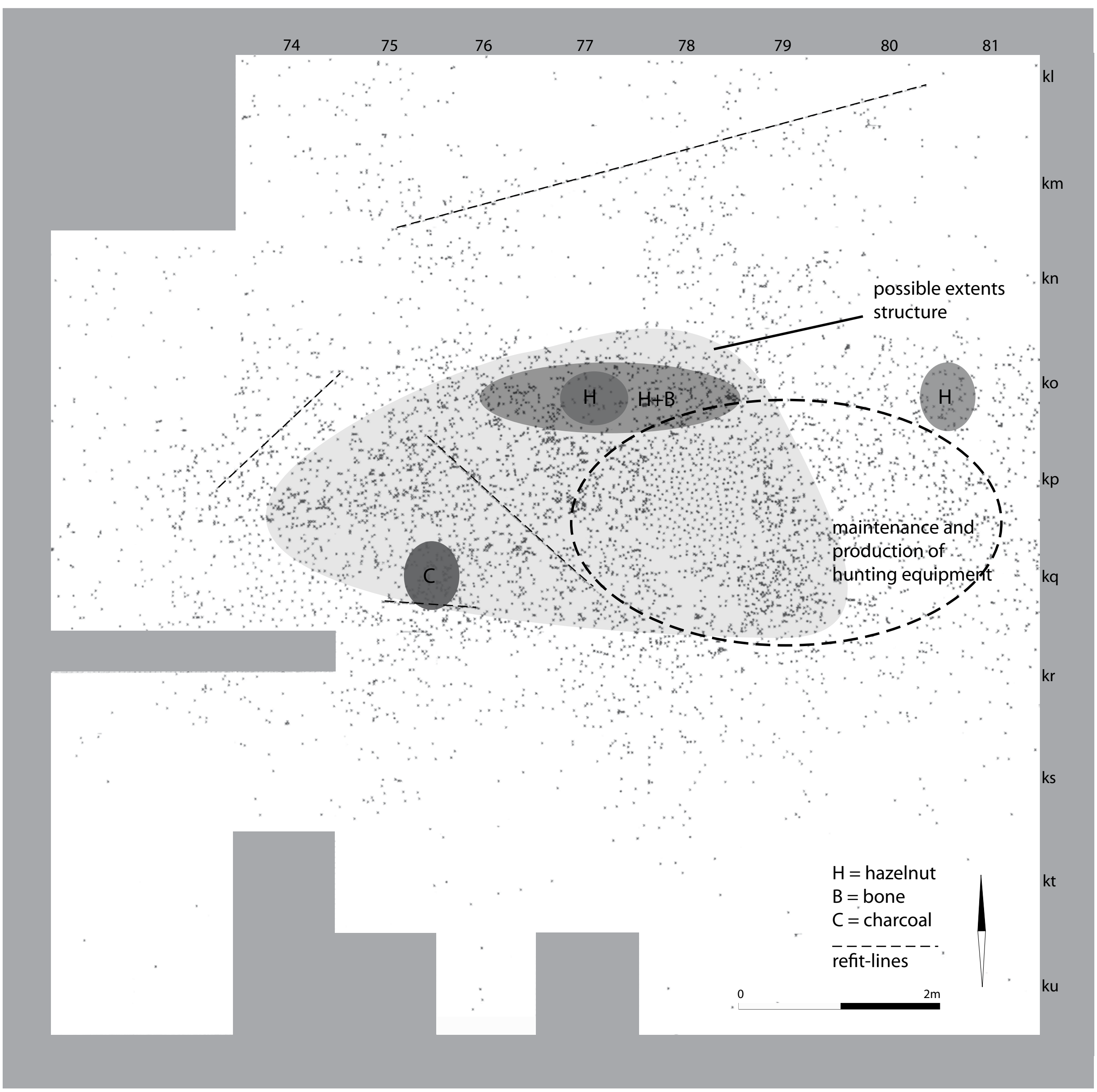
Dwelling structures and other facilities form important indicators for the degree of investment in locations and the level of permanency in occupation. This often relates to the durability of these structures, although anticipated mobility in this sense also forms a factor to take into consideration (see Kent 1991, 56; Kent/Vierich 1989). It is likely that some form of shelter existed at many of the above sites, especially under certain seasonal or weather-related conditions. Yet while some of the hearths and artefact distributions may have been located within the confines of some sort of structure or dwelling no primary evidence of this has been found and any previously accepted hut-features must currently be discarded as tree-fall features (*e.g.* Bubel 2002/2003; Crombé 1993; Kooi 1974; Newell 1980). The main reason for the absence of remains of huts or tents are the intensive postdepositional processes preventing the preservation of organic remains and obliterating whatever features originally may have been present. It should on the other hand be expected that the architecture of these groups of hunter-gatherers will have been of an ephemeral nature, due to their mobile character (Binford 1990; David/Kramer 2001, 282, 285; Gamble 1991, 1-4), and many locations may not have had site architecture at all (see also Verhart 2000, 125-126). Identifying the presence of dwelling vestiges, especially on the basis of artefact distribution, remains a problematic endeavour.

Southern coversand: Weelde-Paardsdrank-sector 5

On the southern coversand only two sites have yielded limited indications for the presence of a shelter (tent or hut), by the distribution of artefacts. The first potential dwelling structure is situated in the well-preserved sector 5 at Weelde-Paardsdrank. It is characterised by a well-defined artefact cluster, measuring 7 x 3 m along the axes. This distinct find pattern suggests a singular short-term activity, yet the quantity and diversity of finds, including organic remains is better in accordance with a more structured frequentation of the location. The excavators suggest that the distinct delimitation of the cluster in this case may be related to some form of shelter (Huyge/Vermeersch 1982, 150, 197). Unfortunately, inadequate excavation of two squares (KP78 and KQ74) and the absence of a clear hearth structure prevent a spatial analysis with the ring and sector method (Stapert 1992), yet the confined pattern in combination with the relatively undisturbed context are visually suggestive of some sort of barrier (see fig. 5.11).

Contrasting with the opinion of the excavators (Huyge/Vermeersch 1982, 150) the diminution of finds on the eastern side of the supposed structure is not less pronounced. It seems demarcated by a relatively sharp break running through squares KO-KQ79. The distribution of finds to the east and south of these squares may reflect activities outside the structure or (door)dumps of refuse. The latter interpretation becomes more plausible if the location of the slope and fen to the south are incorporated. The working areas were probably oriented to the south and southeast in view of the most economical use of water and sunlight (*cf. supra*). Similarly the low density in squares KQ-77-78 may be interpreted as an entrance oriented to the south. Concerning finds, sector 5

Fig. 5.11 Combined visual analysis and functional interpretation of the spatial delimitation and location of artefacts and organic remains at Weelde-Paardsdrank sector 5. (Adapted from Huyge/Vermeersch 1982, plans 5, 6 and 7).



differs from the other two locations at Weelde-Paardsdrank in its concentrations of burnt organic remains and the highest *in situ* artefact density. A closer look at the lithic distribution seems to confirm a non-random distribution (see plans 5 and 6 in Huyge/Vermeersch 1982; *ibid.* 151). Trapezia are mainly concentrated in the eastern part, both within and outside the main concentration, together with most points and microburins, while blades tend to occur more frequently in the west. Most cores are located outside the supposed structure, while more core rejuvenation flakes are found within. This could relate to preventive maintenance in which larger objects are removed from the activity areas (Binford 2002, 189). The pattern of activities represented in the lithic material seems to point to the production and maintenance of hunting implements, predominantly located in the eastern part of the cluster and possibly associated with fire since 21.2 % of the artefacts are burnt (Huyge/Vermeersch 1982, 150). There is also evidence of further activities (see fig. 5.11). Two concentrations of broken and carbonized hazelnut shells were recovered in the northern part of the cluster, both within and outside of the supposed structure, coinciding with the distribution of calcined fragments of bone.[25] In the southwestern part, a considerable dump of charcoal was documented (*ibid.* 151). These organic concentrations are not only indicative of the cooking, processing and – in the case of hazelnuts – possibly the preservation of food, but also point to specific waste behaviour. This is supported by the correspondence of the highest density of lithic materials with a vacuum in the distribution of burnt organic remains (*ibid.* 151).

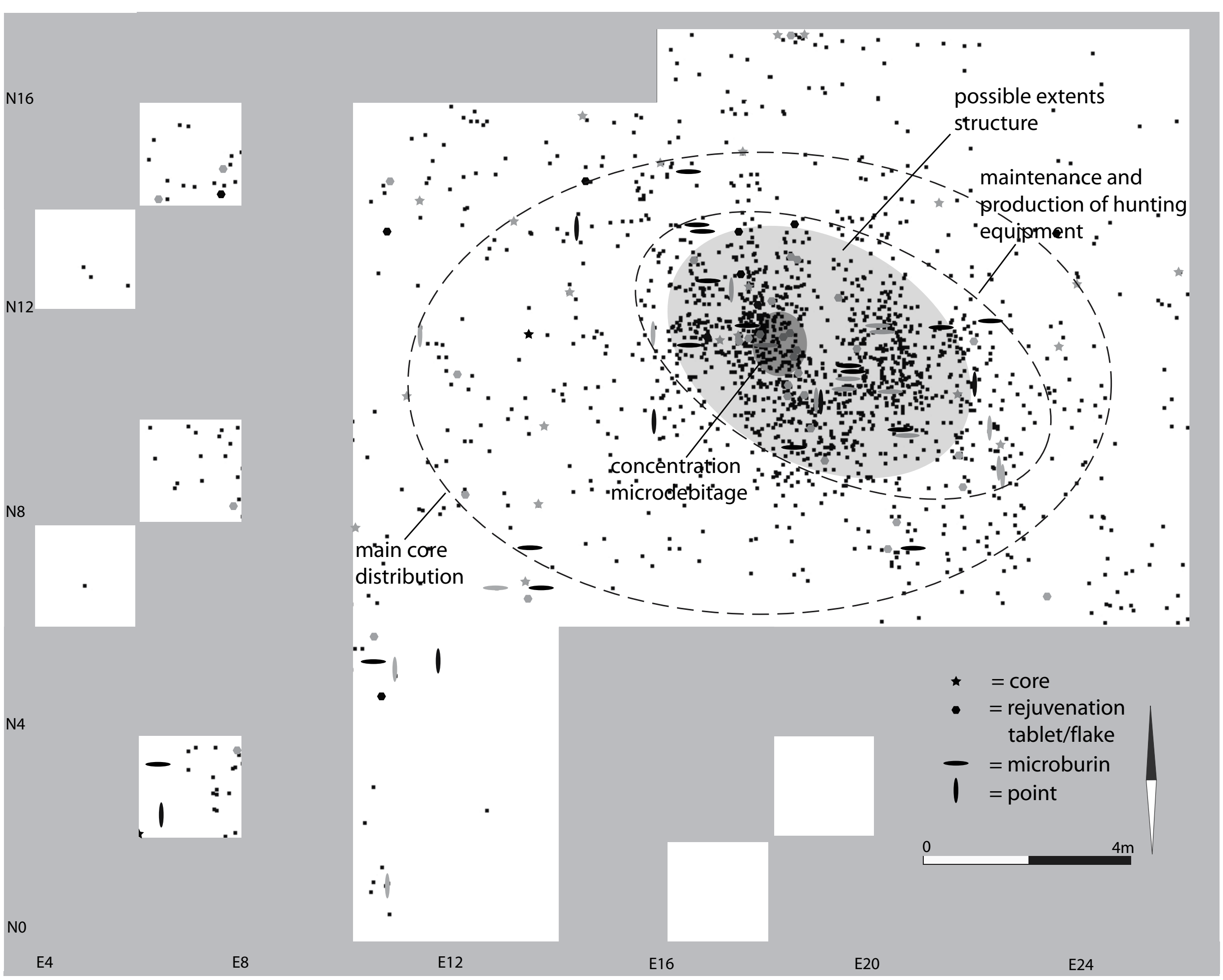
Southern coversand: Meeuwen-In den Damp I

The second possible dwelling structure for the southern coversand landscape is concentration 1a at Meeuwen-In den Damp I. Pilati (1999; 2001; 2009) tested the distribution of finds in an extensive study, both for the sitting model and by the ring and sector method (Binford 2002; Stapert 1992). The potential structure is formed by a vaguely delimited *in situ* U-shaped pattern of *c.* 4 x 3 m (see fig. 5.12). Although displacement of the finds took place (Bubel 2002/2003), the resulting pattern did not correspond with the distribution of tree falls (Crombé 1993; Pilati 2001). Using the ring and sector method, the horizontal distribution demonstrated an almost completely empty central zone within the horseshoe pattern. More voluminous items were located outward, in line with the sitting model, but no clear bimodal distribution pointing towards a barrier effect could be discerned (Pilati 2001, 110-135). Although no primary hearth feature was found, indicative artefacts such as burnt flint, sandstone, quartz and microburins tend to cluster in the same locations, northwest and southeast of concentration 1a. The cores are found mainly outside the concentration, similar to Weelde-Paardsdrank, in this case roughly forming a surrounding arc, while rejuvenation flakes and tablets tend to cluster in the centre. It is remarkable that the waste products of point manufacture, the microburins, are mostly situated in the centre, while worn-out points are located outside the production area and were thus possibly thrown away (*ibid.*). Within the U-shaped pattern a further clustering of several artefact types and RMUs can be made out, while squares N11-E17/18 yielded evidence for a knapping spot. Refitting evidence confirms the location of a centre of activity in the same square (Pilati 2001, fig. 6.1). Pilati (2001, 133-135) argues, that the 'outside sitting model' is supported by the circular structure and the knapping spot. Still, he admits that there is no evidence for other activity areas in the circle, neither does the distribution of burnt items shed any further light on things.

His second hypothesis is based on the ring and sector method (Stapert 1992). In this scenario the remains of at least one knapping spot and the central hearth were pushed outwards. There is some evidence for a centrifugal effect, although no clear bimodal distribution was recorded. The U-shaped pattern may, however, still be caused by the presence of a tent wall. The lateral concentric alignments of artefacts located east and west of the concentration may furthermore indeed be interpreted as refuse thrown out of two opposite entrances (see Pilati 2001; 2009). While Pilati (2001) favours the second model, neither of the two interpretations could be confirmed.

It can thus be concluded that at best certain 'hints' of dwelling structures are present at Weelde and Meeuwen, next to many more indications for outside activities. The absence of distinct primary refuse and the limited size of the concentrations suggest rather small and mobile structures, like tents or light huts (see Karsten/Knarrström 2003, 37). These could be transported or made expediently out of locally available material (Binford 1990).

Fig. 5.12 Lithic distribution of Meeuwen-In den Damp I, sector 1a. Symbols in black are not point referenced. (Adapted from figs. 7.8, 7.10, 7.11, 7.20 and 7.21 in Pilati 2001).



Northern coversand: Bergumermeer-S64B

Similar to the southern coversand landscape no unambiguous dwelling structures are known for the north. In most cases taphonomy and site formation processes are responsible for this. Erosion and especially the difficulty in distinguishing between anthropogenic and natural features hinder identification of structures (Crombé 1993; Newell 1980).[26] Nevertheless, structures have been proposed for some sites.

The best-known potential dwelling structures have been found at Bergumermeer-S64B (Bloemers *et al.* 1981; Casparie/Bosch 1995; Huiskes 1988; Newell 1980; Newell/Vroomans 1972; Odell 1980; Peeters/Niekus 2005; Niekus 2012). Newell (1980) presented six hut features from this site in a critical review of Mesolithic dwelling structures (see also Appendix I). Their interpretation as hut features is based upon a combination of structural elements (postholes, structural stones), soil discolouration and a statistically attested relationship between the supposed floor area and associated activity areas (Newell 1980, 257-258, 265). The hut features (*c.* 7.2-8 x 4-5.2 m) were visible as elliptical alignments of 17-22 manuported stones coinciding with orange to yellow-orange soil discolourations of 32-100 cm in width and with a depth of *c.* 11 cm (Newell 1980, 258 and fig. 3; see also Peeters/Niekus 2005, 212). According to Newell (1980, 260) the features overlap with both the distribution of complete blades as well as the other classes of features and are regularly and orderly spaced 'on what appears to be an intentional plan' (*ibid.*).

On the basis of the information and plans currently available, several critical comments can be made, relating to taphonomy, association, contemporaneity and credibility. These include the many natural disturbances, problems of '*in situ*' attribution, the limits of statistical testing, post-occupational infiltration of humic acids, which would explain the raised horizons, the location of the features with respect to each other and their age, the absence of a cover until the Subboreal, the long-term use of the site and the presence of earlier and later occupation episodes. A more detailed account of Bergumermeer and a review of the plausibility of its hut features has recently been conducted by Niekus within the NWO-Odyssey programme. With regard to the hut features the main conclusion is that this interpretation should be regarded as highly questionable (Niekus 2012). In this thesis the supposed elliptical features of Bergumermeer will therefore not be interpreted as hut features. The site did yield evidence of intensive use in the form of pits, postholes, hearthpits, and manuports over the entire extent of the ridge, as well as an assemblage of 123,746 artefacts, which is more than ten times larger than most Late Mesolithic sites in the LRA. The long-term use of this location (see Appendix I) should however be taken into account.

Northern coversand: structures at Havelte and Nieuw Schoonebeek?

There is hardly any evidence available at the other sites for the existence of structures. At Havelte-H1 three shallow elliptical pits were found, measuring *c.* 2-3 m in length, 1.5-2 m in width and *c.* 30-50 cm in depth. In one of these a truncated part of the podzol horizon was documented, which suggests that these features may be interpreted as tree falls (Price *et al.* 1974, 23). It has been mentioned though by several authors (Bubel 2002/2003; Crombé 1993) that tree falls excellently meet the basic requirements for dwelling structures. The presence of artefacts and charcoal within their fills might thus not be postdepositional in some cases. The site of Nieuw-Schoonebeek yielded 39 sizeable stones of different types, probably collected at the nearby Hondsrug ice-pushed ridge. These stones are interpreted as tent weights, in view of their dimensions and weight (Beuker 1989, 161).

Wetlands and wetland margin: Hardinxveld-Polderweg

At Polderweg the oblong pits K5 (8.5 x 3 m) and K8 (6.5 x 2 m), with a remaining depth of 40-50 cm, were located on the slope of the dune. The bottom of both of these features consists of a compacted (trampled?) layer with organic material, yet the fill was largely devoid of finds (see Hamburg/Louwe Kooijmans 2001, fig. 4.7 and 4.8). The features are associated with several postholes (*cf. supra*). Both pits are accepted here as dwelling structures, more specifically sunken dwellings. This is substantiated by a comparison with archaeologically comparable features from other (Late) Mesolithic sites such as Baarn-'De Drie Eiken', Tågerup, Møllegabet and Lollikhuse (see Van Haaff *et al.* 1988; Hamburg/Louwe Kooijmans 2001, 95; Karsten/Knarrström 2003, 37; Skaarup/Grøn 2004, 41-74; Sørensen 1992).[27] Furthermore, investment in partly dug-in or sunken hut structures has also been documented ethnographically (see Binford 1990, 123). Unfortunately the destructive colluvial processes prevent a correlation of these features with the distribution of artefacts. Possible dwelling structures were also recorded for De Bruin. A large pit (K13a/b) in phase 2 shared some of the characteristics of the hut dwellings mentioned above, but actually consisted of two separate pits and contained a burnt layer (Nokkert/Louwe Kooijmans 2001, 87-88).

River valley: Liège Place St.-Lambert

At Liège sector SDT yielded five stone pavements made up of blocks of sandstone and other river gravels. Three of these (L287, L290, 09-0263) consisted of dispersed concentrations of stones bearing traces of fire and are interpreted as naturally or anthropogenically displaced hearths. The other two (L288, L289) are of similar size, but lack traces of fire. They consist of two layers of sandstone and are well structured. Their interpretation is not clear (see Van der Sloot *et al.* 2003, 96-97), but apart from hearths an interpretation as storage platform is also possible (Cribb 1991, 92-94).[28]

The fact that these stone structures consist of two layers adds to the aspect of investment and possibly recurrent activities. For most of these structures a correlation with one of the two Mesolithic occupations is possible (Van der Sloot *et al.* 2003, 97-98). No detailed information has been obtained on the spatial relationship between the lithic clusters and the stone pavements, although they seem located north of, and partially overlapping with, the western cluster of lithics (compare Van der Sloot in prep. fig. 3 and Leotard *et al.* 1995, fig. 3). The other stone structure, L500, was found in sector DDD and measured *c.* 4 x 4 m. The structure was angular to rounded in shape and also consisted of river cobbles. The pavement was located north of a depression, probably an old channel of the Légia. The pavement could not be dated directly, but most evidence points to a (Late) Mesolithic attribution (see Van der Sloot *et al.* 2003, 98; Van der Sloot in prep., 162). Importantly, the distribution of lithic finds is largely complementary to the structure (*ibid.* fig. 19-21; see also Appendix I). The interpretation of the pavement is still open. While traces of fire have been found, the size and location of the structure points rather to a function as a base or drainage system for a tent or hut (Van der Sloot *et al.* 2003, 97). Remarkable is the increased density of the stone pavement in its northern section, which almost forms a circular feature. This is also the area where the largest stones are found (see Gustin *et al.* 1994, fig. 2). The abrupt delimitation of the feature supports the idea that the layout and construction of the pavement was planned. This may have been time-consuming. Similar stone pavements of intermediate size (1 to 2 m) have been found in a comparable river valley context in midwest France at L'Essart near Poitiers (Marchand *et al.* 2007). These have been interpreted as hearths, possibly related to the smoking of fish (*ibid.* 36). There are also several ethnographic analogies for these structures (see Binford 1990, 127-128).

River valley: Remouchamps-Station LeDuc

At this site another stone structure was found, consisting of several accumulations of quartzitic cobbles (up to 50 cm) in a roughly circular configuration. In some parts there was a superpositioning of several layers up to 40 cm. The overall structure is semi-elliptic in shape, closed off towards the valley. In the southern opening of the structure another accumulation of gravels was found in a shallow pit. Within this accumulation a double hole containing fine gravels was discovered. This feature is interpreted as a posthole (Gob/Jacques 1985, 167). Other features comprise a shallow pit (I25) filled with burnt stone fragments. Most gravels had been subjected to heat. On either side the pit was accompanied by a large sandstone block and only a limited amount of charcoal was found. Another feature (C24) was located in the southernmost part of the dwelling and consisted of burnt and fragmented sandstone blocks. Some of these were found at the bottom of a nearby shallow pit (*ibid.* 167). Most of the calcined bone fragments and artefacts such as trapezes and backed blades were found outside the dwelling in the vicinity of feature C24. Other features include a grouping of prepared cores (square E21), associations of psammite slabs and pebbles and the presence of a knapping area around a 'sitting-stone' (square H24; *ibid.*). Overall the evidence points to a partially covered structure (Gob/Jacques 1985, 174) with an internal structuring of activities. Most activities took place outside around the hearths. The excavators argue that the structural investment and the work involved in transporting several hundreds of kilos of stone indicate more than a provisional investment (*ibid.* 174). The stones were probably collected from the bed of the nearby Amblève river.

5.4.5.6 Graves

Graves and deposition of human remains, forming important aspects of mortuary practice and therewith socio-ideological and ritual practices, can, to some extent, be interpreted as an indication of 'investment' in a site, at least in the sense of a place of some (symbolic) importance (*e.g.* Littleton/Allen 2007). Only a limited number of sites yielded evidence for burials dating to the Late Mesolithic (see Louwe Kooijmans 2007[b]).[29]

Northern coversand: Mariënberg

The site of Mariënberg yielded six features that have been interpreted as sitting graves, found amidst a cluster of hearthpits (see Appendix I). The features consisted of a shallow funnel-shaped upper part (with unknown function) and a cylindrical lower part (Verlinde/Newell 2005; 2006).

The fill of the pits was remarkable. It consisted of a 30-35 cm layer of thick red-coloured sand within which (groupings of) artefacts were discovered, including several (retouched) blades, cores, blocks of flint, hammer stones and sandstone polishing stones. The number of 'grave goods' varies per feature from 0-22 items (Verlinde/Newell 2005, 11-12; Verlinde/Newell 2006). According to Louwe Kooijmans (2012[b], 414) the red stained sand is probably not redeposited red sand, but resulted from the dissolution and diffusion of a red substance ('ochre') derived from an unknown source and deposited at the same level. The sand was probably quarried at the settlement (it included the settlement waste that was found there) and the artefacts were coloured as well (see Louwe Kooijmans 2012[b], 410-411). Time-wise the features probably date to phase 3 or to the hiatus between phase 3 and 4, roughly around 6000 cal BC. They therefore do not seem related to the domestic areas with hearthpits at the site (see Louwe Kooijmans 2012[b]).

The overall evidence indicates that the pits, because of their shape and content, were probably used for intentional deposition and the burial of human corpses (Louwe Kooijmans 2012[b], 409, 415; Verlinde/Newell 2006). Based on comparative research into European Mesolithic burial customs, however, the combination of features remains very unusual within the Mesolithic burial traditions of the LRA (for further information see Louwe Kooijmans 2012[b]; Verlinde/Newell 2013 and Appendix I).

Wetlands and wetland margin: Hardinxveld

Next to isolated skeletal remains, Polderweg yielded a total of five graves, two human inhumations (G1, G2) and three dog burials (G3-5), of which one (G3) was in full anatomical articulation (Louwe Kooijmans 2003, 613). G1 contained the remains of an elderly female, buried in stretched position (N-S) and dated to phase 0. The other burials, dating to phase 1, were found on top of the dune, while one of the dog burials (G5) was situated on the slope (Louwe Kooijmans 2003, fig. 77.4). The burial pit was dug right before the occupation of phase 1 and apart from the skeletal remains contained a few specks and one piece of ochre (Smits/Louwe Kooijmans 2001, 421). The second grave contained skeletal remains of two individuals and no clear burial pit. The remains may have been incomplete due to taphonomic activity or may have been purposefully removed. The most complete dog burial (G3) demonstrates the care that was taken in the deposition of these valued animals.[30] It is noteworthy that the burials (G2-G5) were located next to and in between other features dating to phase 1.

In a similar position as at Polderweg, a human inhumation (G1) was found at De Bruin, at the top of the dune (Nokkert/Louwe Kooijmans 2001, 99-100). The grave contained the skeletal remains of an adult man, buried in an E-W direction. The other grave (G2) contained an adult buried in a sitting position (Louwe Kooijmans 2003, 613). It is noteworthy that at both Polderweg and De Bruin the human burials were cross-cut by later pits indicating either unfamiliarity with or a lack of interest in the presence of these graves.

While only two sites yielded positive evidence for Late Mesolithic burials, the presence of undated graves and small cemeteries, assumed to relate to the Swifterbant occupation at Swifterbant-S21-24 and S11-13, suggests that these practices probably had older roots. Furthermore, loose bone material has been found at a number of locations. While for the Swifterbant sites it can often not be specifically related to either the Late Mesolithic or Early Neolithic phase of occupation (see Constandse-Westermann/Meiklejohn 1979, table 1), it should be realised that this phenomenon was relatively widespread (see Louwe Kooijmans 2007[b]) and clearly has Late Mesolithic origins. As such it formed part of the mortuary ritual practice, while the deposition of these remains may also have had a structuring effect on the use of sites, or may be interpreted as a means of investing in places.

Recently another Mesolithic site in the vicinity, Swifterbant-Bisonweg, yielded a stretched human interment of approximately the age of the oldest Polderweg burial. Further west, a Mesolithic site (Rotterdam-Beverwaard) situated on a river dune (donk) west of Rotterdam yielded evidence of three pits with a small amount of human and animal cremation remains. These were dated earlier than the burials included here, roughly between 7500 and 7000 cal BC (see Appendix I; Zijl *et al.* 2011).[31]

5.4.5.7 Other elements

A number of other elements may be mentioned that indicate investment in a certain place. These include the structural stones (or manuports) that were documented at Bergumermeer and Nieuw-Schoonebeek, some of the features (large blocks etc.) at Remouchamps and Namur, and the potential fish weir at Jardinga. Another element is formed by treefall features or trunks of trees that may have been incorporated in the site structure (*e.g.* Crombé 1993). Particularly the wetland sites yielded evidence for additional investment. At Hardinxveld-De Bruin a feature (A1) found in the contact zone between dune and water is hypothetically interpreted as a channel in connection with a landing stage for canoes (Nokkert/Louwe Kooijmans 2001, 105). The site also yielded evidence for canoes, paddles (also at Polderweg) and part of a fishtrap. Obviously these are partially non-structural investments that were documented because of the good preservational conditions. On the other hand they also point to investments that are (energetically and time-wise) relatively costly and furthermore are a particular (structural) part of wetland occupation.

5.4.6 Late Mesolithic sites and settlement system in the LRA: defining settlement grammar

Above, a number of aspects of Late Mesolithic sites and site use have been discussed. These focused on three perspectives or scales (texture, grain and redundancy; see Cribb 1991) that dealt with the position of sites in the landscape and site location choice, the characteristics and elements underlying site structure and the investment in sites as determined by density and feature variability. As was already stressed a number of times, our perspective is necessarily skewed because of the distinct differences in taphonomy and site formation processes between sites and in relation to the different groups defined. This does not prevent the detection of larger scale trends and characteristics shared by a number of sites, and per theme it is possible to sketch a general outline and detect similarities and differences. Despite the limitations of the macro-scale variables discussed, these elements provide a preliminary framework for investigating the 'settlement grammar' of Late Mesolithic occupation in the study area. Below a characterisation per group is given based on the combined information presented above.

5.4.6.1 The southern coversands: consistent patterning

For sites on the southern coversand there seems to be a distinct link between the factors that characterise site location choice and the structure of these sites themselves. Most sites are situated on the top or the slopes of coversand dunes or ridges, often facing south and in the vicinity of water in the form of peat fens (meres) and streams (*e.g.* Van Gils/De Bie 2008; Van Gils *et al.* 2009). Water, increased biodiversity and raw materials were probably the main incentives for occupation (see Huyge/Vermeersch 1982, 151; see also Randolph Daniel Jr. 2001). Nevertheless, the frequent visits to sites may have taken on a dynamic of their own in a social sense, adding to their development as persistent locations (Schlanger 1992). The frequency and character of these visits is furthermore expressed in the way sites develop. Apart from the potentially structuring and centralizing features of hearths (*e.g.* Séara 2006, 277; Stapert 1992) these sites are shaped by concentrations of lithic debris that cluster on the slope or the top of dunes and ridges, often parallel to the waterfront. These scatters of clusters and concentrations often develop over a considerable stretch of terrain (Van Gils/De Bie 2003). Although some of these concentrations resulted from contemporaneous activities, radiocarbon and typological information point to their development over often extensive periods of time (see for instance Merselo-Haag, Brecht-Moordenaarsven and Weelde-Paardsdrank in Appendix I). They represent accumulations of many relatively short-term and unstructured occupations. It is therefore not so much the persistency of actual places or sites, but rather the consistency in conditions that shapes the formation of these complexes (Amkreutz 2009; Vanmontfort *et al.* 2010; Vanmontfort *et al.* in press). Although severely hampered by taphonomic factors, the short-term nature of frequent repetitive visits to these sites is substantiated by the unstructured characteristics of site development and the relative absence of investment in structures and facilities. Apart from evidence for surface hearths only two sites yielded limited indications for lightweight shelters or tents.

Interpreting short-term stays

A reason for the supposed short-term nature of occupation that characterises the elaborate site complexes in for instance the Campine area, may stem from the local geomorphological and ecological situation. The area is best characterised as mainly densely forested, in the shape of a closed-canopy deciduous Atlantic forest (*e.g.* Bakels 1978; Gregg 1988; Svenning 2002). In this type of landscape locations near peat fens of streams would be the most attractive areas for settlement, because of the proximity of water and occasionally lithic resources, but also because of the diversification in vegetation and the attractiveness to wildlife. Hypothetically these sites may be interpreted as resource patches, acting as nodes in the mobility cycle of the groups inhabiting the area. Although they are rather numerous (*e.g.*

Vermeersch *et al.* 1992, 5; Van Gils/De Bie 2008), they are not very extensive, which would require a residential move as soon as resources diminished. This helps to explain the numerous sites that have been found as well as the fact that they are often extensive, both aspects relating to the frequency of visits to suitable locations over many centuries. These locations, rather than being point-specific, are characterised by the existence of (expectable) consistent conditions, along the extent of a geomorphological feature such as a dune or ridge. It was these consistent conditions that were sought after, instead of particular places (Amkreutz 2009; Vanmontfort *et al.* in press). Recent research in the Campine area of northern Belgium has furthermore pointed out some differences in occupation intensity at some of the sites (Van Gils/De Bie 2008; see also Robinson 2007[b]; *cf. infra*). These could be related to a variety of environmental factors such as raw material abundance, reliable availability of water in the depressions encountered, or accessibility of site locations. Next to these push and pull factors social considerations involving territoriality or significance of certain places should be considered (*e.g.* Schlanger 1992).

From a behavioural perspective, similar models regarding the sustainability of environments have been put forward. Ethnographically oriented patch-choice models give some insight into forager behaviour in these situations (Kelly 1995). They assume return-rates are highest upon entering a 'patch' and (gradually) decrease until a point of diminishing returns is reached with rates dropping below the rates of expectancy levels elsewhere (Kelly 1992, 46; see also Sahlins 1972, 33). The subsequent decision to abandon the patch is based upon the cost of moving and encountering another patch (questions of time and energy). Furthermore, it is assumed that foragers do not return to a patch until its resources are rejuvenated (Kelly 1995, 90). When this perspective is applied to the Campine area, it may help us understand the archaeological patterning. The sustainability of the individual areas where resources cluster, such as peat fens and stream valleys may have been low, but at the same time the costs of moving were also low and the overall number of patches ensured regeneration over time. This would lead to a system of relatively high residential mobility (*sensu* Binford 1980).

5.4.6.2 The northern coversands: differences of degree

The recurrent characteristics that shape Late Mesolithic occupation on the southern coversand only partially determine the 'grammar' of sites in the other groups. On the northern coversand a number of sites is also characterised by lithic concentrations and clusters (*e.g.* Havelte, Nieuw-Schoonebeek and Tietjerk). These sites also yielded some hearthpits as well as other features. Apart from these there is another group with sites such as Bergumermeer and Mariënberg that are characterised by a greater number of structural elements: very high artefact counts at Bergumermeer in combination with a considerable number of structuring elements in the form of pits, hearthpits, structural stones and other features; at Mariënberg low artefact densities in combination with large numbers of hearthpits and, incidentally, graves (see Louwe Kooijmans 2012[b]). Apart from evidence for increased investment in locations, the clusters of hearthpits indicate a degree of spatial structuring. Direct evidence for dwelling structures is scarce.

Based on the characteristics in site location choice, sites on the northern coversand appear to be more oriented to larger ecotones, for instance Mariënberg to the Vecht valley, Bergumermeer to lake Bergumermeer, and Tietjerk and Schoonebeek in between a number of stream valleys. There are, however, also distinct similarities between settlement location choice in this area and the south. Similar locations - elevations in the vicinity of water - were sought after. Furthermore, the overall 'signature' is that of a coversand landscape largely comparable to that in the south, although there are obvious differences in for instance subsoil (moraine deposits), water systems, drainage and, later on, intensity in peat growth (see palaeogeographical map '5500 cal BC'; Vos *et al.* (eds) 2011, 43). Although the limited site evidence available does point to differences in structure and investment at sites, these should be interpreted as of degree rather than kind.

5.4.6.3 Wetland (margin) and river valleys: a different type of occupation?

There is a difference between the type of wetland settings within this group, with Polderweg and De Bruin forming one end of the spectrum. The other sites, most notably those of the Swifterbant cluster, Hoge Vaart and Urk are situated in landscapes that are becoming increasingly wet. Evidently, several of the Swifterbant sites characterised by hearthpits as well as the Late Mesolithic phases with hearthpits at Hoge Vaart and Urk (see Peeters 2007; Peters/Peeters 2001) may be compared to some of the sites in the northern coversand group. The information for Oudenaarde and Melsele is too limited to compare, but positive evidence of dug-in features fails. Where the former sites are characterised by considerable numbers of hearthpits, these are largely lacking at the latter. Favoured by good preservation, Polderweg and De Bruin yielded a variety of other features, including pits, postholes, possible dwelling structures and graves, next to (only) a few hearthpits. This points to a diversified structural investment, corresponding with the use intensity and level of permanency of occupation demonstrated for these sites (*e.g.* Louwe Kooijmans 2003). The structuring of individual elements at sites and their patterning and location with respect to each other can best be studied at the Hardinxveld sites, where there is evidence of intra-site zonation (Louwe Kooijmans 2003, 610). The top and upper slopes of the dunes yielded most features, including the supposed sunken dwellings at Polderweg. The lower slope and foot of the dune, bordering on the wetland, probably formed an activity area as demonstrated by (colluviated) debris and quantities of charcoal indicative of hearths. The wetland margin yielded artefacts, which indicate the presence of a toss-zone (see Louwe Kooijmans 2003). As argued earlier (section 5.4.4.3) this division, although reflective of a zonation in the use of the site, is to a significant extent shaped by (post-)depositional processes in relation to the gradient of the slope. Currently a similar tripartite division has not been documented as distinctly at other wetland sites. At least for the main domestic occupation phase (phase 1, *c.* 5500-5300 cal BC) the zoned use of the site indicates a structured and repeated use of domestic space at the same location according to the same principles. All this time it was the same location to which people returned and which they structured according to the same set of rules. Because of the increasingly limited availability of other suitable places in the surrounding area (see Mol 2001[a]) and the continued structured layout it is also likely that we are dealing with the same group of people. Based upon one of Schiffer's general rules (1995, 37), there is an inverse relationship between increased intensity of occupation and spatial correspondence between use and discard locations. While this does not preclude the factor of 'anticipated mobility' (see Kent 1992; Kent/Vierich 1989) it basically means that the level of spatial structuring at sites that are inhabited for more prolonged periods of time will be greater than that at sites that are not. The dune top sites of Hardinxveld in this respect differ distinctly in character from the sites on the southern coversand.

Additionally, increased investment in sites is also documented for the river valley sites; at Liège in the form of stone pavements or platforms and stone hearthbases, consisting of multiple layers; at Remouchamps perhaps in the form of a covered structure or hut. This may imply as well that these sites, because of their increased investment, potentially saw increased site structuring in relation to more extended stays.

Aquatic perspectives

An important reason for the different signature of the sites in the wetland group, in particular Hardinxveld, may be taphonomy in relation to site location choice. Naturally, a well-preserved site at a small location in the wetlands will leave a different archaeological signature than an extensive upland coversand site. From this it follows that many of the noted differences between the documented sites are gradual, rather than fundamental and relate to the specific local circumstances of preservation. Next to this, however, it is also evident that not all the landscapes in the regional groups defined here are comparable and that regions are characterized by different ecological and geomorphological circumstances, which provide different habitational windows. The differences that are noted with respect to the issues discussed above are most distinct in comparison to wetland locations and in particular the Hardinxveld sites. This may be explained by the fact that the wetland and wetland margin sites are situated in a landscape with a wide array of aquatic resources. These offer different opportunities and margins for occupation and mobility and, as indicated by a wide variety of anthropological and archaeological research (*e.g.* Ames 2002; Binford 1990; Coles/Coles 1989; Kelly 1995; Out 2009; Nicholas 2007[a,b]; Van der Noort/O'Sullivan 2006), allow for longer stays and a general decrease in mobility. Seasonal information at Polderweg for instance indicated that the site was used in phase 1 as a seasonal base camp during winter and that De Bruin might have functioned as a subsidiary site in various seasons (Louwe Kooijmans 2001[b]; 2003). To some extent the wetland and developing wetland landscapes of the Rhine-Meuse delta, the Scheldt valley and the IJssel-Vecht area are an inverse image of the upland coversand area.

Not including the special activity site at Jardinga, the sites in the river valley group, situated near Liège next to the Meuse or one of its tributaries, are also characterised by an aquatic setting, in this case a river or stream. At Liège limited faunal indications point to seasonality (see López Bayón 1994), indicating a human presence in late winter and/or early spring. The faunal and fish remains at this site as well as at Namur also form positive evidence for both the rich environment within which the sites were located and the fact that most of the available resources were indeed exploited. In this respect the river valley locations may also be interpreted as relatively rich and diverse settings, and comparable to some extent – with respect to their economical opportunities – to the wetlands and wetland margins.

5.4.6.4 Interpreting variability

The contrasts sketched above are based on a limited number of sites and only form a rough indication of the variability that must have been present within the Late Mesolithic. The main contrasts that stand out are found in the type of occupation that characterises the southern coversand landscape and wetland sites such as both Hardinxveld locations. From the perspective of mobility and settlement systems it was hypothesized that these differences potentially related to the different opportunities offered and constraints imposed by the wetland aquatic environment on the one hand and the upland coversand region on the other. This type of model also explains the differences in settlement structure and investment with long-term place-bound behaviour on the one hand and a search for consistent conditions and elaborate site complexes on the other. However, these sites or systems cannot be studied in isolation. They characterise the variability of Mesolithic occupation in different types of landscape, but should also be understood as parts of the settlement system of mobile communities and should therefore be further contextualised, both geographically as well as functionally. In order to create a better understanding of the different types of sites and settlement systems in general, it is important to gain insight into the range of activities that characterises them. In the following section the lithic toolkit of the documented sites will therefore be further analysed.

5.5 Lithic assemblage analysis

This section reviews the technological and typological aspects of the studied lithic assemblages, including raw material composition (Wommersom quartzite and other stone materials).

The composition of the lithic assemblages of the studied sites forms a complementary perspective on Late Mesolithic site use that is relatively less affected by different conditions of preservation in comparison to for instance features, site structure or organic remains. Of course other site-formative and excavation-related distortive factors do apply (see Chapter 4), which influences the comparability of some assemblages.

The aim of the analysis is to discern to what extent the lithic assemblage composition provides information on site use, mobility strategies and the settlement system. This involves the pinpointing of general characteristics of the sites and defined groups as well as differences among them. In combination with the other aspects of sites mentioned above, this may shed light on the diversity between Late Mesolithic sites and the presence or absence of larger-scale contrasts between regions.

5.5.1 Theoretical background

Lithic procurement, stone tool production and artefact use form part of the spectrum of activities performed at sites. The relative importance of these activities within and between different sites may highlight similarities and differences in site use or function. Since all sites to some extent are buried surface collections

(Binford 1987[b]), the composition of the lithic assemblages reflects site function only in part, but may be used to detect more coarse-grained patterns between (groups of) sites. This is based on the premise that certain aspects of stone tool technology and the composition of the lithic toolkit relate to activity spectrum, site use and mobility (*e.g.* Andrefsky 2005; Bamforth 1986; 1991; Binford 1983(1976); 1983(1979); Bleed 1986; Kelly 1992; Shott 1986; Torrence (ed.) 1989).[32] The aim is to see whether general characteristics may be defined.

5.5.1.1 Curated and expedient technologies and toolkits

Many factors influence community- or agency-based choices in technology and toolkit composition (Bamforth 1991, 217). These include aspects such as tradition, raw material distribution and risk minimization. Since not all of these can be accounted for, partly because of differences in recording (see below), it is necessary to base an analysis on more general 'robust' categories of assemblage types. One of these is the distinction between curated and expedient technologies.

Curated technologies, often characterized as 'efficient', are aimed at the production of formal tools and generally involve extensive maintenance, repair and reuse of material. They are often blade-based and require considerable investment in time and energy. This contrasts with expedient technologies, which are more geared towards an *ad hoc* production of technologically simpler and formally less distinct, often flake-based, tools. This type of technological system is generally more wasteful with respect to raw material (*e.g.* Andrefsky 2005; Bamforth 1986; Binford 1983(1976); 1983(1979); Torrence 1983).

Although characterized by (functional) overlap (*e.g.* Bamforth 1986, 39-40; Kelly 1992, 55-56), there is a general difference between curated and expedient technologies. It should be noted though that while a general distinction between flake and blade contributions to the studied assemblages is possible, this is not absolute as site assemblages almost always include both. Furthermore, flakes are always overrepresented since they form part of the initial stages of blade-based debitage. Another factor is the general absence of use-wear analysis for most sites studied, which limits the degree to which the purpose of unmodified flakes can be determined. This is also the case with blades, although their design in general includes intentionality. Finally, with respect to tools, it is difficult to establish a singular distinction between curated and expedient components. While tool design (see also Bleed 1986; Kuhn 1994) leading to formal tools may be seen as an aspect of curated technologies, not everything that does not classify as a retouched flake falls within this category. Curated and expedient technologies and toolkits with curated or expedient elements do not lend themselves to a black and white distinction. There will be overlap and combinations, yet an emphasis in blade technology and an increased contribution of more formal tools points to (more) curated behaviour. It is therefore the comparison of more general aspects of the lithic assemblage that points to differences between sites and groups. The main implications of these differences between technologies, involving anticipation with regard to future tasks and functional diversity in relation to these, will be discussed below.

Cores and core rejuvenation

An aspect of the distinction between curated and expedient technologies is formed by the contribution of cores. As cores have been interpreted (archaeologically and ethnographically) as regularly transported parts of 'personal gear' (Binford 1983(1979); see also Andrefsky 2005), their contribution and that of core rejuvenation flakes points to the relative importance of a mobile toolkit. Unfortunately, at many of the studied sites no distinction has been made in the types of cores present (blade or flake).

5.5.1.2 Assemblage composition

Another indication of site function and related behavioural aspects is the assemblage and toolkit composition. Observed differences and similarities between the typological composition of (groups of) sites relate to different typological choices. From a general perspective, certain shifts in emphasis between the typological spectra of sites relate to different emphases in performed activities, site function and the settlement system. It should be noted as well that tool morphology is not directly informative on tool function or performed activities. Scrapers, retouched blades and flakes and even points have been used for a variety of tasks. Use-wear analysis has only been performed for a limited number of sites and often only gives a general indication of contact material and motion of performance. This indicates that it is not possible to identify all activities performed, nor to characterize site function based on stone tool typology alone. Again the aim is to detect more general characteristics.

5.5.1.3 Aspects of mobility and site use

Both the technological distinction between curated and expedient industries and the assemblage composition provide information on the activity range performed at sites, site function and mobility. Subsequently it is of importance to relate and interpret these characteristics to ethnographical and behavioural models and theory.

With regard to expedient and curated technologies it is generally accepted that, also in relation to lithic source locations, the relative contribution of flakes and blades may be informative on (aspects of) mobility. Curated technologies and formal tools are often typical for groups with a high(er) level of residential mobility. Tools are often flexibly oriented, multifunctional and can be rejuvenated or redesigned. They are made in anticipation of and preparation for tasks ahead, when the risk of being unprepared is too high. Expedient technologies and informal or non-standardized tools are more typical for groups with a lower mobility and longer residential stays. Tools are used and discarded over a short period of time and are manufactured according to need. This often entails that there is little uncertainty with regard to the availability of lithic resources (see Andrefsky 2005, 226-227; Binford 1983(1979), 275-286; Kelly 1992, 55; Torrence 1983, 11-13).

Although it has been argued that the distinction between curated and expedient technologies is not absolute (Bamforth 1986, 49; Chatters 1987, 341), proportional differences may prove insightful.

Cores and transport costs

Additionally the contribution of cores may prove informative. As regularly transported parts of 'personal gear' (*cf. supra*), cores function as a mobile supply of raw material (Binford 1983(1979), 276-277; Kelly 1988, 719) from which flakes or blades can be struck according to need. Evidently, transport costs and portability form important factors (*e.g.* Shott 1986; Torrence 1983). Cores could also be used as hammers, anvils, cleavers or chopping tools (*ibid.*). Although influenced by factors such as raw material distribution (see Bamforth 1986, 48), it can be argued that cores functioned as important elements for flexibly facilitating mobility and various (unanticipated) tasks.

In contrast other studies in optimization modeling have demonstrated that it is also efficient to carry around small implements such as finished tools and blanks instead of cores (Kuhn 1994, 437). While combinations of both strategies appear likely, the choice to incorporate cores is related to increased flexibility in producing what is needed at a certain time, and, perhaps, the aforementioned bulk of a core.

Implications of assemblage composition

While the technological characteristics introduced above are mainly informative with respect to mobility, the typological composition of the assemblages studied may, in relation to this, provide a more detailed perspective on site function. This is based upon the correlation between assemblage diversity and site type (see Andrefsky 2005, 216-218). According to Kelly (1992; 1995) the degree, frequency and distance of residential mobility have important effects on the character and activities of groups of hunter-gatherers, as evidenced by ethnography. This in turn influences archaeologically measurable variables such as site structure and stone tool technology (*cf. supra*). Shott (1986), on the basis of ethnographically documented groups of hunter-gatherers, has correlated assemblage diversity and mobility. He discovered an inverse relationship between assemblage diversity and frequency as well as magnitude of mobility (see fig. 5.13).

Fig. 5.13 Generalized relationship between residential mobility and artefact diversity. Adapted from Shott (1986, fig. 2) and Andrefsky (2005, fig. 8.5).

The underlying idea is based on the notion that artefact diversity varies in different systems of mobility (see Andrefsky 2005, 218; Binford 1980, 17-19). The basic premise is the difference between a limited length of stay and therefore a limited spectrum of activities, as witnessed in short-term base camps or special activity sites, and more extended stays and a broader spectrum of activities as expected at longer term base camps (see Shott 1986). This difference is assumed to be reflected in the number of tool classes or artefact diversity at these locations.

When applying this modulation to the groups of Late Mesolithic sites selected here, it should be realized that almost all sites have at least some artefacts per designated class, since the assemblages are in fact, at least to a certain extent, time-averaged amalgamations of multiple and divergent visits to the same location. While this limits the degree of detail, the general emphases in the artefact spectrum represent functionally characteristic choices, especially where a distinction in more formal tools and tools of an *ad hoc* nature may be distinguished, or at sites where one or more tool classes are dominant. The absence of more specific spatio-temporal information with respect to the toolkit therefore does not have to stand in the way of analysis (see for example Bamforth 1991, 228).

5.5.2 Characteristics of the lithic datasets

The analyses are based upon the categorized counts of lithic artefacts in the available literature. These were subsequently scored for a number of typological, technological and raw material variables. They are presented in Appendix II for technology (IIA), typology (IIB) and raw material (IIF-H). Before analyzing the results a number of distortions should be taken into account. These relate to dealing with archaeological assemblages shaped by a variety of factors.

Limits of the dataset

First, not all of the typological and technological categories used in the original literature are similar and some categories are not recorded for all sites. This limits the available detail and necessitates the merging of categories (see also Appendix II for site-specific comments). Most general categories do prevail at all sites indicating that a general analysis and characterisation is possible. Other secondary factors include differences in excavation methodology (*e.g.* was surface material included, did sieving take place, what part of the site was excavated, etc.).

Other limitations derive from more primary factors, some of which have been discussed in Chapter 4. Of major importance are spatio-temporal considerations. Especially in the coversand landscape, sites lay exposed and were used for a considerable period of time. This means that in most cases excavations form a spatial selection of temporally diverse uses of the site. These may involve the main use of a location, but also more singular special activity events. Since assessing use time and intensity is often impossible only a 'blurred' generalized image of site use is attainable. Major factors are excavation methodology, site taphonomy and multi-period sites. Next to this, lithic information is restricted by the functional limits of typology in combination with the absence of use wear and the regular lack of an organic component.

Apart from these factors that impinge upon the nature and resolution of the data-set available, the general context (both physical and social) of past site use forms a factor as well. An example is formed by the ecological properties of the past environment surrounding sites (what activities were likely to occur), or the availability of (types of) raw material. Moreover, it should be taken into account that many aspects of the diversity in hunter-gatherer lifeways, as documented ethnographically (*e.g.* Kelly 1995), may be generalized, but often escape archaeological detection. Technological choices and typological composition in this respect are also (at least partly) influenced by factors such as group traditions and know-how, individual preference and anticipated tasks. This means that from an archaeological and behavioural perspective, the observed characteristics among the studied sites should be interpreted, not as absolute indicators of mobility and site function, but as general stresses in relation to these issues. Also it should be noted that the diversity documented may be rooted in a number of different, non-exclusive factors.

Sites, groups and emphases

The lithic assemblages studied are site-based datasets. These are shaped by the factors mentioned above and are interpreted as generalized images of past site use. The aim in this section however, is to detect regional characteristics for the groups defined above. Therefore intra-group similarities or differences are regarded as indicative of the homogeneity of (generalized) site use in a certain area. Several aspects should be defined.

- In line with the analyses above, the southern coversand group is relatively large and forms a representative sample of site use in that region, while site numbers for the other defined groups are limited. This means that a comparative analysis centres on similarities and differences with respect to the southern coversand group.
- While the assemblage characteristics may be influenced by a number of factors (see above and Appendix II), it is apparent that sites with a special character or with too limited artefact numbers overall should be excluded, because they introduce a bias to the general perspective. Two sites fall into this category beforehand. The first is Jardinga-Johannahoeve in the river valley sites group. This site (see Appendix I; Prummel *et al.* 2002; Prummel/Niekus 2002/2003) may be categorized as a special activity butchery site (of aurochs) on the banks of the Tjonger stream. Its lithic assemblage is limited in counts and range, which confirms its specialized nature, but makes it inappropriate for comparison. The second excluded site is Swifterbant-S83 (see Appendix I; Jordanov 2005). The assemblage derives from two small test trenches and is partly of a Middle Mesolithic date. Furthermore the tool spectrum is (numerically) too small.
- In the analyses presented below sites with a dataset that is quantitatively too limited for the category under analysis will be excluded from consideration. Since this may differ per category and comparison, these exclusions will be mentioned in the text.
- In dealing with the variables discussed below it should be taken into account that while the aim is to detect (regional) characteristics in site use and mobility (*cf. supra*), there may be a range of alternative explanations, not all of which will have materialized archeologically.

5.5.3 Technological characteristics

Below a number of technological characteristics of the studied lithic assemblages will be discussed. As argued above differences in recording limit the degree to which all aspects of sites may be compared. With respect to technology the distinction between blade and flake cores was only recorded at eight sites. Also, often it is not specified whether cores are exhausted or fragmented, if truncated blades are present, or what the character of core rejuvenation products is. For the same reason counts of fragments, chips or debris have been left out of the analysis since these are heavily dependent on excavation procedure and personal attribution. The remaining categories are formed by cores, core rejuvenation products, blades, flakes, microburins, burin spalls and tools. These are presented in fig. 5.14.

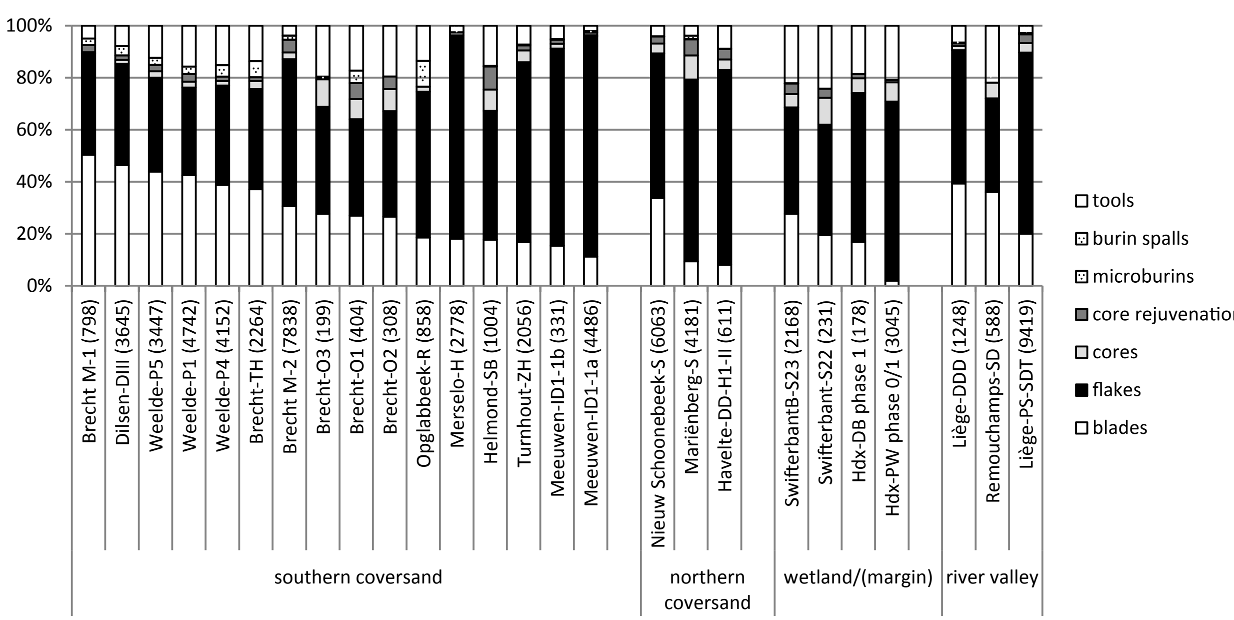
In total 26 sites yielded information on the technological composition of the assemblage, with an emphasis on the southern coversand landscape group.[33] The relatively large contribution of tools for Brecht-Overbroek and Helmond-Stiphoutsbroek may result from the incorporation of surface finds. The overall composition is however not affected.

In fig. 5.15 the results are combined per group. While numerically only the southern group is well represented some of the contrasts are interesting and reflect the distribution in fig. 5.14. Apart from the relatively large tool component at wetland sites, which will be discussed further on, the most apparent technological characteristic is the difference in the contribution of flakes and blades. The contribution of cores and core rejuvenation flakes also deserves mention.

5.5.3.1 Blades and flakes

As argued above blade- and flake-based industries offer a perspective on the type of technological system practised and its potential implications. Fig. 5.16 presents the contribution of flakes and blades per site.[34] Sites on the southern coversand are characterised by a considerable contribution of blades, while this is less so for sites on the northern coversand or in the wetland group. This is

Fig. 5.14 Percentages for technological categories per site. Total counts in brackets. See also Appendix IIA.



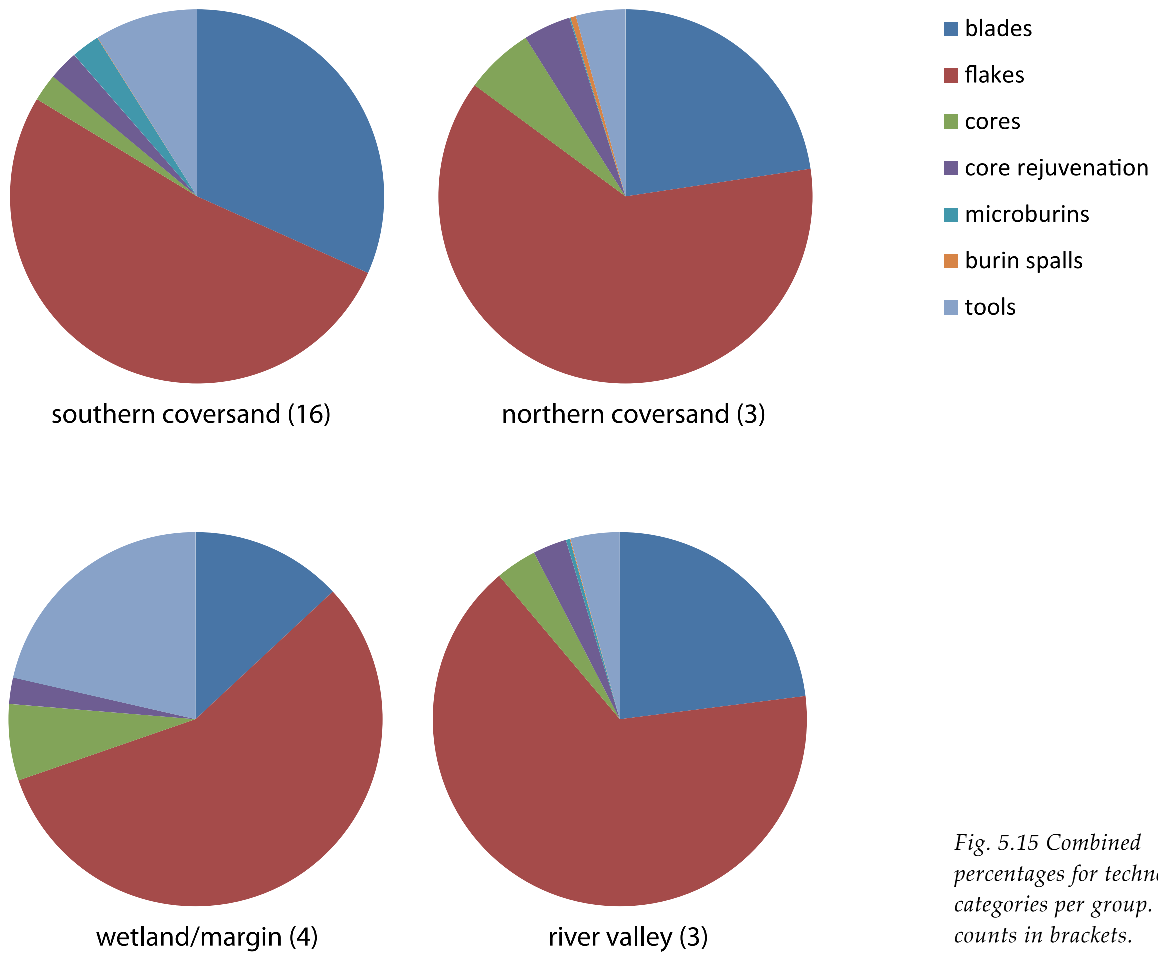


Fig. 5.15 Combined percentages for technological categories per group. Total site counts in brackets.

the case both at sites with completely excavated assemblages as well as locations (Brecht-Overbroek I and II and Helmond Stiphoutsbroek) where (part of) the assemblage is surface-related. The group of river valley sites also demonstrates a considerable contribution of blades. Within the group of wetland sites there is a distinct difference between both Hardinxveld sites where the contribution of blades, in particular at Polderweg, is limited and Swifterbant-S22 and S23 where the composition is more balanced.

When the scores of the individual sites are combined into group scores, regional differences become even more apparent (see fig. 5.17). Evidence for the relative importance of blade production on the southern coversand is evident. The contribution of blades at the river valley sites might, if the Ardennes sites are exemplary for the Meuse valley, perhaps reflect a system in close contact with sites similar to those on the southern coversand. For the wetland group it is clear that both Hardinxveld sites are characterised by a flake-based industry, which clearly contrasts with sites in the other groups, while blades play a more important role at Swifterbant-S22 and S23.

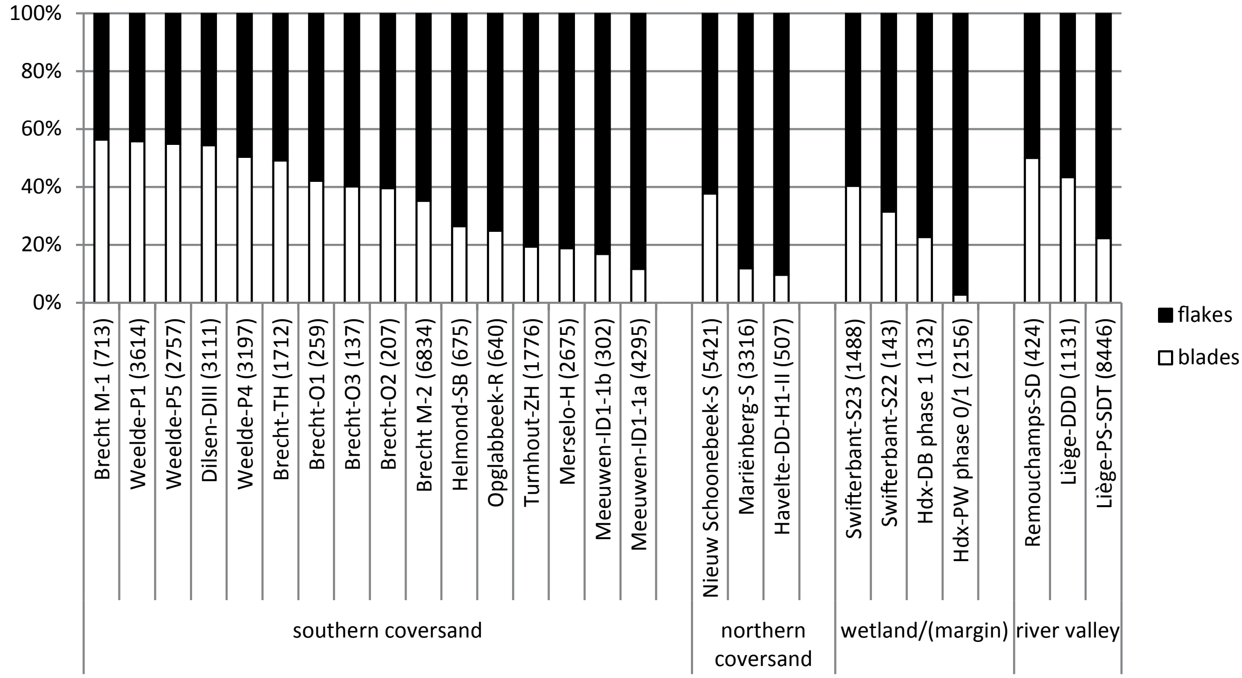


Fig. 5.16 Percentages for blades and flakes per site. Counts in brackets.

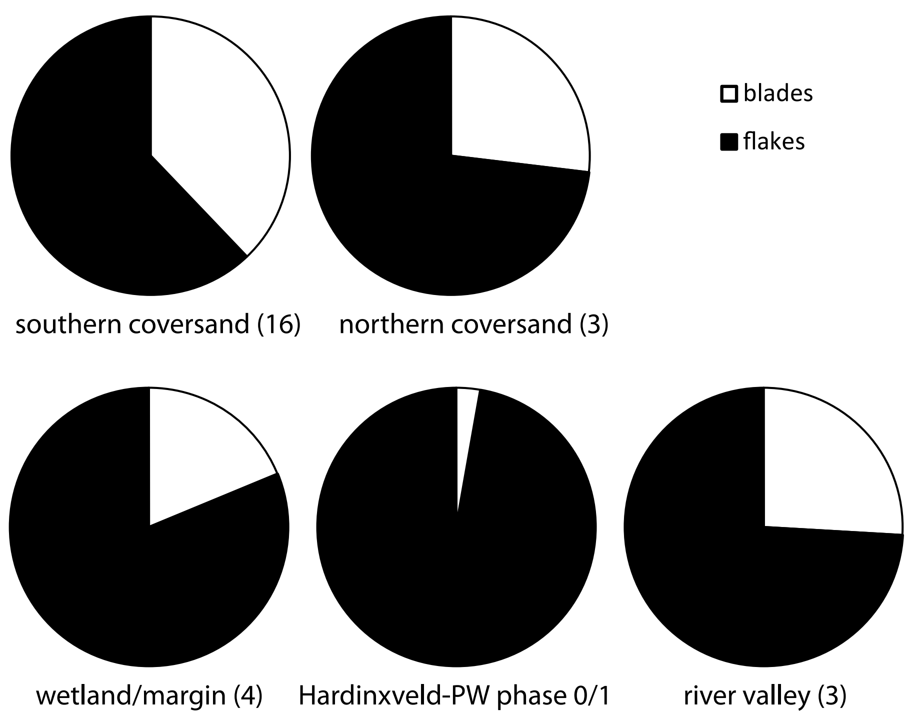


Fig. 5.17 Combined percentages for flakes and blades per group. Number of sites in brackets.

The available information on core type confirms the importance of blade production on the southern coversand (see fig. 5.18). This contrasts most distinctly with the wetland Hardinxveld sites.[35] The wetland margin locations of Swifterbant also stand out and quite oppositely indicate that blade cores were also of importance there, although this is somewhat qualified when compared to the contribution of flakes and blades (see fig. 5.16).

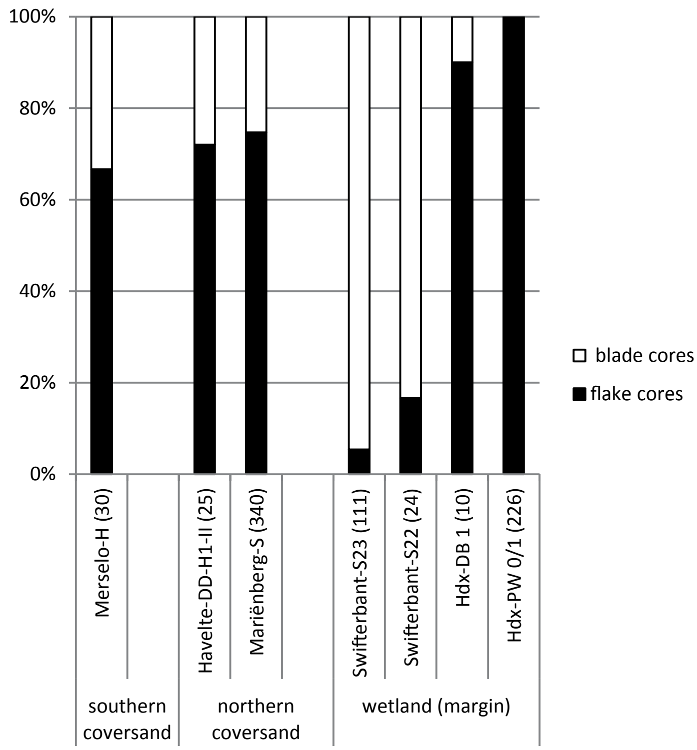


Fig. 5.18 Relative composition of flake and blade cores for informative sites. Number of cores in brackets.

Table 5.12 Mean number of cores per group in relation to excavated area. (Based on assemblage counts excluding chips and debris and including tools.)

	N sites	area excavated m²	N cores/rejuvenation flakes	mean contribution cores to assemblage
southern coversand	16	7278	932/1007	2.37
northern coversand	3	5440	643/443	5.95
wetland/(margin)	4	3139	371/127	6.60
river valley	3	478	401/329	3.56

5.5.3.2 Cores and core rejuvenation flakes

In relation to the flake and blade emphases in the assemblages described above it is informative to put the occurrence of cores into perspective as well. These are presented in fig. 5.19. What is most apparent is the relatively low number of cores for a number of sites on the southern coversand. Only in two cases do they exceed 100 in number.

This particular perspective regarding sites on the southern coversand becomes even more apparent when the mean number of cores per group is combined with the overall area excavated.

It appears that especially for the southern coversand area in view of the area excavated the overall number of cores is low for the group and the individual sites. This may be emphasized by the fact that excavation at sites on the southern coversand was often aimed at artefact clusters, hypothetically increasing the expected number of cores. This is confirmed by their lower contribution to the assemblage. The river valley group is most comparable to this situation.

Combining the information from cores and core rejuvenation flakes it appears that the latter only match and exceed the contribution of cores for a group of sites on the southern coversand (see fig. 5.20). This supports the general characteristic described above regarding the more limited importance of cores at sites on the southern coversand.

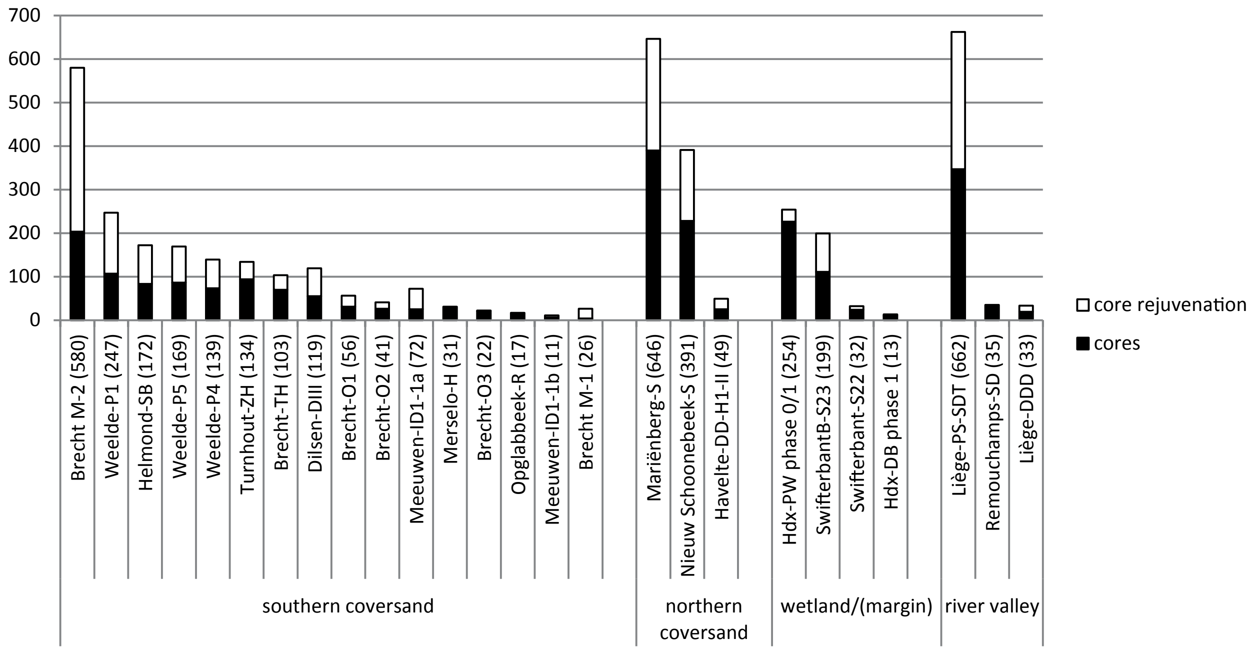


Fig. 5.19 Counts for cores and core rejuvenation flakes per site and group. See also Appendix IIA.

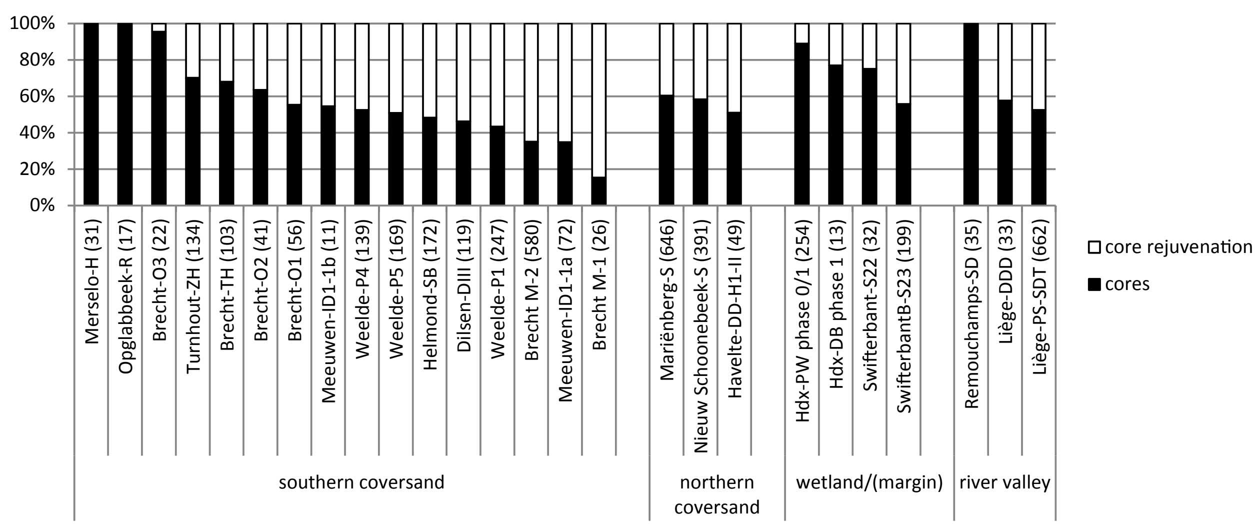


Fig. 5.20 Percentages of cores and core rejuvenation flakes per site. Number of artefacts in brackets.

5.5.3.3 Technological characteristics and potential implications

The characteristics recorded for debitage technique and cores described above form indicators for specific types of technological behaviour, connected to aspects of mobility and the settlement system. As argued above emphases in flake- or blade-based industries may reflect the type of mobility system in use in relation to the tasks employed, although certain intrinsic limitations should be taken into account (*cf. supra*). With respect to the sites studied here, those on the southern coversand are characterised by a more important contribution of blades overall.

In particular the Hardinxveld sites contrast with this with a mainly flake-based industry. Blades are hardly of importance there and the bipolar core technology was mainly geared towards producing workable edges on flakes (see Van Gijn *et al.* 2001[a], 133, 159; see also Andrefsky 2005, 241). This would argue for a higher degree of mobility for sites in the first group in comparison to distinct wetland locations as Hardinxveld with a lower residential mobility.

Blades are often used for the production of a variety of formal tools such as trapezes and Montbani blades. It is important to note that the contribution perspective here is based on five sites where blades are more important than flakes and four additional sites that demonstrated small differences. Further, intermediate evidence is provided by the importance of blade cores for sites in the southern coversand landscape and the contribution of microburins to the overall assemblage (see fig. 5.15). Flakes are evidently more important at most other sites, but unfortunately site numbers apart from those in the southern coversand group are too low to argue for more distinct regional characteristics. Microburins are typical waste products of the blade-based fabrication of trapezes. As argued above, the river valley sites are somewhat comparable in composition to the sites on the southern coversand.

When the contribution of cores and core rejuvenation flakes is included, the lower contribution of cores at sites on the southern coversand appears to be significant. This would potentially be in line with a higher mobility if it is argued that cores are part of the mobile toolkit (*cf. supra*) and were therefore regularly transported away from site to site and discarded upon exhaustion on the way to or at another site. The ratio between cores and rejuvenation flakes potentially supports this. The larger contribution of the latter to sites in the southern coversand landscape may indicate a higher level of core exhaustion and transport of cores at these locations. Especially the wetland site of Polderweg yields opposite, contrasting evidence. Cores were regularly discarded there while rejuvenation seems to have been less important, which also supports an expedient character.

Alternatively it should be realized that the number of cores and the ratio between cores and rejuvenation flakes may be influenced by a number of other primary factors, such as the size and quality of the raw material (mostly rolled nodules, terrace flint or flint from moraine deposits) and the influence of testing upon procurement, specific tasks and tradition. As such it may only form an indication of secondary importance.

From a technological perspective there are thus several identifiable differences. The main contrast exists between the group of sites on the southern coversand and wetland sites, especially the site of Polderweg. The former group is characterised by relatively low numbers of cores, a considerable contribution of blades to the assemblage and evidence for a curated technology, while Polderweg can be characterised as the opposite end of the spectrum with a high contribution of cores (*c.* 7% of the assemblage), a dominance of flakes and an overall expedient technology. The other sites are more difficult to characterise and can be placed on a continuum between these two, indicating a certain degree of variability, mainly of sites on the northern coversand and in the wetland group. The distinction in technology can be regarded as indicative for different patterns of mobility, suggesting an overall higher level of residential mobility at sites on the southern coversand. This contrasts most distinctly with the results obtained for Polderweg and a comparison should be understood against the specialist wetland background of the latter site.[36]

5.5.4 Typological characteristics

The typological characteristics of the artefact spectrum provide insight into the range of activities performed at a site and the emphases therein within and between regions. This is also informative as to aspects of mobility and the settlement system. In this respect, tool morphology is not directly informative on tool function or performed activity as argued above (scrapers, retouched blades and flakes and even points have been used for a variety of tasks and use-wear analysis has only been performed for a limited number of site assemblages. This limits the identification of activities and the functional characterization of a site. On a more general level differences and similarities observed between the typological composition of assemblages of (groups of) sites may point to different typological choices and preferences. Such shifts in accent detected within the typological spectrum may indicate different emphases in activities performed, and offer a perspective on the (regional) nature of the settlement system in general.

An overview of the typological characteristics of the different groups of sites is presented in fig. 5.21 (A-D), see also Appendix IIB. Sites with an overall small sample size (less than 25 tools), overall low numbers of artefacts (less than 400 artefacts), or difficulties in attribution have been excluded from further analysis to avoid biases caused by site-specific research intensity.[37]

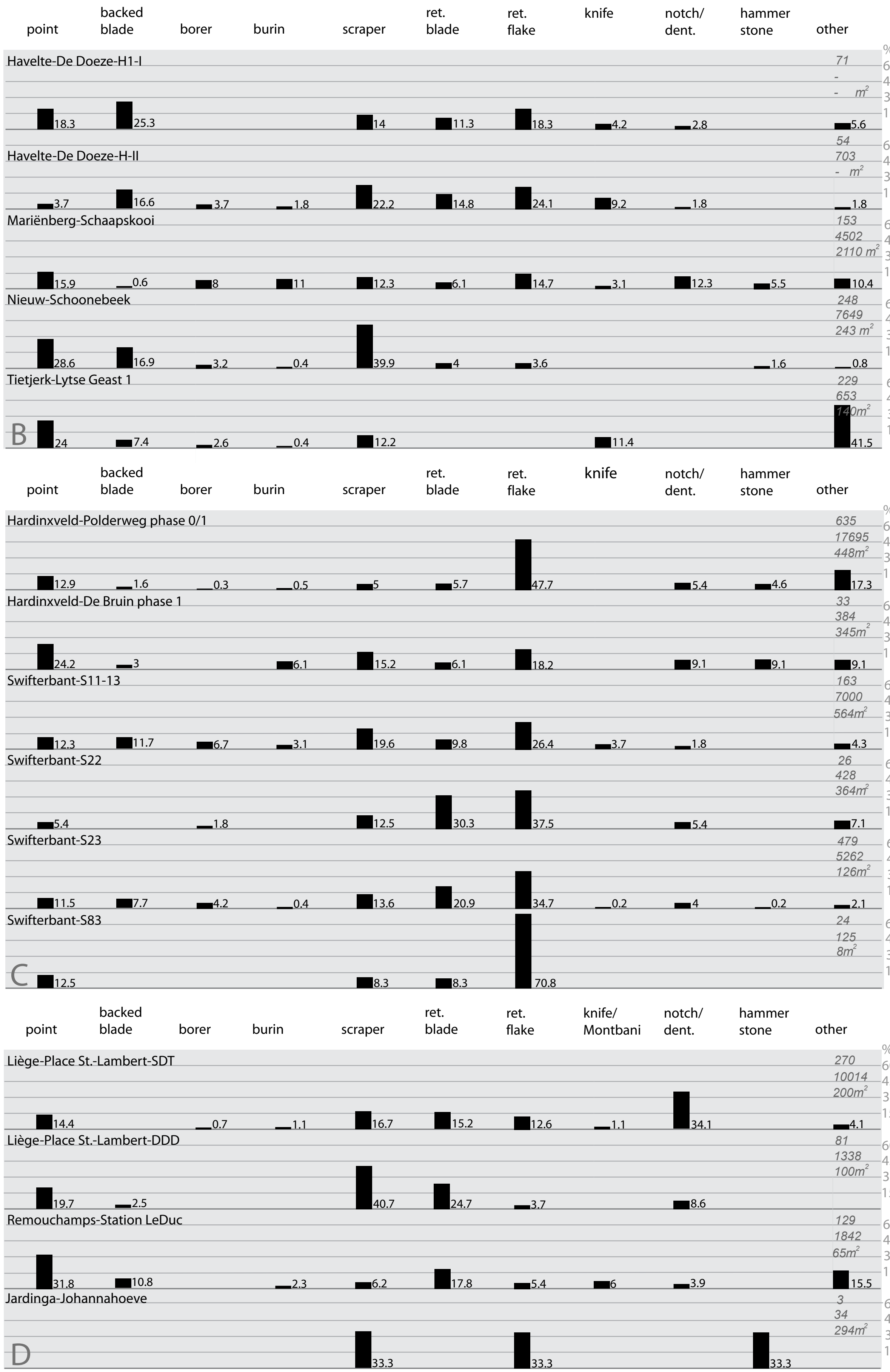
The typological characteristics and their composition per site for the most important artefact categories have been presented in fig. 5.22.

The composition of the most important artefact categories gives a first impression of the characteristics of the different sites individually and per region. For the southern coversand landscape the overall importance of points (*c.* 40%) is striking. For the northern coversand and river valley sites points are also of importance, yet some display a less significant contribution in favour of other tools. Only in the wetland (margin) group do points play a significantly smaller role. Another feature is the importance of retouched blades, both in the assemblages of the southern coversand group and those of the river valley sites, as well as at the wetland margin sites Swifterbant-S22 and S23.

Combining the evidence from the different sites per defined region or group enables the elucidation of group percentages. It should be taken into account though that the combined evidence only has a broad base for the southern coversand group. These results are presented in fig. 5.23.

The group compositions reflect some of the characteristics mentioned above. Apparent is the importance of points in the southern coversand group and to a somewhat lesser extent the northern coversand group and river valley group. The composition of both of these latter groups, however, is characterised by more diversity regarding other types of tools, while the overall composition of the river valley group somewhat resembles that of the southern coversand sites. The wetland (margin) groups deviates most from this with an emphasis on non-formal tools and a smaller role for points. In the following, several typological elements will be discussed in more detail.

Fig. 5.21 Typological percentages per site arranged according to the groups defined, respectively southern coversand landscape (A), northern coversand landscape (B), wetland/wetland margin (C) and river valley/ valley floor (D). Outlined on the right are number of tools, total number of artefacts and area excavated.


point
backed blade
borer
burin
scraper
ret. blade
ret. flake
knife
notch/ dent.
hammer stone
other
%
60
45
30
15
Havelte-De Doeze-H1-I
18.3
25.3
14
11.3
18.3
4.2
2.8
5.6
71
-
- m²
Havelte-De Doeze-H-II
3.7
16.6
3.7
1.8
22.2
14.8
24.1
9.2
1.8
1.8
54
703
- m²
Mariënberg-Schaapskooi
15.9
0.6
8
11
12.3
6.1
14.7
3.1
12.3
5.5
10.4
153
4502
2110 m²
Nieuw-Schoonebeek
28.6
16.9
3.2
0.4
39.9
4
3.6
1.6
0.8
248
7649
243 m²
Tietjerk-Lytse Geast 1
24
7.4
2.6
0.4
12.2
11.4
41.5
229
653
140m²
B
Hardinxveld-Polderweg phase 0/1
12.9
1.6
0.3
0.5
5
5.7
47.7
5.4
4.6
17.3
635
17695
448m²
Hardinxveld-De Bruin phase 1
24.2
3
6.1
15.2
6.1
18.2
9.1
9.1
9.1
33
384
345m²
Swifterbant-S11-13
12.3
11.7
6.7
3.1
19.6
9.8
26.4
3.7
1.8
4.3
163
7000
564m²
Swifterbant-S22
5.4
1.8
12.5
30.3
37.5
5.4
7.1
26
428
364m²
Swifterbant-S23
11.5
7.7
4.2
0.4
13.6
20.9
34.7
0.2
4
0.2
2.1
479
5262
126m²
Swifterbant-S83
12.5
8.3
8.3
70.8
24
125
8m²
C
knife/ Montbani
Liège-Place St.-Lambert-SDT
14.4
0.7
1.1
16.7
15.2
12.6
1.1
34.1
4.1
270
10014
200m²
Liège-Place St.-Lambert-DDD
19.7
2.5
40.7
24.7
3.7
8.6
81
1338
100m²
Remouchamps-Station LeDuc
31.8
10.8
2.3
6.2
17.8
5.4
6
3.9
15.5
129
1842
65m²
Jardinga-Johannahoeve
33.3
33.3
33.3
3
34
294m²
D

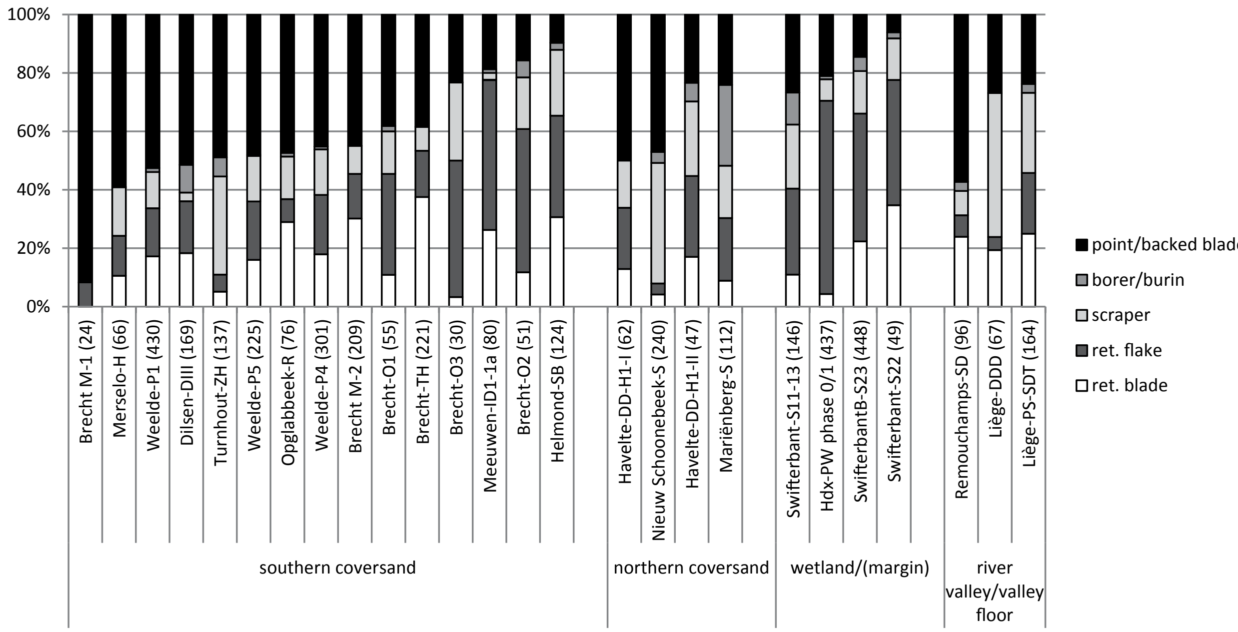


Fig. 5.22 Typological percentage composition per site for the major categories of tool types.

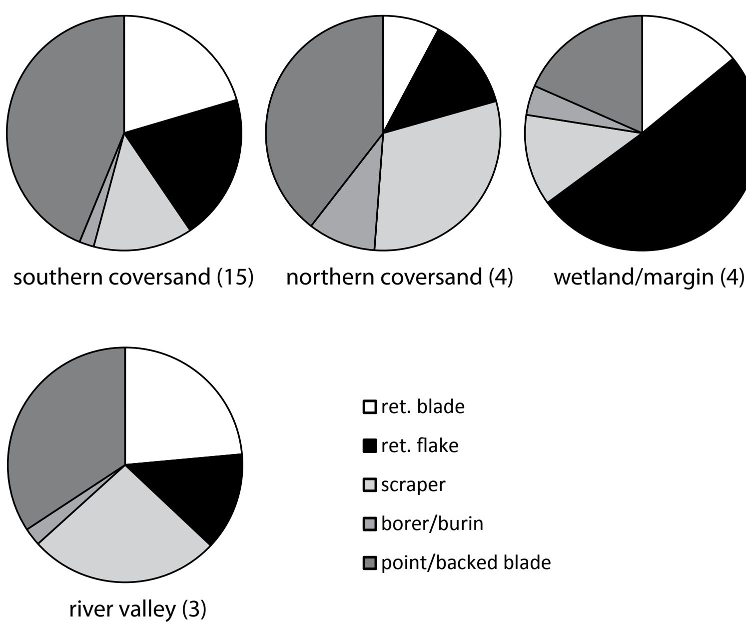


Fig. 5.23 Typological percentage composition per group for the major categories of tool types.

5.5.4.1 Points and backed blades

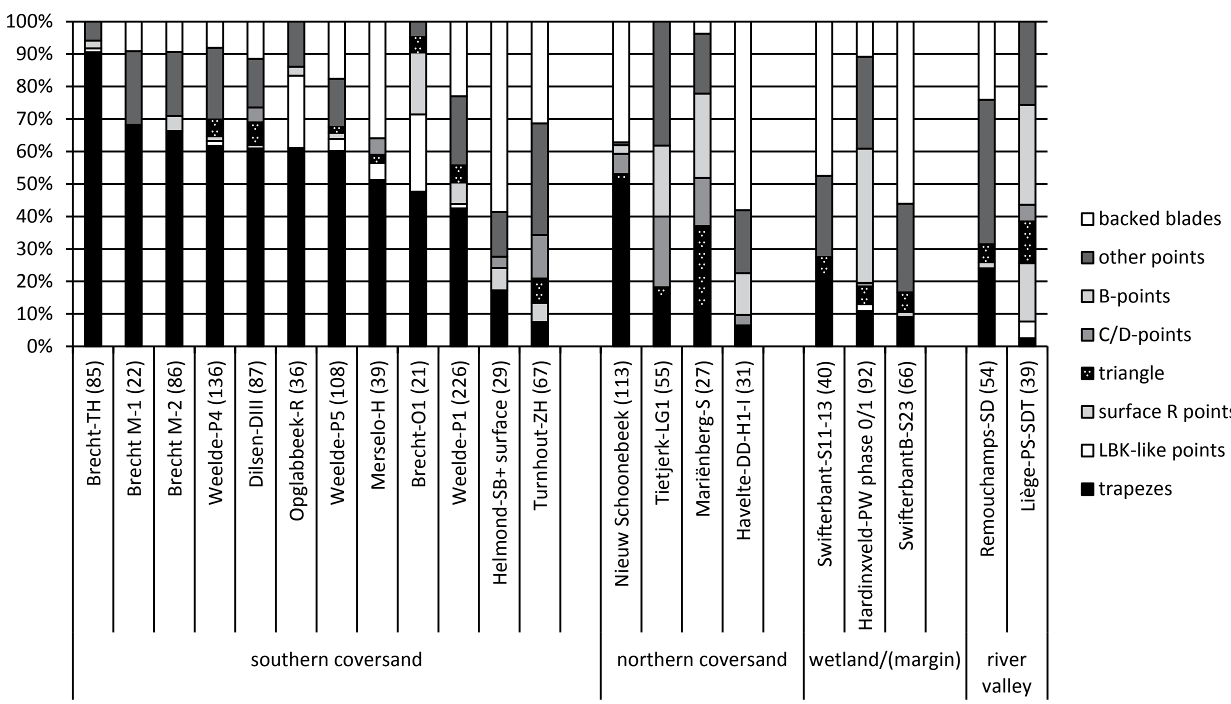
Points most likely represent curation (retooling) and discard of arrows and arrowheads. Therefore sites with many points are often interpreted as (temporary) hunting camps. While this terminology is too restrictive for the range of activities performed, the presence of many points stresses the importance of hunting (see Binford 1987[b]; 1980, 8-12; Boaz 1998, 308).

A first observation concerns the importance of points at sites in the southern and the northern coversand landscape and at the river valley sites, as mentioned above (see fig. 5.22 and 5.23; see also Appendix IIB). This differs from the relative paucity in points at sites in the wetlands and wetland margin group. The counts for the northern coversand landscape are somewhat influenced by the high number of points and backed blades at Nieuw Schoonebeek. Since backed blades are probably parts of composite tools, this may skew the perspective. In any case the divergent contribution at the wetland sites and in particular at Hardinxveld-Polderweg is significant. In line with its distinct wetland location this may, for example, point to a greater importance of fishing as opposed to terrestrial hunting (see also the contribution of points at Liège in fig. 5.21).

Further information may be obtained from point type diversity, which is presented in fig. 5.24 (see also Appendix IIC). Of the sites with quantitative typological information mentioned above, those with point counts below twenty have been excluded. It should be noted once more that certain point types remained in use for a long time, but all may in fact be part of Late Mesolithic assemblages (*cf. supra*; Arts 1989, fig 8; Crombé 1998).

Trapezes and trapeze production are most common at sites on the southern coversand. The contrasts between the groups may be explained from a regional perspective, identifying the dominance of trapeze production as a characteristic southern feature. Alternatively, but less likely, it may be related to specific functional properties making them especially useful for hunting in the (southern) coversand landscape (see also Fischer 1989). LBK-like points are clearly a southern feature as are points with surface retouch such as *feuilles de gui* (see Verhart/Arts 2005, 249). Triangles, points with retouched bases and D-points signal continuity, especially in the north (*ibid.*). The importance of points with unretouched base (B-points) at Hardinxveld-Polderweg is remarkable. Since the site is firmly dated to the later part of the Late Mesolithic and is situated in a central to southern

Fig. 5.24 Percentages for point types per site. Total counts for points in brackets.



site/group	N points and backed blades	N tools	percentage
southern coversand (15)	963	3482	27.7
northern coversand (4)	182	526	34.6
wetland/(margin) (4)	199	1303	15.3
Hardinxveld-PW-phase 0/1 (1)	92	635	14.5
river valley/valley floor (3)	112	480	23.3

Table 5.13 Percentages for tools and backed blades for the different groups and Hardinxveld-Polderweg. Number of sites in brackets.

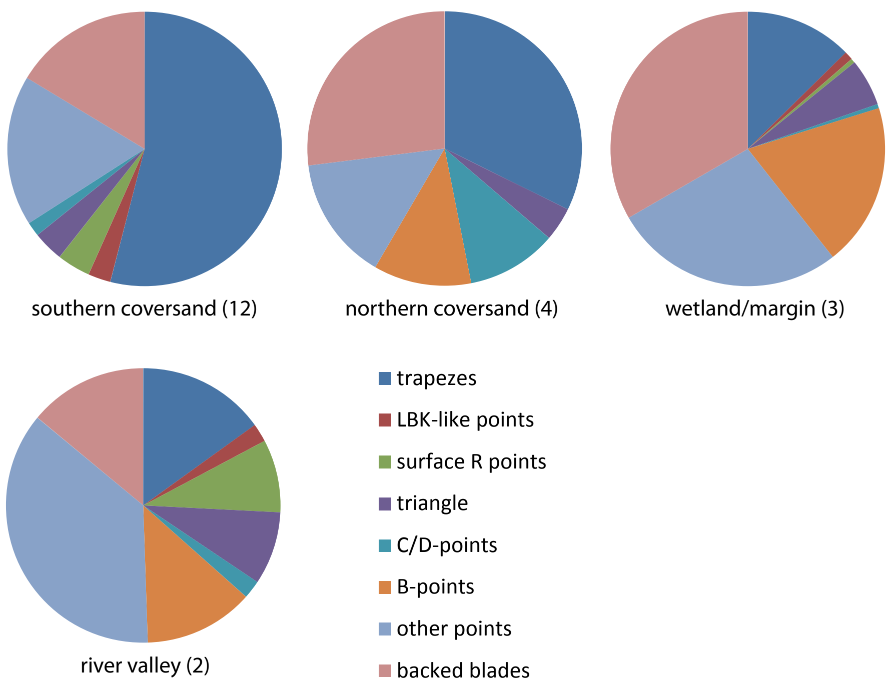


Fig. 5.25 Group percentage composition for point types. Number of sites in brackets.

location within the LRA, one would have expected a predominance of trapezes. Instead the B-points indicate a distinctly different accent which may point to different functional requirements. This might either be a functional adjustment to specific wetland conditions or be related to the quality of the material and the expedient technology characteristics for the Polderweg assemblage. Without both Hardinxveld sites, values for this point type at wetland sites would concur with the other groups. Finally, backed blades seem of more importance in the north and at river dune sites, especially at Swifterbant.

If the counts are combined per group (see fig. 5.25), the compositions once more accentuate the dominance of trapezes at sites on the southern coversand, the greater diversity elsewhere and the importance of B-points and backed blades for the group of wetland sites.

5.5.4.2 Other tools

Of the other artefacts (see figs. 5.21 and 5.22), scrapers show some variability in their contribution. Since these artefacts are easily recognized, it is likely that differences point to different emphases in the activity spectrum and are not research biased. These tools are used for a wide variety of tasks (Andrefksy 2005; Odell

1981), hence a broader spectrum of activities at sites in the northern coversand and river valley group (in particular at Liège) may be proposed, although the small number of sites involved limit such a conclusion. The low numbers recorded for Polderweg may be attributed to the effects of a largely expedient technology where retouched flakes may have replaced scrapers for certain activities (see Van Gijn *et al.* 2001[a], table 6.14).

Borers and burins form a minor contribution to most sites. They may be indicative of a broader emphasis in task spectrum at sites in the wetlands and wetland margin or on the northern coversand when compared to sites in the southern coversand landscape. Especially the contribution of burins at Mariënberg is striking. Although difficult to compare, Bergumermeer-S64B yielded similar high counts. The low numbers for Polderweg might again relate to the effects of an expedient technology.

Montbani blades (see Robinson 2010, 141) are mainly found on the southern coversand and have been compared and combined with the group of knives, mainly found on the northern coversand and on the northern river dunes in the wetland group.[38] The Montbani blade is characteristic for the southern coversand landscape and in combination with points forms an important, formal contribution to the artefact spectrum. Notched and denticulated artefacts appear of more importance at river valley sites, especially at Liège.

At some sites the 'other tools' category is relatively large (see fig. 5.18). The majority of these at for instance Weelde, Liège or Remouchamps is formed by indeterminable microliths and artefacts that may either be waste or tools, such as, for instance, truncated blades (see Huyge/Vermeersch 1982, 167; Van Gijn 1989, table 22 and 23). Other lithic artefacts were incorporated as well.[39]

5.5.4.3 Retouched flakes and blades

Another typological component of the lithic assemblages of the sites studied is formed by retouched flakes and blades. They are presented in fig. 5.26.[40] Sites with counts below 10 have been excluded.

The distribution between retouched flakes and blades per site in general resembles the distribution between flakes and blades as demonstrated in fig. 5.16. This indicates that a representative part of the respective flake- and blade-based debitage techniques distinguished for the individual sites and groups results in non-formal tools. Especially the increased contribution of retouched blades (in comparison to unmodified blades) indicates that a considerable part of the unmodified blades may perhaps be interpreted as blanks. This supports the distinction made earlier between more curated industries, as distinguished most convincingly for the southern coversand area and river valley sites, versus a more balanced spectrum for sites in the other groups. The importance of curated elements within the technological and typological aspects of sites in the southern coversand landscape is further substantiated by the contribution of Montbani blades.

Noteworthy is the importance of retouched blades at river valley sites, which is consistent at all three locations. The similarities in composition compared to sites on the southern coversand potentially supports the idea of correlating these types of sites (typologically and technologically) in a complementary settlement system (*cf. supra*).

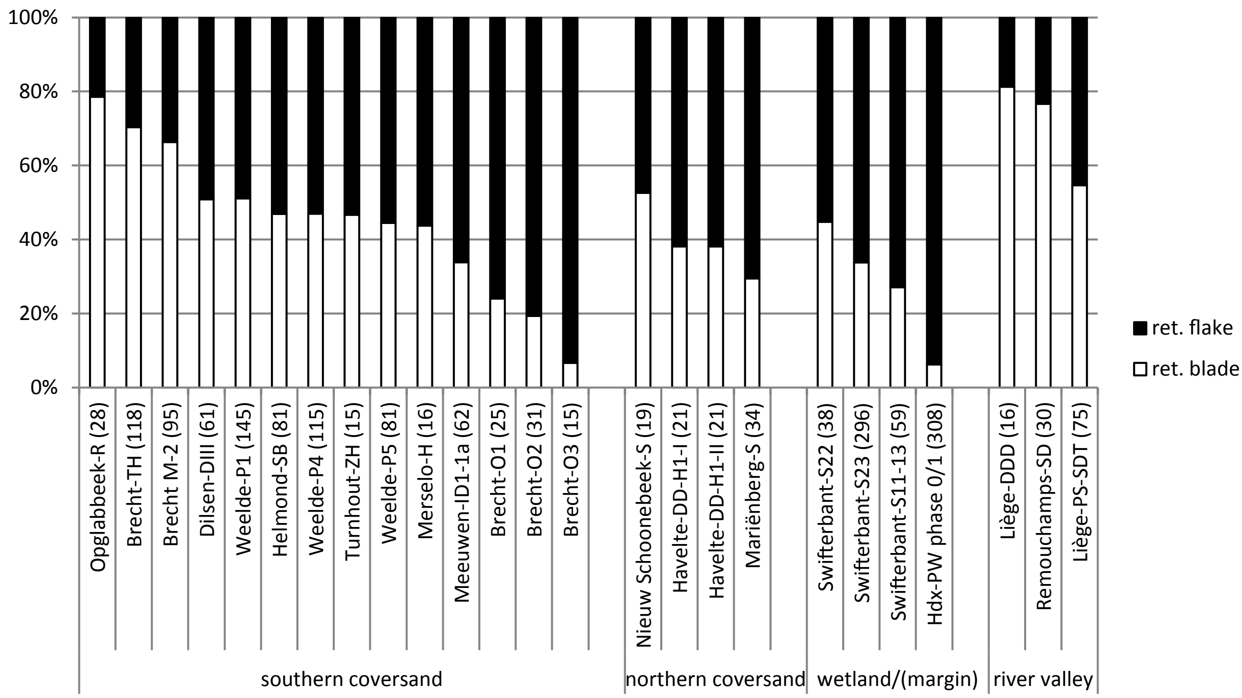


Fig. 5.26 Percentages for retouched flakes and blades per site. Total counts in brackets.

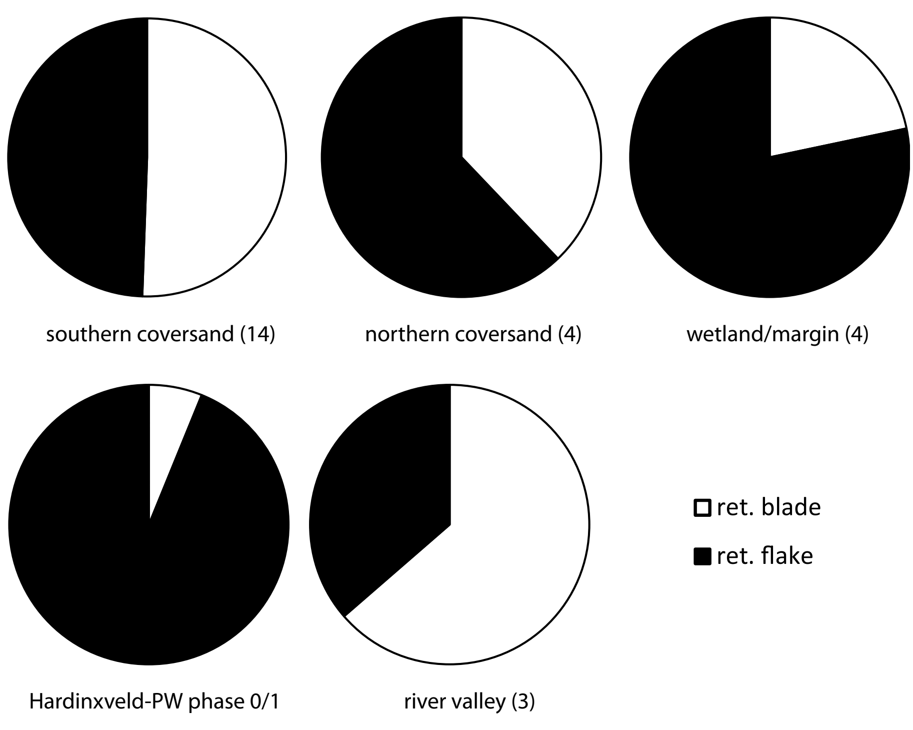


Fig. 5.27 Group percentages for retouched flakes and blades. Number of sites in brackets.

The contribution of retouched flakes is largest for the wetland site of Hardinxveld-Polderweg. The nearby site of De Bruin only yielded six retouched flakes and two retouched blades, yet despite its low numbers seems to confirm this composition.

When the results from the individual sites are combined per group (fig. 5.27), the general distribution mirrors that of flakes versus blades (see fig. 5.17). The most distinct feature remains the contrasting importance of retouched blades for the southern coversand group in comparison to wetland sites, in particular Hardinxveld-Polderweg. The distinctive position of Swifterbant-S22 should be noted in this, however.

5.5.4.4 Percentage distribution and box plot analysis

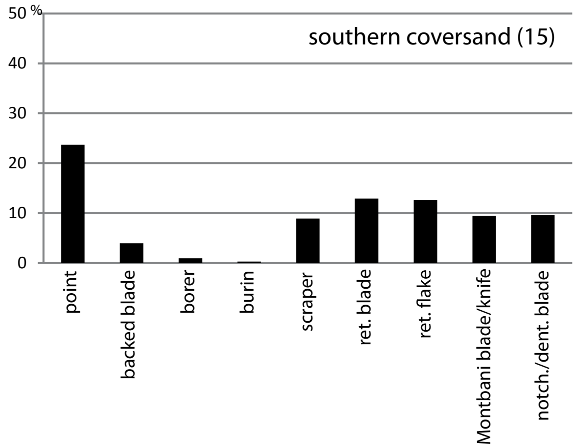
Based on a number of the analyses presented above, the percentage counts may be grouped (see fig. 5.28). Hardinxveld-Giessendam-Polderweg has been plotted both as an individual site as well as within the group of wetlands or wetland margin sites. Exclusion of Polderweg from this group did not seriously alter the composition. Due to the low number of sites in three of the four groups, the statistical significance of the distributions with respect to each other was tested as well (see Appendix IID).

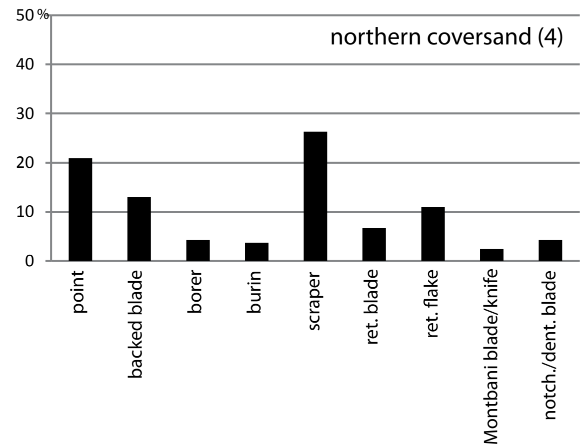
The compositions point out some of the characteristics mentioned above. This involves the similarities between the southern coversand and river valley group (regarding points, Montbani blades and retouched blades). The 'typological investment' within the southern coversand group in points indicates production and therewith terrestrial hunting. This differs from somewhat more diverse spectrum of sites on the northern coversand and the more limited importance of points and dominance of retouched flakes at the wetland (margin) sites, Hardinxveld-Polderweg in particular.

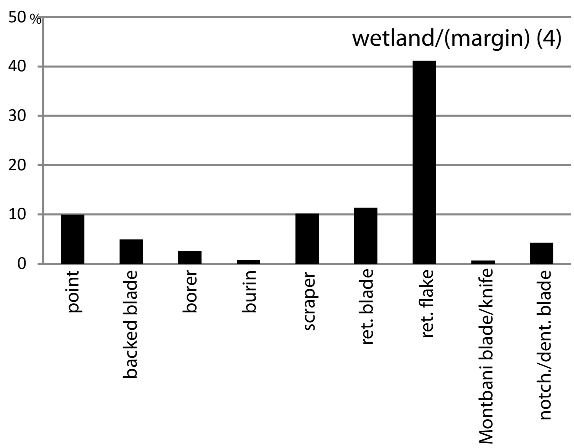
In order to understand these different emphases in the typological composition of the assemblages from a functional perspective, a set of boxplot analyses based on the percentage distribution is introduced (fig. 5.29). The boxplot graphs present both the individual tool types as well as functional categories. Points and backed blades have been grouped within a hypothetical 'hunting toolkit'.[41] Similarly, tools related to processing and production tasks, including borers, burins, scrapers and notched or denticulated artefacts have been grouped under 'processing toolkit'. Retouched flakes and blades make up a general third group, while the formal Montbani blades and knives form the last group.

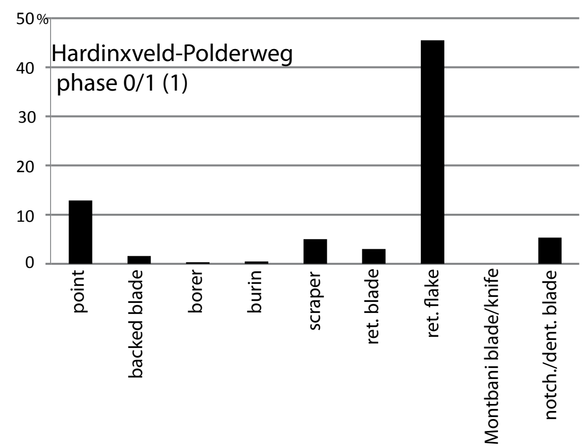
Points are relatively important at sites on the southern coversand. More than half of the sites yielded values of *c.* 25% or more. Backed blades are less common. On the northern coversand these are often of high importance, although the distribution is strongly influenced by the sites of Havelte (25%) and Nieuw Schoonebeek (17%). Points are also of relative importance at sites in the river valley group. In the combined graph for the 'hunting toolkit' the distribution of points and backed blades and their median for the group of southern and northern coversand sites stand out, especially with respect to the wetland group.[42]

If points form the strongest indication for hunting activities then a 'hunting toolkit' seems to have been of distinct importance for sites in the southern coversand landscape, especially when combined with the group percentages (fig. 5.28) and offset against the quantitatively broad dataset. The importance of backed blades should be noted as a potentially important feature of sites in the northern coversand landscape, in relation to hunting activities.









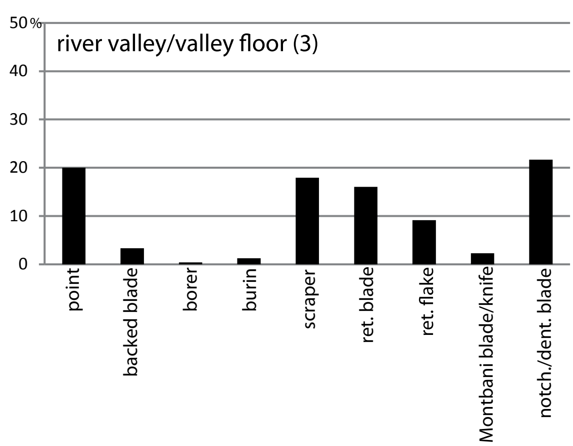


Fig. 5.28 Percentages of the typological assemblage composition per group and for Hardinxveld-Polderweg separately. Number of sites in brackets.

Borers yield relatively low values for sites in the southern coversand landscape and seem of less importance at the valley floor sites. This contrasts with the upper values, but not necessarily the distribution in both other groups. Burins yield low values in general, although this appears most consistent for sites on the southern coversand. The high contribution of burins at Mariënberg (11%) may point to specific task focuses at this site, or it is an artefact of identification. The distribution of scrapers is less outspoken. It can only be noted that the upper extremes within the northern and river valley group exceed the contribution of scrapers to assemblages in the southern coversand landscape. Notched and denticulated artefacts provide a relatively low contribution in all groups when outliers are excluded. When grouped within a 'processing toolkit' the most characteristic feature is formed by the extremes in the group of sites on the northern coversand and those in river valley situations. On the basis of the studied sites, (formal) processing artefacts form a relatively smaller contribution to assemblages in the southern coversand landscape and in the wetlands.

The distribution of retouched flakes and blades mirrors the percentage counts above. In the group of wetland (margin) sites, the importance of retouched flakes is distinct, while retouched blades are significantly influenced by both Swifterbant outliers. Assuming retouched flakes and blades fulfilled similar functions, the overall counts in the 'general toolkit' indicate that all groups are comparable in their contribution of these tools to the assemblage, except for the group of wetland (/margin) sites. There the contribution of retouched blades and flakes stands out markedly.

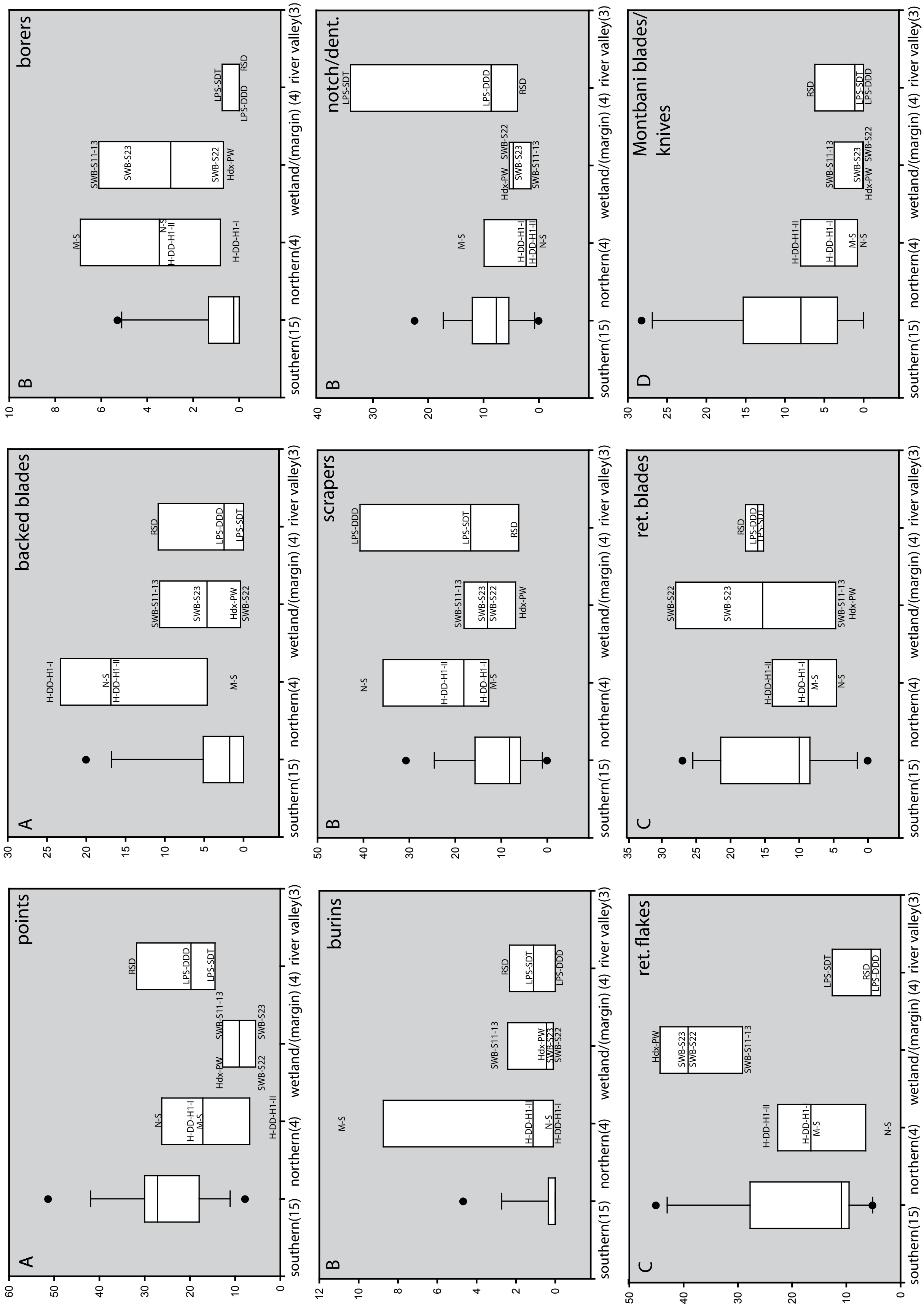
Finally, the distribution of Montbani blades (mainly documented for the southern coversand landscape and river valley sites) and knives (mainly documented for the northern coversand landscape and at the wetland (margin) sites) point to a low contribution for these elements at the wetland or wetland margin sites. This may relate to the compensating function of retouched flakes and blades. On the southern coversand Montbani blades clearly form a relatively important contribution to the toolkit, suggesting that they may be interpreted as specifically (reliable) and multi-functional tools related to hunting activities.[43]

Interpreting differences

The boxplot distributions do not allow the identification of assemblage types, but point out differences in emphases. In the southern coversand landscape the assemblages, dominated by points and Montbani blades, fit hunting activities, including the primary butchering of carcasses and the processing of meat. While these activities are also of importance in the other groups their overall typological basis is somewhat broader and perhaps indicative of a more diverse set of activities. The wetland (margin) sites demonstrate a relatively smaller contribution of hunting tools and a greater importance of general tools such as retouched flakes. It should further be remarked that the various artefact distributions for sites in the southern coversand landscape, with the exception of Montbani blades, show a relatively limited spread, indicating the existence of homogeneity and consistency within these assemblages. The higher number of sites for the southern coversand landscape further confirms this distribution.

5.5.4.5 Visual cluster analysis

A complementary approach to the analysis above is offered by cluster analysis. This statistical analysis has proven useful for detecting (latent) patterns within archaeological data. However, both the array of methods available and the nature of the data often complicate an objective application and detection of inherent structure (see Shennan 1997, 253-254). An alternative approach is provided by arranging data into star plots (Chambers *et al.*, 1983). This is a visual method for displaying multivariate observations. The length of the individual rays corresponds with the size of the variable. The overall configuration of properties



A
points
backed blades
B
borers
burins
scrapers
notch/dent.
C
ret. flakes
ret. blades
D
Montbani blades/
knives
southern(15)
northern(4)
wetland/(margin) (4)
river valley(3)

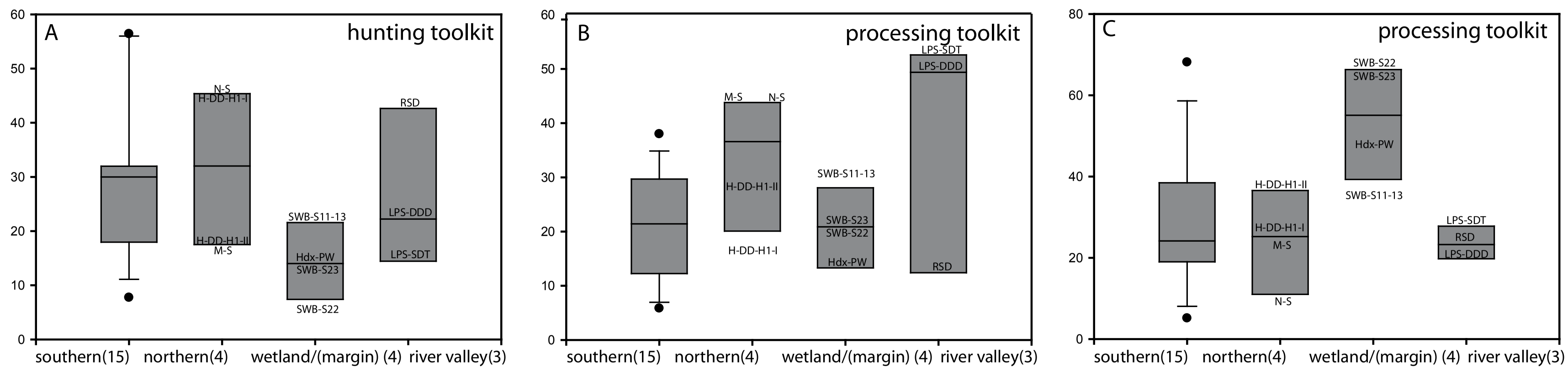


Fig. 5.29 Boxplot graphs for tools and combined functional categories. For the small groups individual sites have been plotted within the distribution graphs in order to pinpoint the nature of the specific distribution (see table 5.1 for abbreviations). (A) Boxplot graphs for percentages of 'points', 'backed blades' and combined 'hunting toolkit'. (B) Boxplot graphs for percentages of 'borers', 'burins', 'scrapers' and notched and denticulated artefacts as well as for the combined 'processing toolkit'. (C) Boxplot graphs for percentages of 'retouched flakes', 'retouched blades', and combined 'general toolkit'. (D) Boxplot graphs for percentages of Montbani blades and knives.

per observation (site or group) and their ordering allow for the detection of similarities or differences. This approach offers a visual alternative for what has been discussed earlier.

The data have been plotted per group for the entire tool assemblage (see fig. 5.30) and for the assemblage excluding retouched flakes, blades, hammerstones and 'other tools'.

In general the composition of the star plots accentuates the importance of points and Montbani blades at sites in the southern coversand landscape and, to a lesser extent, backed blades and points in the northern coversand landscape. The different shape of the star plots for the wetland group relates to the role of retouched flakes and blades, once more indicating their important contribution to these assemblages. Within the river valley group points clearly dominate and a somewhat more balanced image appears, along the lines of the southern coversand group. The star plots that exclude the general category of retouched flakes and blades clearly demonstrate the distinct focus on point manufacture, curation and therewith hunting for sites on the southern coversand.

In the analysis the individual sites were plotted as well and, in particular for the southern coversand, wetland (margin) and river valley sites, yield largely similar perspectives, comparable to the group composition. The relevance of assemblage diversity is based on the premise that there might be sites with a more general function and those with a more specialist function (Andrefsky 2005, 214). While the time-averaged nature of most of the sites prevents an appropriate analysis of site types, different but consistent emphases in assemblage composition may be informative on the absence or presence of activities.[44] One statistical approach, used by Chatters (1987, 363-366), to assess the degree of diversity and therewith specialization within studied assemblages is the evenness index (see also Andrefsky 2005; Rhode 1988). The results of this test for the different sites and groups statistically confirmed the lower values and hence greater homogeneity for sites in the group on the southern coversand and to a lesser extent the southern river valley sites, especially when retouched flakes and blades are removed from the counts (see Appendix IIE).

5.5.4.6 Typological characteristics and potential implications

From a typological perspective the site assemblages for the southern coversand stress the importance of hunting as a primary activity, which is substantiated by the number of sites that yielded information. The similarities between the river valley sites and those of the southern coversand hint at the presence of similar communities from a material perspective: formal tools such as points and Montbani blades characterise the assemblages, while retouched blades form an important contribution as well.[45] The emphasis in the assemblage spectra of the different sites in this area is relatively uniform and points to the importance of hunting (see also Crombé *et al.* 2011[b], 468).The assemblages of sites on the northern coversand are largely comparable, but have a less outspoken character. The contribution of scrapers, burins, backed blades and borers point to a more varied toolkit, although these types are not absent elsewhere. The contribution of retouched blades is less distinct when compared to the south. The wetland and wetland margin sites yield a different picture. Points are less important there. Retouched flakes dominate the spectrum at Polderweg, while S22 and S23 show a more important contribution

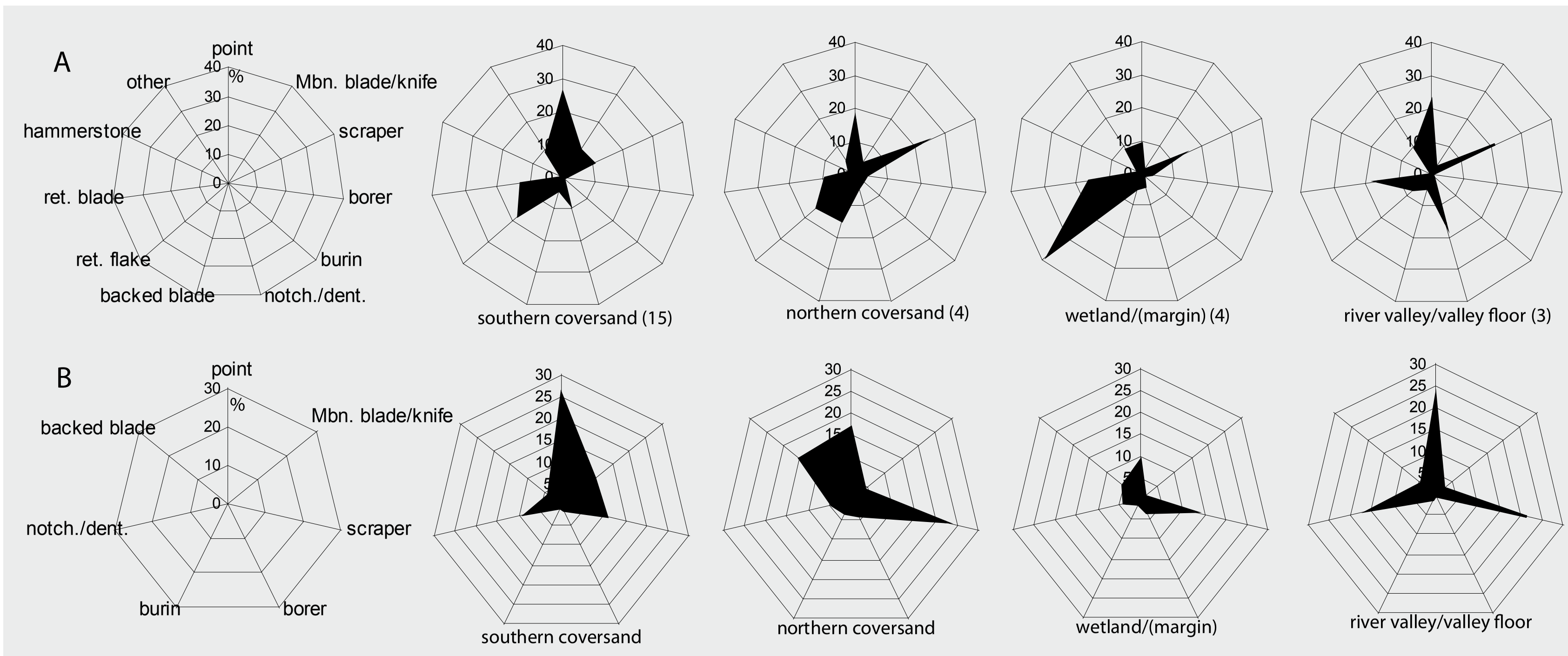


Fig. 5.30 Visual cluster analysis (star plots) of tool assemblage percentages per group (A) and for a selection of artefacts, excluding retouched flakes and blades, hammerstones and 'other tools' (B). Number of sites in brackets.

of retouched blades, in line with their technological component. At these wetland (margin) sites the tool spectrum differs most from that of sites on the southern coversand, mainly in terms of a more limited contribution of points and an important role for retouched flakes.

Based on the assemblage compositions the main distinction between a group of southern coversand sites characterised by curated elements, both in technology and typology, and sites with a more expedient character such as those in the wetland group and in particular Hardinxveld-Polderweg remains. The assemblages of many of the other sites should be understood as representing differences of degree rather than kind.

5.5.5 Wommersom quartzite

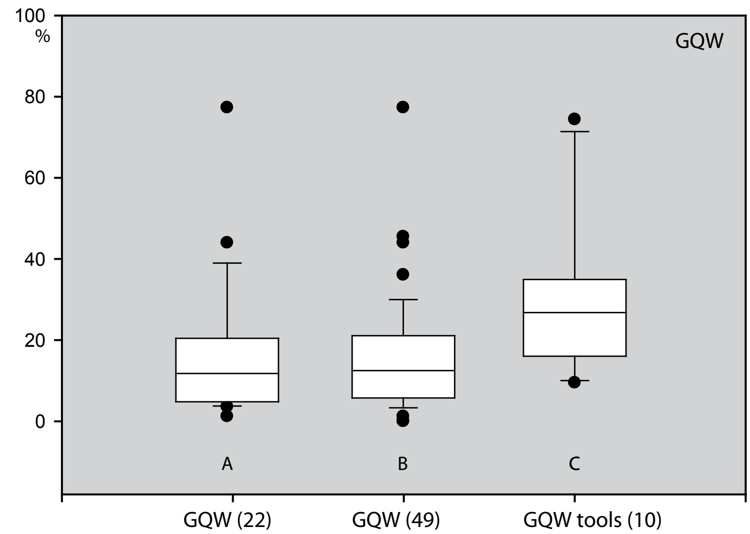
The technological and typological analysis above did not incorporate the role of raw material. The raw material composition and its information regarding resource procurement, mobility and the settlement system will be discussed below (see section 5.5.6). There is however one aspect that offers a complementary perspective on the typological and technological information presented earlier. This involves the role of Wommersom quartzite in assemblages on the southern coversand.

5.5.5.1 Wommersom quartzite contribution

Of both quantitative and qualitative significance is the contribution of Wommersom quartzite (*Grès Quartzite de Wommersom*, or GQW), to the assemblages on the southern coversand. The grey to dark grey mottled quartz is not too fine-grained and is ideally suited for the production of blades and microliths (Gendel 1984, 144). Since the only outcrop is located near Tienen in the Hageland (Gendel 1982), this type of raw material is predominantly found at sites in the southern coversand group.[46] Other southern locations include the river dune site of Melsele which yielded *c.* 5% of GQW (Van Berg *et al.* 1992), while sector DDD at the valley floor site of Liège yielded *c.* 8% (Van der Sloot *in prep.*). Further north GQW is only encountered sporadically.[47] Noteworthy is the relative importance of GQW for sites on the southern coversand. On average between 5% and 20% of the assemblages there was made of Wommersom quartzite. The specifics of this distribution have been plotted below (see fig. 5.31, see also Appendix IIG and IIH).

The contribution of GQW to the assemblages of these sites is significant. There are outliers, such as Brecht-Moordenaarsven 1, where a knapping place may have been excavated (see Appendix I) and for the sites documented by Vermeersch (1976) it should be taken into account that these are mostly surface samples, yet the importance of GQW is distinct.[48] Within the group of sites on the southern coversand (and occasionally outside this group), the procurement and use of Wommersom quartzite should therefore be interpreted as a meaningful characteristic. One explanation for its importance may be found in its qualities as a very workable, 'forgiving' raw material, excellently suited for the production of blades and microliths (see Gendel 1984). Below, a number of aspects are studied in more detail, based on those sites that yielded informative raw material counts.

Fig. 5.31 Boxplot distribution of the percentage of Wommersom quartzite for sites on the southern coversand. (A) sites used in this study. (B) sites used in this study combined with the Hageland sites documented by Vermeersch (1976). (C) sites informative on the Wommersom component in the tool spectrum (N tools > 15). Dots signify outliers. Number of sites in brackets.



5.5.5.2 Technological preference and Wommersom quartzite

Several technological categories of artefacts are informative on the importance of Wommersom quartzite. In fig. 5.32 the contribution of Wommersom and flint is compared for cores and core rejuvenations flakes.

As argued earlier the importance of core rejuvenation flakes in relation to cores may point to the fact that cores may have belonged to the transported part of the toolkit (*cf. supra*; Robinson *et al.* 2008, 65). Fig. 5.32 further demonstrates that at several sites Wommersom cores form an important component and that Wommersom rejuvenation flakes at some sites are quantitatively even more important. This may support the idea of the role of cores and in particular those of Wommersom quartzite as parts of a transported mobile toolkit in a curated technological system, although the overall number of sites is limited.

When reviewing the information on debitage (see fig. 5.33), Wommersom quartzite also forms a relatively distinct component, especially in relation to blades where it was often worked in Montbani style (*e.g.* Huyge/Vermeersch 1982, 159; Lauwers/Vermeersch 1982, 6; Maes/Vermeersch 1984, 71; Robinson 2010, 138-140; Vermeersch *et al.* 2005, 69).

Fig. 5.34 demonstrates the contribution of GQW to the microburins found. In view of the relation between Montbani-style debitage and the microburin technique in point production (see Robinson 2010, 140-142), Wommersom quartzite, from a technological perspective, may have been favoured for the manufacturing of arrowheads at some sites. Although there are also many microburins of flint, the importance of GQW for point production (see below) may be indicative of a preferential use.

Not only did Wommersom quartzite function in a different procurement and exchange system, but technologically was relatively often worked with blade debitage. It may have mainly served the purpose of producing microliths for hunting equipment.[49]

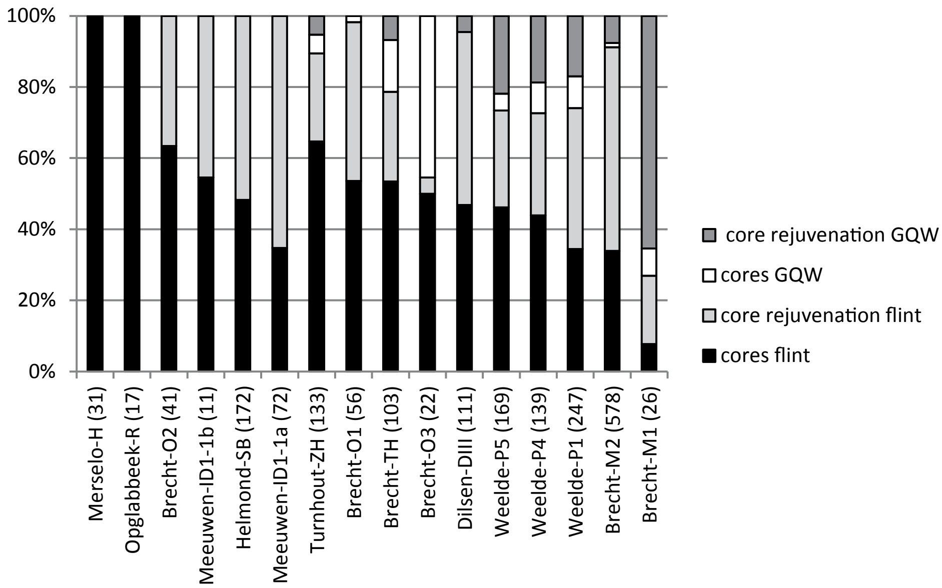


Fig. 5.32 Percentages of flint and GQW cores and core rejuvenation flakes at sites on the southern coversand (counts in brackets).

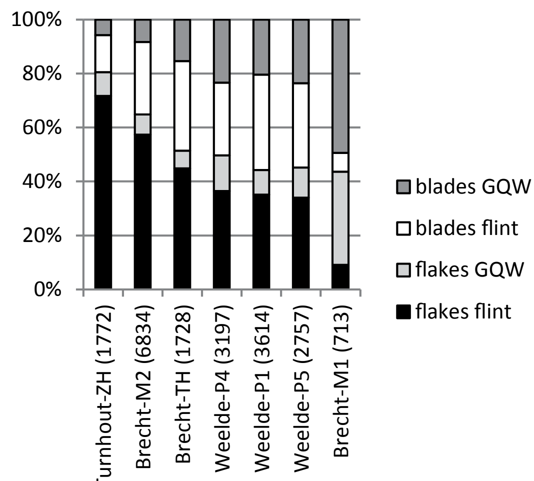


Fig. 5.33 Percentages of flint and GQW flakes and blades at sites on the southern coversand (counts in brackets).

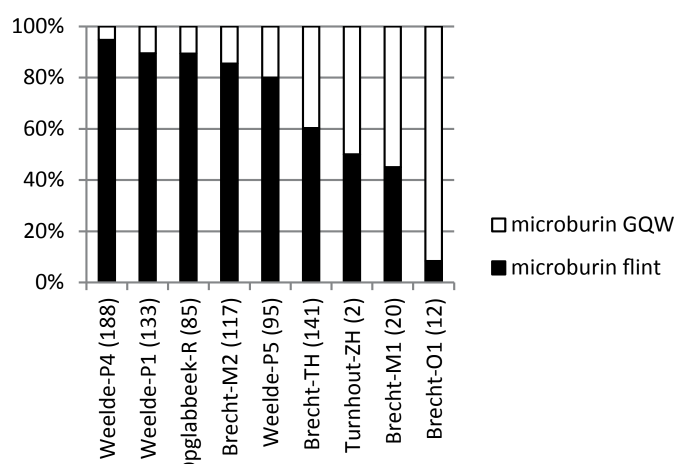


Fig. 5.34 Percentages of flint and GQW microburins at sites on the southern coversand (counts in brackets).

5.5.5.3 Typological characteristics and Wommersom quartzite

The technological characteristics described above are reflected in some of the typological aspects of the assemblages documented for sites with qualitative information on raw material use. GQW forms a frequently used raw material for the production of points, as already visible for the microburins. A contribution of 15-20% appears to be the norm (see fig. 5.35). For backed blades Wommersom quartzite appears to have been of less importance.

The production of typical formal tools such as scrapers, notched or denticulated artefacts and in particular Montbani blades supports the importance of GQW in blade production and the subsequent fabrication of formal tools. For scrapers 10-20% appears to be the norm and for notched or denticulated and Montbani blades even 20-40% (see fig. 5.36).

The contribution of GQW to the categories of retouched flakes and blades follows that of the technological categories of flakes and blades discussed above. Again GQW is of increased importance in the production of blades (see fig. 5.37).

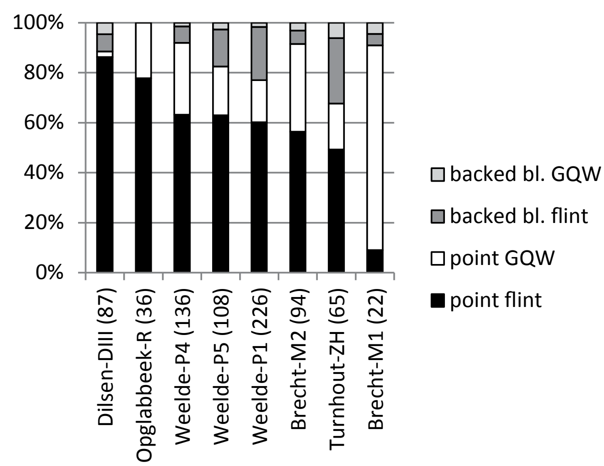


Fig. 5.35 Percentages of flint and GQW points and backed blades at sites on the southern coversand (counts in brackets).

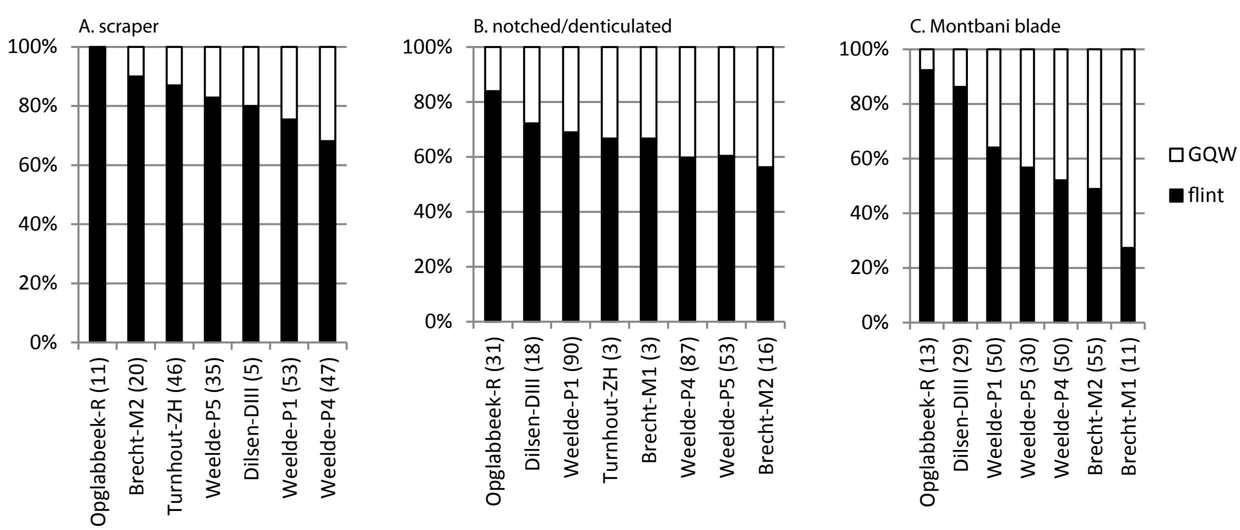


Fig. 5.36 Percentages of flint and GQW for (A) scrapers, (B) notched and denticulated artefacts and (C) Montbani blades at sites on the southern coversand (counts in brackets).

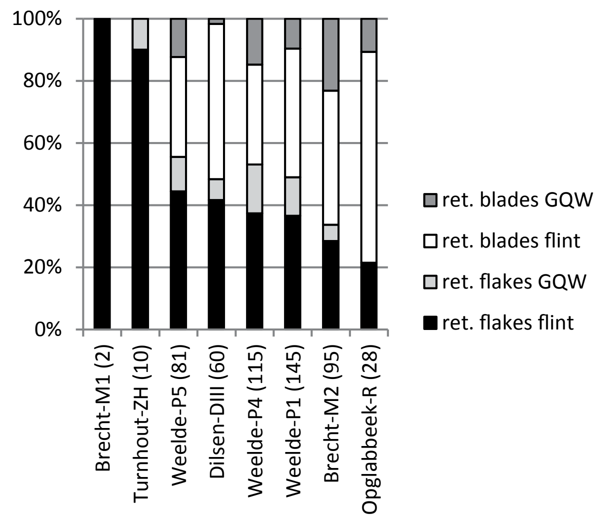


Fig. 5.37 Percentages of flint and GQW retouched flakes and blades at sites on the southern coversand (counts in brackets).

5.5.5.4 Interpreting the contribution of Wommersom quartzite

The technological and typological comparisons above point to the importance of Wommersom quartzite as a consistent raw material component at sites on the southern coversand. Its function in the production of blades and formal tools is apparent when the raw material composition of tools is compared for Wommersom quartzite and flint. This could be done for those sites that provided raw material information both in general as well as in relation to individual tool types. These are Brecht-Moordenaarsven 1-3, Thomas-Heyveld, Dilsen-DIII, Opglabbeek-Ruiterskuil, Turnhout-Zwarte Heide and Weelde 1,4 and 5 (see fig. 5.38).

Although only a number of sites yielded enough comparative information, it is evident that GQW forms an important contribution to the tool spectrum and that it is relatively often used for tool production. This is further supported by a recent detailed lithic study for the Belgian Mesolithic. This indicated that for the Campine area in particular there was a clear preference for Wommersom quartzite in armature production (Robinson 2010, 180, 199).[50] The superior qualities of Wommersom quartzite made it a functionally reliable material that may also have had certain social connotations (*e.g.* Wiessner 1983; see also Crombé 2002, 104; Ruibal *et al.* 2011) as well as a role in exchange networks, or as territorial marker (Gendel 1984; 1989; Heinen 2006; Terberger 2006).[51]

Based on these considerations the role of Wommersom quartzite supports the idea of a more curated technology and toolkit for sites on the southern coversand. This might relate to the need for qualitatively robust and trustworthy tools. As argued earlier tool shape, size and design form important factors, especially for mobile groups having to deal with transport costs (see Kuhn 1994, 438). The care taken in, for example, trapeze or Montbani blade production points to good craftsmanship and perhaps even overdesigned components. These are characteristic for so-called reliable systems that are counted on to work when needed (Bleed 1986, table 1). In this sense the use of GQW in particular might be seen as functioning within a curated technology (*sensu* Binford 1983, 283 (1979)), where tools are used, maintained and recycled intensively. The implications of a higher mobility and a typological emphasis on point production and possibly hunting may have required reliable qualities. In that respect Wommersom quartzite

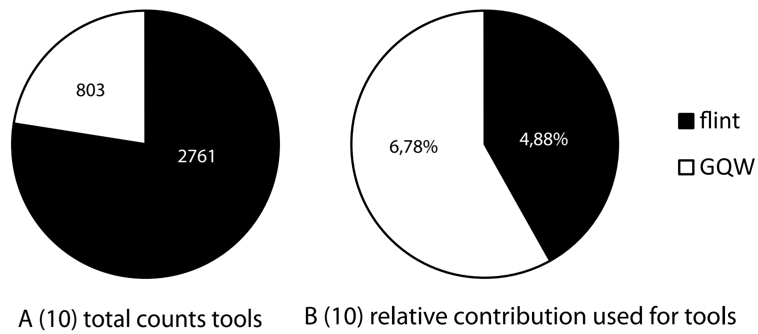


Fig. 5.38 (A) Total counts for tools of flint and Wommersom quartzite in 10 informative assemblages. (B) Relative contribution of Wommersom quartzite (6.78%) and flint (4.88%) use for tools. Number of sites in brackets.

might have served as the ideal 'travel toolkit'. Another crucial factor in this is the availability of raw material (see also Randolph Daniel Jr. 2001), whereby curation can be linked to overall regional scarcity in raw material (Bamforth 1986, 40). Although there appears not to have been an absolute shortage in the availability of Wommersom quartzite, its single outcrop, distance and possible social constraints on procurement, stress the particular role GQW played in toolkits on the southern coversand. Especially in view of the rather regular supply to sites at a distance of up to 90 km from the source (see below).

Phtanite chert

Several sites on the southern coversand also yielded evidence for additional raw materials (see Appendix I; Verhart 2000, 83). Of limited yet recurrent importance is the role of phtanite or lydite of Ceroux-Mousty. This is a fine-grained radiolarian chert that can be found in the valley of the Ry-Angon near the village of Ottignies. It is characterised by a homogeneous texture and black colour, which stresses the singularity of this type of raw material. Huyge and Vermeersch (1982, 153) argue that some material might have originated from river gravels, yet the size and quantity of artefacts at some sites (for example Brecht-Overbroek I and Brecht-Thomas Heyveld) do not point to the use of small rolled nodules. Its limited but recurrent presence in assemblages up to 140 km from the source indicate its sought-after (symbolic?) value. Although the number of sites and artefacts (see Appendix IIG) is rather low, the contribution of phtanite appears to decrease as sites are situated further from the potential Ottignies source area. The (surveyed) sites of Vermeersch (1976) demonstrate a contribution of 10-40 artefacts at distances up to 40 km. Further away the contribution drops, yet outliers are formed by Weelde-Paardsdrank (16 artefacts at 85 km) and Brecht-Overbroek I even yielded 90 artefacts at 82 km away (Huyge/Vermeersch 1982; Vermeersch *et al.* 2005, 69). The occurrence of 83 debitage products at the latter site, including eleven unworked pieces and a core rejuvenation fragment indicate the local processing of one or more phtanite cores and the occurrence of five microburins and several trapezes point to the production of arrowheads. Other artefacts at Overbroek I are several Montbani blades. The remaining sites yielded far lower quantities of phtanite, comprising blades or Montbani blades, a crested blade, a backed blade, microburins, a trapeze, an endscraper and some debris. Although Overbroek I demonstrates that phtanite was also worked locally, the predominance of tools and the scarcity of waste suggest that this raw material type was predominantly transported in the form of blanks or finished products. It therefore appears that phtanite may have taken on a role or function comparable to Wommersom quartzite, although the limited numbers appear to indicate less frequent local production.

5.5.6 Raw material procurement

Apart from the technological and typological composition of the studied lithic assemblages, the role of raw material and resource procurement strategies forms and additional perspective on aspects of mobility and the settlement system (*e.g.* Kelly 1992, 55). The distance to the original geological source or outcrop forms just one aspect (see Pasda 2006, 196) as ethnographic and archaeological accounts point out the variability present in procurement strategies, including residential, logistical and large-scale mobility, down-the-line exchange, trade and raids (*e.g.* Dennell 1985; Kind 2006; Lovis *et al.* 2006[a,b]; Mauss 1990 (1950); Randolp Daniel Jr. 2001; Whallon 2006; Zvelebil 2006).

This makes us aware of the problems involved in interpreting evidence of raw material procurement strategies, but it does not necessarily hinder a comparative analysis of this evidence. Similarities and contrasts may be informative on actual differences in procurement strategies, although often these cannot be pinpointed more precisely.

5.5.6.1 Raw material composition

Not all sites yielded information regarding the composition of raw material. For the southern coversand landscape some 22 sites or parts of sites yielded information regarding the composition of the lithic raw material spectrum, while a further 27 sites, most of which are surface collections from the Hageland area (see Vermeersch 1976), provided additional information (see Appendix IIF and IIG). Information for the other groups is limited to single sites. The available information is presented in fig. 5.39.

The majority of artefacts is made on regionally available rolled nodules (see Appendix I). These can be of fluvial origin, often found within older terraces, or derive from a moraine context (in the north) and are usually of mediocre to inferior quality (*e.g.* Price *et al.* 1974, 35; Verhart 2000, 83). The river pebbles in the south have even been described as heavily rolled and weathered nodules of frost cracked flint, recovered from river beds (Crombé 1998; Robinson 2010, 132). This demonstrates that most of the time the majority of tools could be fabricated locally and need not have been of high quality. Of course this type of raw material is not always inferior (when properly selected). Probably the availability of these resources formed a factor in choices pertaining to mobility and site location. The other groups of raw materials are more informative on procurement and mobility strategies. While information is limited to a few sites, most descriptive accounts of raw material composition at other sites, such as Hoge Vaart-A27, Mariënberg, Urk-E4 and the Swifterbant sites, confirm the predominance of locally available flint of modest quality.

Combining this information, it can generally be stated that sites located outside of the southern coversand landscape relied heavily on locally available flint. Other elements usually comprise up to 5% of the assemblage.[52] This category for most sites comprises artefacts of sandstone, chert, quartz, quartzite and phtanite, and limited other types of flint.[53]

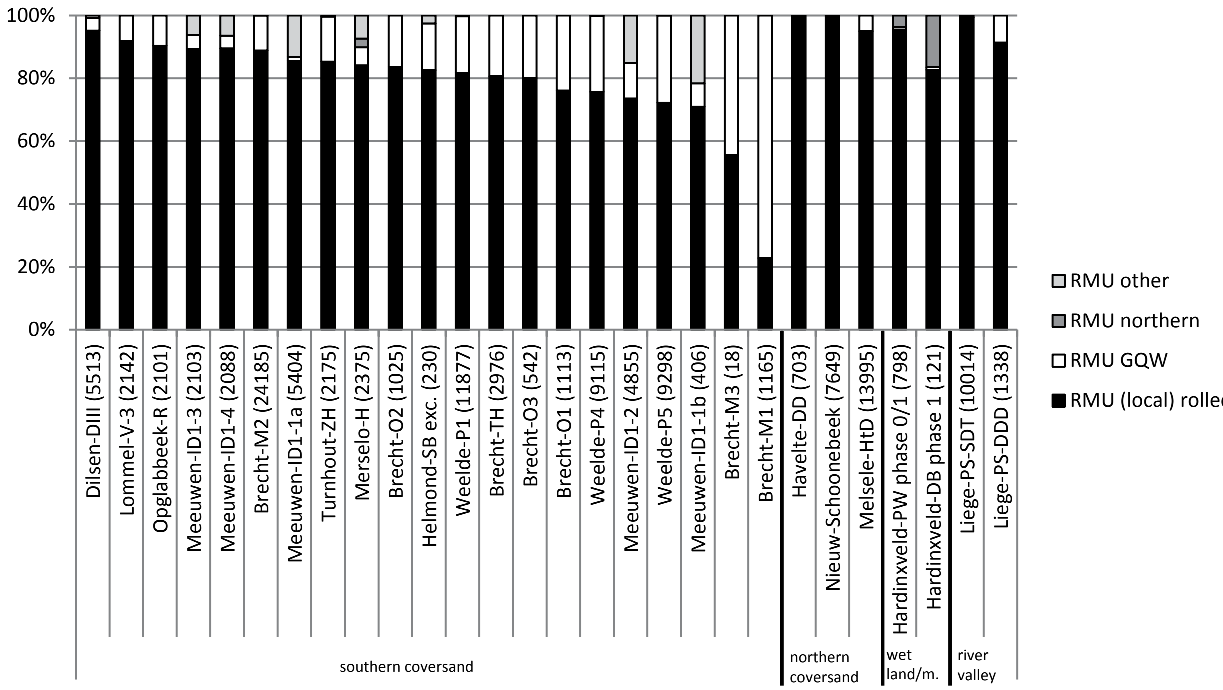


Fig. 5.39 Percentages for raw materials in lithic assemblages per site. Total counts in brackets.

5.5.6.2 Practices of procurement: Wommersom quartzite

More information may be obtained by focusing on the systems of procurement. This may be based on the percentage distribution in relation to the source area. Most information in that respect is available for the southern coversand and the role of GQW as discussed above.

The geographical distribution of GQW seems to be roughly delimited by the Meuse, the Scheldt and the Rhine, covering an area of *c.* 40.000 km^2 (Gendel 1984; Van Oorsouw 1993) with occasional finds in the German Rhineland (Arora 1979). This distribution – in combination with certain point types – has been interpreted as the territory of a dialectic tribe (Verhart/Arts 2005, 242; see also Gendel 1989; Robinson 2010, 134). All sites fall within this territory. In fig. 5.40 the known percentage frequencies of the studied sites with Wommersom quartzite have been plotted against their direct distance to the outcrop. The sites previously studied by Gendel (1984, 139-143) have also been incorporated in the plot. Additionally several substantial surface collections from the Hageland studied by Vermeersch (1976, 237) and at the time attributed to a Late Mesolithic 'in contact with farmers' have been included.[54] Since the latter study was confined to the Hageland, the clustering of artefacts within 25 km from the source area and their absence between 25 and 50 km, is research related. In general the plot as generated by Gendel (1984, fig. 7.5) is confirmed, but more sites have become available.

If sites with low artefact counts are left out an even more distinct distribution appears: up to 70 km from Wommersom rather substantial quantities of Wommersom quartzite are found in the assemblages, varying roughly between 5% and 30%, with an overall mean of 14.5%. Several concentrations at Meeuwen yielded counts up to 10%, while Brecht-Moordenaarsven 1 is responsible for an outlier of 77.3% for Wommersom quartzite and potentially represents the single event of a GQW knapping episode.

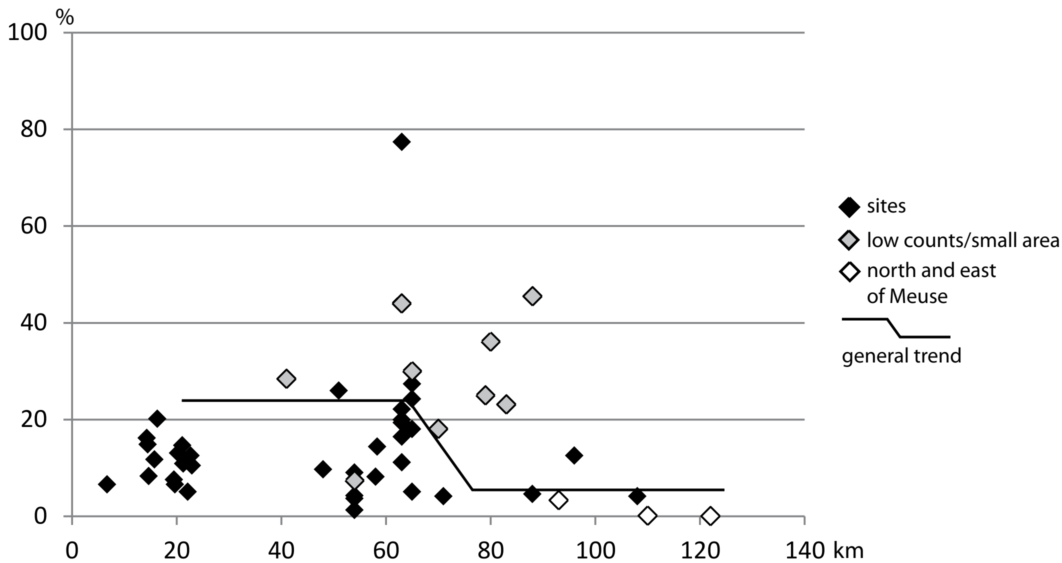


Fig. 5.40 Percentages of Wommersom quartzite plotted against the direct line distance from Wommersom. Grey squares: sites with low artefact counts (N < 500), or small excavation areas. White squares: sites north and east of the Meuse. (For point information see Appendix IIG, Gendel 1984 and Vermeersch 1976).

The pattern beyond *c.* 70-90 km distance is characterised by a decrease in sites and a sharp drop in the GQW percentages (see also Crombé/Cauwe 2001, 56).[55] Currently this drop in percentage seems less related to the barrier function of the Meuse than previously suggested (Gendel 1984, 142), since sites, both east and west of the Meuse yielded low counts. The Atlantic Meuse probably consisted of multiple channels with a lower energetic discharge and was probably easier to cross than its current successor. In addition, the Meuse may have been an important source of raw material and a conductor for transport and interaction.

Unfortunately, the overall pattern is still strongly influenced by the uneven distribution of qualitatively informative sites.[56] If the supposed drop at around 70-90 km is a reflection of past behaviour then both intrinsic (annual) mobility and down-the-line exchange do not completely explain this phenomenon. Crombé and Cauwe (2001, 56) in this respect mention the transportation of substantial (30-77%) amounts of GQW to the sandy area between the Meuse and Scheldt and a rapid drop beyond to *c.* 5%. They argue for the existence of local groups (microbands) exploiting small (*c.* 100 x 100 km) territories. The existing distribution patterns would be related to the seasonal movements of these individual groups exploiting the outcrop (see also Crombé *et al.* 2011[b], 468). Although much is still unknown regarding the procurement of lithic raw material in this area and Wommersom quartzite in particular (Robinson 2010, 135), a plausible scenario would be the combination of exploitation systems. Up to 70-90 km from the source, the relatively high contribution of GQW to the assemblages may be explained by an important contribution of intrinsic mobility in combination with intensive exchange. Procurement in this zone may have been direct and embedded within the cycle of mobility (see Binford 1983(1979); Crombé 1998, 61). Outside this zone less intensive or less frequent contacts between groups of hunter-gatherers resulted in a more restricted exchange of this type of raw material.

Additional evidence is provided by the technological qualities of the form in which GQW may be procured. Wommersom quartzite occurs as tabular blocks and is easily workable without intensive preparation (Gendel 1982; Van Oorsouw 1993). This might explain the absence of intensive quarrying, testing and preparatory debris at the location of the Steensberg (see Gendel 1984, 132). Cores of Wommersom quartzite do occur in some numbers at sites such as Brecht, Meeuwen and Weelde, closer to the source, but are scarce to absent at for example Dilsen-Dilserheide III, Nijnsel III, Merselo-Haag and (probably) also at Helmond-Stiphoutsbroek outside this zone (*e.g.* Gendel 1984, 146; Luypaert *et al.* 1993, 14; Verhart 2000, 79-83, 105; Vermeersch *et al.* 1992, 17). It is plausible that cores could have played a more prominent role within the exchange system with direct access, while finished artefacts or blanks may have travelled further into the periphery (see also Van Oorsouw 1993, 47). This forms a further argument indicative of the relative scarcity of GQW, its associated curated use and its interpretation as a very mobile component of the toolkit in that area (*cf. supra*; Crombé/Cauwe 2001, 56).

Summing up, the information on GQW in combination with the technological and typological characteristics sketched above indicate that the use and procurement of this raw material hold a special position at sites in the southern coversand area and the southern river valley sites. GQW may be characterized as a favoured material, especially in the production of formal tools such as trapezes, that was used alongside local rolled flint nodules and distributed through a different mechanism, most likely incorporating embedded procurement in relation to exchange. It therefore points to a distinct degree of mobility.

5.5.6.3 Practices of procurement: long distance supply

Where Wommersom quartzite points to a system combining intrinsic annual mobility and exchange, a different accent is provided by the raw material procurement at both Hardinxveld sites in the wetlands of the Alblasserwaard area. Procurement there contrasts with the Wommersom and local rolled nodule system described above. Since both Hardinxveld sites are located in the extensive wetland environment of the Dutch delta, the nearest outcrops of terrace flint (forming the majority of the lithic toolkit) were located at a distance of *c.* 70-100 km, while natural stone could be found at the ice-pushed ridges near Utrecht at a distance of 45 km (Louwe Kooijmans 2001[a]; Van Gijn *et al.* 2001[b]).

As is demonstrated in table 5.14 the sites of Polderweg and De Bruin potentially would yield 258 kg of flint and 277 kg of natural stone, if the entire site was excavated (x5). Since all lithic resources had to be procured and transported over distances ranging from minimally 45 km up to 250 km, this represents an energetically costly undertaking.[57] It should be noted though that with respect to the occupation span, this means that less than 1 kg of lithic raw material was discarded at the sites on a yearly basis. Furthermore it is not known to what extent raw material was procured through interaction and down-the-line exchange, although Louwe Kooijmans and Verhart (2007) argue in favour of at least partial intrinsic mobility, perhaps aided by canoes in the form of expeditions.

It should be realized that the sites were not occupied continuously or for the same purpose during the millennium that they were used. Polderweg phase 1 and De Bruin phase 2 yield most material. Additionally a seasonal occupation, as was attested most evidently for Polderweg phase 1, is most likely (see Louwe Kooijmans 2003). These considerations, in combination with the fact that we are dealing with what was eventually left or abandoned at the site, again add value to the (yearly) effort invested in providing the sites with a sufficient lithic supply.

	occupation period	N flint	N stone	W flint (g)	W stone (g)	W flint (g) overall (x5)	W stone (g) overall (x5)	W flint (g) per year	W stone (g) per year
Polderweg all phases	*c.* 500	18938	*c.* 63 (large)	25547	31648	127735	158240	51 (255)	63.3 (316.5)
De Bruin all phases	*c.* 1000	12263	unknown	26226	2385	131130	119250	26 (130)	23.8 (119)
total	(*c.* 1000)	31201	unknown	51773	55498	258865	277490	78 (390)	87.1 (435.5)

Raw material	rolled nodules	terrace flint	Rijckholt	northern flint	GQW	Belgian Lightgr.	natural stone	pyrite
Distance to source in km	70-100	70-100	*c.* 150	70-100	90	*c.* 150	45-150	150-250

Table 5.14 Quantitative information on the number and weight of flint and other stone artefacts transported to Hardinxveld-Giessendam Polderweg and De Bruin, in combination with an estimation of the distances to the raw material sources. Numbers in brackets are estimations for the entire site (multiplied by a factor of 5).

The presence of an unused pre-core of *bergfrische* Rijckholt flint and other large pieces (see Van Gijn *et al.* 2001[a], 128-129), point to the nature of procurement as inclusive of considerable bulk material and indicative of canoe transport (see also Ames 2002), perhaps rather than down-the-line exchange. In general, the nature of the resource procurement at Hardinxveld and its isolated position with respect to resources contrasts somewhat paradoxically with the expedient nature of its industry. This supports the interpretation as a relative stable long-term residential location.

5.5.6.4 Comparing systems of procurement

Based on the information regarding local lithic resources and Wommersom quartzite at sites in the southern coversand area and the raw material procurement at Hardinxveld a number of procurement system models may be sketched that are characterized both by common aspects but also distinctly different emphases. Evidently these types of systems are static generalizations of past dynamic procurement systems. These are of course influenced distinctly by the geographical and environmental setting of the sites, the actual distance to the sources of raw material and the socio-economic aspects of the communities involved. The systems have been visualized in fig. 5.41.

Based on the information available, the first model (A) is characteristic for most sites located in the northern coversand landscape, but also applies to wetland margin sites such as Hoge Vaart and the Swifterbant sites. The sites are situated in the vicinity of local sources of lithic raw material. In most cases these are outcrops of erratically transported nodules of mediocre to inferior quality located at a distance of 1 or 2 km up to *c.* 10 km (*e.g.* Beuker 1989; Deckers 1982; Peeters 2007). The flint is procured, used and discarded locally, while a small number of artefacts might have been taken along to the next location (solid grey line) or exchanged (dashed grey line). Additionally other lithics might complement the assemblage (white lines). These can be obtained through direct mobility, or indirectly through exchange. An exceptional example is provided by an artefact of Wommersom quartzite found at the site of Hoge Vaart-A27. Most of the time, however, it will be difficult to distinguish between those lithics that are part of regular procurement practices and those that should be considered 'additional' or 'exotic'.

The second model (B) represents lithic resource procurement in the southern coversand landscape and at the southern river valley sites. The basic properties of the first system also apply here. This is visualized by the dashed square in the upper left representing a situation similar to the first model (A). It should

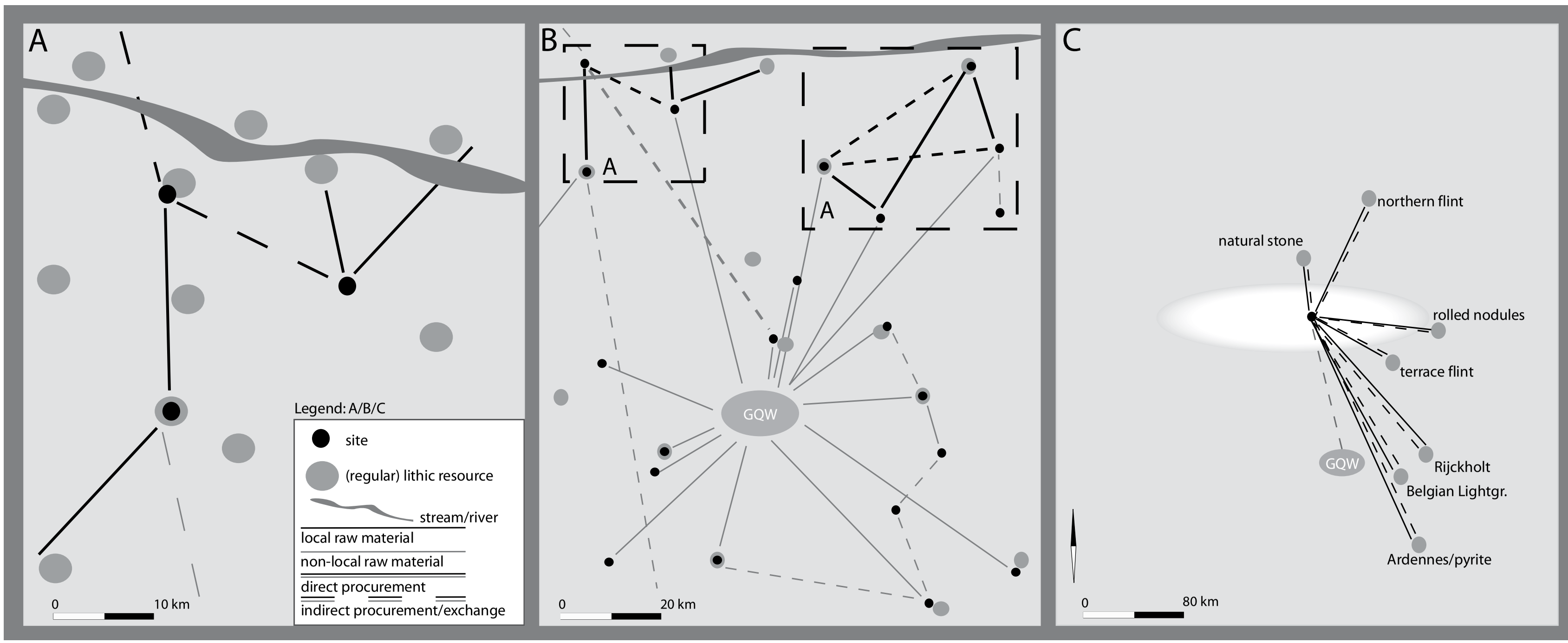


Fig. 5.41 Schematic representation of hypothetical resource procurement systems in the LRA. Type A marks a system focusing on residential moves to resources in combination with exchange. Type B incorporates the characteristics of A but emphasizes the distribution of Wommersom quartzite. Type C is based upon the wetland sites of Hardinxveld-Giessendam Polderweg and De Bruin. Note the differences in scale.

be noted though that outcropping sources of fluvially rolled nodules were less homogeneously distributed, compared to the erratic flint in the north. Furthermore procurement of Wommersom quartzite through direct mobility (either focused or embedded), or indirectly through exchange is an important feature of this system. The relatively high contribution of GQW to the assemblages up to 70-90 km from the source suggests that the Wommersom outcrop was regularly visited from sites in mobility cycles situated in that zone. The low numbers of cores and the specific qualities of GQW described above, also demonstrate that it was regularly transported between sites or exchanged (*e.g.* Crombé/Cauwe 2001, 56; Verhart 2000, table 2.14; Vermeersch *et al.* 1992, 17). These options have been depicted in the dashed square in the upper right corner and elsewhere. There are also some sites without Wommersom quartzite. For phtanite it may be suggested that exchange mechanisms, focusing on blanks and finished products were probably more important (*cf. supra*).

The third model (C) has been documented for the wetland sites of Hardinxveld-Polderweg and De Bruin. Their isolated position away from lithic resources required a procurement strategy where raw material was transported to the sites over considerable distances (45-250 km). There is little information on the relation between procurement through intrinsic mobility or exchange. The presence of canoes and raw material of considerable volume and weight (*e.g.* the Rijckholt precore) might point to the importance of organized expeditions (Ames 2002; Louwe Kooijmans/Verhart 2007), perhaps aimed at procuring larger nodules. It is also possible that raw materials were brought to the site at the start of each occupation. This would be more in line with Binford's argument of embedded procurement (1979 (1983), 273-275) and residential mobility. Axes made of bones of aurochs (see Louwe Kooijmans 2003; Appendix I) at least indicate direct mobility to the southern upland coversand area.

5.5.6.5 From raw material patterns to mobility processes

The systems that have been sketched above have in common that they represent lines of contact rather than the mechanisms of mobility underlying them. Based on ethnographical and archaeological parallels (*e.g.* Dennell 1985; Kind 2006; Kelly 1995; Lovis *et al.* 2006[b]; Whallon 2006; Zvelebil 2006) and excluding trade and raids, three general systems of procurement may be outlined. The first involves intrinsic mobility in which those resources are used that, as it were, are found 'along the way'. This involves local outcrops of raw materials that are incorporated in the yearly round as well as adjustments of residential mobility patterns to include them. The second involves what may be termed expeditions. These are often logistical moves towards particular raw material resources with the distinct purpose of extracting them for use elsewhere. On may envisage that there is a zone of overlap between an expedition and a logistical foray (*sensu* Binford 1980) from a residential base in the relative vicinity of a raw material source. A third mechanism is formed by exchange, either in a down-the-line pattern, or of a more targeted nature.

Binford (1983(1979), 273-275) argues that raw material procurement was usually embedded within the scale of mobility related to subsistence activities (see also Crombé 1998, 61; Rensink 1995, 91), a detailed study by Gould and Saggers of the Western Desert Aborigines indicates the existence of 'Special-Purpose' procurement (see Gould/Saggers 1985, 120). The study argues in favour of the existence of ritual and social mechanics governing raw material procurement: '*… there is ample evidence that Western Desert Aborigines made special efforts to visit lithic sources, usually as part of a visit to an adjacent sacred site, but sometimes, too, in order to obtain raw material that was known to have superior technical qualities*' (*ibid.*). This 'exotic stone hypothesis' presupposes the existence of long-distance social relationships or networks enabling long-distance movement and exchange of lithic materials (*ibid.* 122). Furthermore it is argued that the utilitarian properties of the raw material, next to its accessibility, form an important factor in procurement strategies. This is demonstrated by a case-study of James Range in Australia, where despite the local availability of raw materials, usually within one kilometre of semi-permanent water supplies, a considerable amount of exotic lithic material was used. The latter has superior technological qualities and was procured for this very reason (Gould/Saggers 1985, 124-134; Andrefsky 2005, 239-243).

It is difficult to indicate which mobility processes best apply to the patterns sketched above. The archaeological resolution does not allow for detecting shifts in strategies, combinations between strategies or a clear-cut distinction between intrinsic procurement and exchange. In general it appears that residential mobility and expeditions may have contributed greatly to obtain raw material from sources with a general open access, while (down-the-line) exchange should be considered as well, perhaps for specific items.

With respect to the models discussed above it is plausible that the regular lithic procurement at sites on the southern and northern coversand is characterized by a system of intrinsic mobility. Local sources of flint were exploited by sites situated in their vicinity and these outcrops may have formed a distinct pull factor in settlement location choice. Similarly, for the southern coversand, Wommersom quartzite will have been exploited by intrinsic mobility, especially because of its considerable contribution to almost all assemblages. However, since not all of the sites where Wommersom is present are likely to form part of mobility cycles that included the Wommersom outcrop, it is likely that specific expeditions in combination with exchange form a distinct aspect of this system. Further research into the quantitative and qualitative contribution of GQW at (Late) Mesolithic sites may shed light on the specific mechanisms that apply. For the Hardinxveld wetland sites a different principal mechanism appears to be in place. These sites were not situated next to lithic resources, but in the vicinity of water, transport routes and faunal and botanical sources. Subsequently they acted as 'magnets' attracting and accumulating the necessary raw material for habitation in this area. Procurement strategies probably included material that was brought to the site from the previous residential base, but must also have included (long distance) expeditions as well as exchange. In contrast to the other sites emphasis here is directed more towards supplying sites with sufficient raw material from elsewhere, instead of residential moves towards resources.

Through this distinction we are afforded several glimpses of the character of Late Mesolithic settlement systems and mobility. The main contrast appears to be that between sites where consumers 'map onto' the majority of lithic resources in their mobility rounds and those locations where (lithic) raw material is brought in from considerable distances (see also Binford 1980, 10). The contribution of Wommersom quartzite for sites on the southern coversand represents an intermediary position in this respect as it will partially have been the result of intrinsic mobility or expeditions in combination with exchange. It might be argued that the consistency of the contribution of GQW at many sites may result from intrinsic mobility or expeditions in relation to shorter duration of occupation and frequent visits, characterised by a regular introduction of Wommersom quartzite to locations (see also Andrefsky 2005, 234).

5.5.7 Conclusions regarding lithic assemblage spectrum and raw material

The available information on the technological and typological composition of the studied assemblages and the raw material component is limited. Evidently the 'signal' of more specific or salient toolkits and systems of procurement has to an important extent been lost within the 'noise' of repeated occupations, activities and combinations of strategies (*e.g.* Smit 2010; Sommer 1991; see also Chapter 4). Furthermore the quantitative distribution of sites, as argued earlier, is biased towards the southern coversand area, implying that similarities and differences are mainly coloured with respect to this dataset.[58] Taking these aspects into account a number of general conclusions may be given.

- The group of sites on the southern and northern coversand and the river valley sites are mainly characterized by the importance of points in the tool spectrum. For most sites on the southern coversand points distinctly form a consistent dominant category. This underscores the importance of hunting activities. In most cases the typological differences between sites on the northern and southern coversand appear to be more gradual than fundamental. The limited number of sites on the northern coversand do demonstrate a more varied typological spectrum, while points and Montbani blades are typical for sites on the southern coversand. Next to this, both the technological and typological characteristics point to similarities between the southern river valley sites and those on the southern coversand. This is further supported by the contribution of Wommersom quartzite. This could indicate that sites in both areas were part of comparable systems of mobility.
- The wetland sites, in particular both Hardinxveld sites, demonstrate a distinctly different character in the tool spectrum of their assemblages. Non-formal tools, in particular retouched flakes, form an important component and point to an expedient technology. This is substantiated by the technological component which is convincingly flake-based. This contrasts most with the (importance of the) curated blade-based component and importance of hunting implements in assemblages on the southern coversand. These differences may suggest different technological systems, where expedient systems as at Hardinxveld may indicate a lower residential mobility (*cf. supra*). This divergent composition should, however, be understood against the wetland background of the Hardinxveld sites, their particular environmental context and related specific activity spectrum (see also Louwe Kooijmans 2003). Some of the wetland margin sites are adjacent to the northern coversand uplands and may be more related to sites there.
- In relation to both the technological and typological characteristics of the studied assemblages, the role of Wommersom quartzite in the spectra of sites on the southern coversand may be understood in particular in relation to the

production of formal tools such as points (trapezia) and Montbani blades. It therefore functioned as a raw material with a distinct purpose, intent and probably value.

- Regarding raw material procurement the main component in the systems of sites on the southern coversand, northern coversand and of river valley sites is formed by local sources of flint (of erratic or fluvial origin) that were mostly part of the intrinsic mobility round. The role of Wommersom quartzite in assemblages on the southern coversand should additionally be understood within a similar system of procurement, most likely in combination with targeted expeditions and exchange. Of a different nature is the type of resource procurement demonstrated at Hardinxveld. There a logistical system was in place which supplied this wetland location with raw material over considerable distances, most likely through expeditions in combination with exchange.
- The limited indications provided by the studied tool assemblages, as well as the problems involved in characterising them, form a further indication for the fact that the study of Late Mesolithic mobility and the character of its settlement system should be studied within the wider context of the sites and take into account aspects such as ecological context, site location choice, site structure, investment, raw material choice etc. (see Kelly 1992; Kent 1992, 635). Only a combined approach offers the opportunity to complementarily compare sites and evidence.

5.6 Discussion

The comparison of information from various categories in the preceding paragraphs will now be placed in an interpretative framework. The main emphasis will be placed on the degree to which the information may be understood with available models and information from ethnography. As has become evident, most information is available for the sites of the southern coversand group that are relatively intercomparable, and these contrast most with the the distinct wetland locations Hardinxveld-Giessendam Polderweg and De Bruin with their qualitatively different characteristics. The interpretative potential of the other sites and groups studied is quantitatively limited. The following section will introduce models for mobility and settlement systems and discuss the available evidence and diversity.

5.6.1 Data criticism and interpretative approach

The classificatory systems for a distinction in settlement types dating to the Mesolithic in the LRA have been discussed and criticized above, most notably those of Newell (1973) and Price (1978; see also Mellars 1976[a]). Criticism mainly centred on the fact that the sites used in the analysis dated to different phases of the Mesolithic and were not found within one regional context. Environmental variables or site location choice were not incorporated in the analysis either. Moreover, the models did not account for possible reuse of the same locations (*cf. supra*; see also Lanting/Van der Plicht 1997/1998; Niekus 2006; Raemaekers 1999; Verhart 2003; Verhart/Groenendijk 2005). Meanwhile, other studies have demonstrated that these locations often consist of diachronically inhabited, spatially overlapping units (*e.g.* Crombé *et al.* 2006; Peeters 2007; Rensink 1995; Séara 2006; Van Gils/De Bie 2008). Only sites that have been 'sealed' in a pristine state of a settlement system could potentially be classified in such a system (see also Binford's (1981[b]) 'Pompeii-Premise'). For the Mesolithic these situations have only rarely been documented and are not representative (*e.g.* Bokelmann 1986).

This evokes the question of what evidence for (Late) Mesolithic site function and settlement system we are left with. On the basis of the sites reviewed above it can only be concluded that almost all should be interpreted as time-averaged palimpsests of multiple visits to the same location and that there is often no closed association between artefacts, features and radiocarbon dates (*e.g.* Crombé *et al.* 2012). Due to reuse, spatial overlap, site formative processes, and absence of organic remains (see also Conkey 1987), resolution at most sites will remain coarse. Even the most informative episode of occupation at the wetland site of Hardinxveld-Polderweg (phase 1) is the result of 100-200 years of visits and activities.

This does not mean that most of the sites we study are uninformative, but it *does* mean that we should adjust our questions to the resolution at hand and 'tune in' to the type of signal that *is* present (see Chapter 4). Since most Late Mesolithic sites that are detected in the LRA can be seen as multi-component palimpsests of repetitive visits to the same location, questions should thus focus on their nature (see Jochim 1991, 315). Why did these locations develop into frequently visited sites, or 'persistent places' (*sensu* Schlanger 1992)? What is the rationale behind settlement location choice? Is there evidence for consistent structuring of space or investment in locations and activities? Which emphases are to be found in the overall artefact assemblage (see for example Bamforth 1991)? How do these relate to the environment and how does this differ from other persistent places?

While these questions will not lead to the identification of a site typology or reveal specific chronological developments, they are informative on (part of) the Late Mesolithic settlement system. In the following, results of the comparative analysis of Late Mesolithic sites presented above will be interpreted in the light of aspects of mobility and the settlement system. The distinction between logistic and residential mobility as proposed by Binford (1980) will be used as a starting point.

5.6.2 Theory on mobility

Before interpreting the archaeological patterning regarding Late Mesolithic mobility a number of theoretical aspects are presented. These form a framework for understanding the characteristics of and differences between the studied sites and their implications with respect to settlement systems and mobility.

5.6.2.1 Beyond foraging and collecting

A considerable number of ethnographic and archaeological publications have addressed, interpreted and categorized (hunter-gatherer) mobility (*e.g.* Bettinger 1999; Binford 1990; Habu/Fitzhugh 2002; Zvelebil 2006).[59] They present a wide and variable range of present and past hunter-gatherer settlement systems and form a good indication of the heterogeneity present (see Lovis *et al.* 2006[a], 175). Furthermore they present useful approaches for studying past mobility. Binford's 1980 paper, *Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems* *and Archaeological Site Formation* is one of the most influential contributions to the understanding of hunter-gatherer mobility (Fitzhugh/Habu (eds) 2002). In this article Binford distinguishes between two resource strategies with distinct patterns of mobility related to the exploitation of the natural environment. The first strategy, termed 'residential mobility', is characterised by frequent residential moves whereby camps are located or 'mapped' onto resource patches. Consumers are thus moved to goods. Binford termed these groups 'foragers' (1980, 5-7).[60] The other resource strategy is labeled 'logistical mobility' and is practised by what Binford terms 'collectors'. Base camps are located next to one critical resource or 'magnet location' which is exploited for an extended period of time. Other resources (food and non-food, see Binford/Johnson 2002, *viii*) are procured through logistical mobility, involving specialized 'task groups'. These might operate at a great distance from the base camp, moving goods to consumers. Technological investment in storage and facilities is common (Binford 1980, 10).

While foraging systems are most common for areas with (regular) resource patches or undifferentiated areas (*e.g.* the tropical rainforest), collector strategies are '*accommodations to [spatially and/or temporally] incongruent distributions of critical resources or conditions*' (Binford 1980, 5-10). These are often groups living in arctic or sub-arctic environments (see Kelly 1995, 120). Using Effective Temperature (ET) as a measure, Binford demonstrated the importance of the link between mobility and the environment.

The model stresses the strategies behind the patterns we observe and specifies the material consequences of hunter-gatherer behaviour in intersite variability in tool assemblages and site types (Habu/Fitzhugh 2002, 2). This latter aspect gave archaeologists potential tools for the interpretation of observed site patterning within a framework of 'Middle-Range' theory. Rensink (1995, 86) adds that the concepts not only reflect upon resource exploitation strategies, but also refer to other aspects of hunter-gatherer life, such as technological organization, social structure, anticipation and planning depth. While this adds to the value of this model, several points of criticism need to be raised.

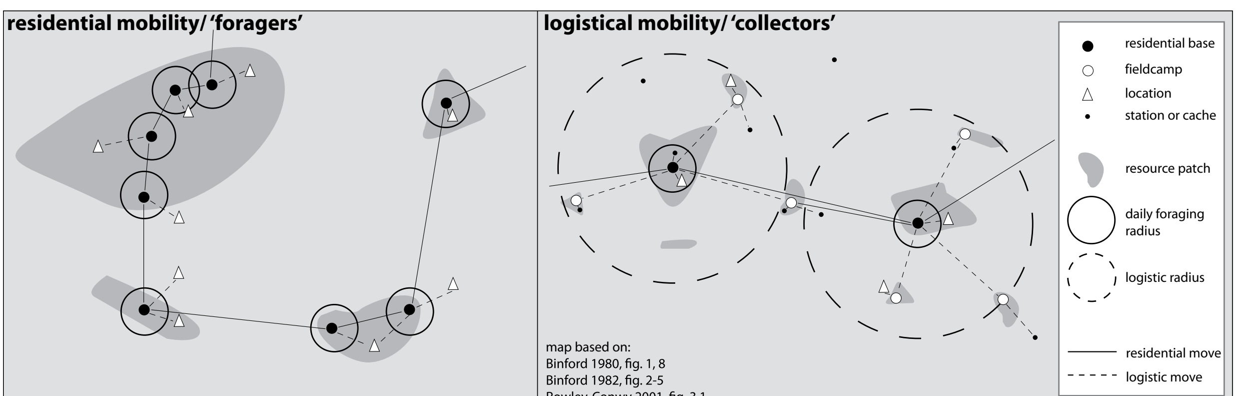
5.6.2.2 Criticism of the forager-collector model

While the forager-collector model provides a valuable tool for studying hunter-gatherer mobility and settlement systems, certain aspects of it and similar models (*e.g.* Bettinger 1999; Hayden 1981; Woodburn 1980) should be pointed out. The forager-collector model has been used to dichotomously categorize archaeological sites as belonging to one of either category (for criticism and examples see Binford/Johnson 2002, *xi*; Chatters 1987, 337-338; Kelly 1992, 45; 1995, 117; Raemaekers 1999, 118, but also 192; Rensink 1995, 99; and recently Crombé *et al.* 2011[b]). However, the concepts were not intended as '*polar types of subsistence-settlement systems*', but '*as a graded series from simple to complex*' (Binford 1980, 12). Foragers and collectors form broad generalizations on a continuum of resource strategies, with many intermediate and combined strategies in between (see Chatters 1987, 337). The central message therefore is that most of the actual mobility, as it was experienced by past groups of hunter-gatherers, involved a multitude of decisions at the agency-level of groups and individuals for a variety of predominantly economic, but also social, political and ritual reasons.[61] Mobility is also distinctly related to issues of age, gender and skill (*e.g.* Kelly 1992, 57), frequently leading to both group fissioning as well as aggregation (Chatters 1987, 348). It should thus be realized that mobility consists of a very complex, interrelated set of motivations, most of which are beyond our archaeological scope. Bearing these arguments in mind, one can only agree with Kelly (1992, 60; see also Chatters 1987, 337) that in order to arrive at a better understanding of mobility and sedentism, we need to understand that mobility is not just variable, but multi-dimensional.

While this places the forager-collector model in perspective it does not argue against its use. Many of the nuances introduced above lack characteristic material visibility. This makes them important as cautionary tales, but of less use to archaeology. The strength of the forager-collector model lies in its identification and contrasting of two very different resource strategies, each with a distinctive type of mobility, organization of movement, settlement pattern, material consequence and potential archaeological output. While the latter aspect is confounded by many of the factors mentioned above, most importantly redundancy in site use, the model offers two well-defined extremes for interpreting archaeological evidence for mobility systems, without denying that there is in fact much variability that should be accounted for (*cf.* Kelly 1995, 34).

From this perspective it is appropriate to use the forager-collector model as a heuristic framework for identifying and analyzing this variability, also with respect to archaeological evidence of mobility strategies and settlement patterns. A schematic representation of this framework has been depicted in fig. 5.42.

Fig. 5.42 Model of residential versus logistical mobility and ethnographic characteristics.



ethnographic reference

Characteristics:	
-common in mid- to high latitudes	-common in all latitudes
-common in continental or humid/tropical areas	-common in non-continental areas
-lower population densities/pressure	-higher population densities/pressure
-high famine mortality	-low famine mortality
-high % terrestrial	-importance of aquatic and vegetative resources
-no to little dependence on storage	-importance of storage
-high residential/low logistical mobility	-low residential/high logistical mobility
-limited site structuring/differentiation	-increased site structuring/differentiation
-low investment/limited facilities	-increased investment/facilities
-no or limited occupational specialization	-specialization
-no or limited territoriality	-territoriality
-no or limited exchange	-increased importance of exchange

based on:
Binford 1980; 1982; 1990;
Keeley 1988; Kelly 1995;
Price/Brown 1985;
Rowley-Conwy 2001

5.6.2.3 Site location, settlement structure and persistency

Site location and site structure are related to the possibilities provided and constraints imposed by the natural environment. The choice for a certain site location is often based upon the availability of crucial resources in the environment. These in turn influence the character of settlement as for example expressed in refuse areas, spatial structuring or features. It also constrains the spectrum of activities performed at a location and hence the specialized or broad nature of the toolkit and the technological choices made therein. Within the forager-collector model (Binford 1980) this 'targeting of resources' plays a crucial role. Within collector strategies, sites are located near a crucial resource and other resources are harvested in a logistic manner. Forager strategies exploit resources until the diminishing returns drop below a certain threshold (depending on the specific situation; see Kelly 1995) and subsequently move to a new location. As a result, base camps in a logistically mobile system are inhabited longer than base camps in a residentially mobile system. Based upon one of Schiffer's general principles (1995, 37), there is an inverse relationship between increased intensity of occupation and spatial correspondence between use and discard locations. While this does not preclude the factor of 'anticipated mobility' (see Kent 1992; Kent/Vierich 1989), it means that the degree of spatial structuring at sites that are inhabited for extended periods of time will be greater compared to sites that are not.[62] Additionally, within stable systems it can also be expected that, given the (seasonal) regeneration of resources, the frequency of reoccupation will be greater in residential systems. From this it follows that there might be an archaeologically detectable distinction between regularly occupied sites of some 'duration' with a certain degree of spatial structuring and investment and more frequently occupied sites with a more erratic character. While the degree of 'permanency' of base camps in both systems thus might be the same, there is a considerable difference in the frequency and duration of visits.

A note on persistency

In relation to the discussion on permanency outlined above, an alternative and complementary perspective is offered by the perspective of persistent places. Almost all Late Mesolithic sites analysed here can to some extent be characterised as persistent places. This generally means that sites have been used for extensive periods of time, but there are two important additional considerations. Firstly, different and non-exclusive time-scales might be active. For example, the temporally unrelated killing and butchering of aurochses at Jardinga on two separate occasions forms one end of the spectrum, while the extensive and consistent use of Mariënberg, or the seasonally repetitive occupation of Polderweg form another. Secondly, different motives may result in the long-term use of a specific location. In this vein, Schlanger argues that persistent places are locations that are repeatedly used during the long-term occupation of a region (1992, 97) and defines three main categories.

1. Persistent places that have unique qualities with respect to activities performed, such as the proximity of water, resources or good hunting grounds.

2. Persistent places that are marked by features that serve as a focus for reoccupation. This particularly relates to built environment, such as huts, houses, (storage) facilities etc. This category thus relates to what was defined above as 'investment'.
3. Persistent places as locations that through their long history of occupation harbour considerable quantities of cultural materials. These accumulations of material might become important structuring components of the cultural landscape and provide an exploitable resource of expedient or cached tools. Here sites are thus more or less defined as quarries, where necessary raw materials can be obtained by 'scavenging'.

While Schlanger's subdivision covers important motives for the development of persistent places, it is mechanistic in that only economic or material incentives are defined (see also Barton *et al.* 1995, 81). Various ethnographic accounts provide evidence for the fact that the 'fixedness' of mobility rounds to certain places is to a significant extent culturally motivated (*e.g.* Kelly 1992, 48; Kent 1992; Vickers 1989). Religious and political motives, marriage opportunities, trade and exchange might all have formed additional incentives for visiting the same locations over and over again. In this respect Barton *et al.* (1995, 110) particularly point out the range of meanings attached to features in the natural landscape and their meaning as boundary or reference point, means of transport and communication and for defining social and group identities. It is thus important to note that while economic or material considerations might have formed the initial reason to visit a certain place, other motives will, in time, have contributed to the persistency of these locations, or even have become the main reason for visiting.

The contrast sketched above indicates that from a general perspective there is a difference between persistent places in relation to the combination of a specific set of consistent conditions and persistent places that combine a multitude of motives, including considerations of distinct socio-cultural character. At the latter sites there may be a more consistent use of space over time, involving distinct place-bound structuring and investment. Specific places were sought out and physically altered, through structures and facilities, to cater to the (seasonally) recurrent needs of their inhabitants. The presence of huts, canoes, facilities such as fish weirs and considerable quantities of raw material point to a certain degree of inalienable 'ownership'; specific places seemed to have belonged to specific groups. A claim that might have been substantiated by the presence of burial grounds and depositions and that might have involved increased territoriality and appropriation of place (Kelly 1995; Littleton/Allen 2007, 295; Nicholas 2007[a,b]; Price/Brown 1985, 11; Rowley-Conwy 2001, 44; Zvelebil 2003[b]).

5.6.3 Implementation: site location choice and settlement structure

The section above presented a theoretical background and approach for dealing with (Late Mesolithic) hunter-gatherer settlement systems and mobility. This also highlighted the difficulties involved in relation to both the ethnographical variability and the (remaining) archaeological patterning of mobility. In the following the characteristics of Late Mesolithic occupation for the sites and regions studied will be discussed against this background.

5.6.3.1 Southern coversand area: consistent conditions

Most locations on the southern coversand lack internal structuring. In some cases (*e.g.* Weelde-Paardsdrank sector 5) flint knapping debris, remains of hearths, hazelnutshells and bones have been found together. While it can be argued that the absence of temporal resolution prevents a proper analysis of the contemporaneity of these activities and events of refuse disposal, the same argument can be used to indicate the absence of any consistency in the spatial structure of these locations. More important arguments are, however, found on another level. Most of the sites in the southern coversand landscape show similar characteristics in site location choice, mainly focusing on (sun-exposed) slopes of coversand dunes and ridges bordering on little streams or fens. Site location choice seems to have been less governed by a return to a specific place, than by a return to a specific set of conditions existing within a known patch or rich area with respect to resources, water and perhaps wildlife diversity (Amkreutz 2009; Van Gils *et al.* 2009; Vanmontfort *et al.* in press). This led to the development of extensive site complexes of chronologically mostly unrelated, yet spatially contiguous and overlapping clusters and concentrations (see also Vanmontfort *et al.* 2010[b], 48). At Lommel-Molse Nete and Opglabbeek-Ruiterskuil recent prospecting research was able to indicate the large extent of these scatters of finds. At Opglabbeek the 1971 excavation measuring 145 m^2 could for example be correlated with an area of 20000 m^2 yielding Mesolithic finds (see Van Gils/De Bie 2006). Despite the taphonomically limited resolution this points to a high degree of redundancy, correlation between activity and refuse areas and a generally limited investment in features other than occasional hearths. Thus, many aspects of these sites point to a considerable level of residential mobility.

5.6.3.2 Wetlands and wetland margin: from space to place

The consistency in site location choice and settlement structure as exemplified by Hardinxveld-Polderweg and De Bruin contrasts with the characteristics outlined for the southern coversand area above. Analogous to the 'positioning strategy' employed by collectors (see Binford 1980, 14-15) these sites are evidently located near, or within an area of (critical) resources. The elaborate wetlands provided water, shelter and an abundance of wildlife and vegetable sources. Next to terrestrial species, aquatic resources such as fish, beavers and many species of birds could be procured. Furthermore many species of wood and other botanical resources such as waternut (*Trapa natans*), yellow waterlily (*Nuphar lutea*) and waterlily (*Nymphaea alba*) were available (Bakels/Van Beurden 2001). Although it is evident that the fens and small streams of the southern coversand also provided 'rich' elements within the landscape, the scale and character of the wetlands of the (Dutch) delta form a difference of kind rather than degree. As demonstrated, for instance, by the seasonal information available for Polderweg and De Bruin (see Louwe Kooijmans 2003; *cf. infra*) these extensive wetlands provided a highly sustainable landscape enabling an occupation duration of up to several months. There is evidence that the sites were used on multiple occasions during the year (see Louwe Kooijmans 2001[a,b]). From this it follows that residential locations in this area are liable to be characterised by an increased level of spatial structuring and investment. This is confirmed by the archaeological evidence of both Polderweg and De Bruin. Both sites were located at a considerable distance from dry land, which over time only increased (see Louwe Kooijmans 2001[a], fig. 15.3a). Furthermore, out of the many available locations, the rather small donk of Polderweg and, later on, the donk of De Bruin were specifically selected for establishing residential bases (see also Louwe Kooijmans 2001[a], 449). This implies investment in transport over water in order to reach these locations and this may have been preferred above a site location in the wetland margin.[63] It also implies that specific places were targeted, although there was in fact more or less an 'archipelago' of locations with similar qualities (*e.g.* Verbruggen 1992[b]). The entire array of motivations for revisiting these locations is not within the scope of archaeological resolution, although it is likely that economic reasons, next to physical site location arguments, were only part of the story (see Barton *et al.* 1995; Schlanger 1992). The effects can be documented in the continuity represented in radiocarbon dates, the consistency in seasonality and the amount of material that was brought to the site. From a spatial perspective, the continuous and recurrent structuring of the site forms a further argument for a consistent use of space. This involves the existence of a living area on the top and on the slopes of the dune, activity areas on the slope and at the foot and refuse disposal areas in the bordering marsh. It represents a consistent, graded use of space practised over a considerable length of time. The degree of spatial structuring, the level of redundancy and the 'fixedness' of these locations point towards a logistical, collector-type mobility strategy.

5.6.3.3 Northern coversand area and river valley sites: within the continuum

Unfortunately most other sites are less informative. Hearthpit sites such as Mariënberg or Hoge Vaart are located at the convergence of ecozones, which may have provided possibilities for an extended stay. The resolution of the ^{14}C data and the absence of clearly associated faunal remains prevent an indication of the actual length of stay. The hearthpit sites found on the river dunes at Swifterbant suffer from the same problems. Hypothetically, the duration of occupation at hearthpit sites might be anywhere between the average site occupation on the southern coversand and the seasonal occupation of for example Polderweg. Investment in specific facilities such as hearthpits (see Perry 1999; Verlinde/Newell 2006) and the (questionable) spatial structuring with respect to flint knapping argue for more integrated spatial structuring. Similar conclusions may be reached for other sites. Bergumermeer-S64B for example was located on the margin of an extensive lake, providing rich resources. This might be correlated with the presence of indications for spatial structuring as demonstrated by features, hearths, postholes and manuports (see Newell 1980). More evidence for an extended stay and increased spatial structuring is provided by the southern river valley sites. Liège-Place St.-Lambert, Remouchamps-Station LeDuc and to a lesser extent Namur-Grognon are all located in the margins of rich floodplain environments of middle-sized to large rivers. While all sites show evidence of considerable investment, most emblematically demonstrated by the stone-based structures (Gob/Jacques 1985; Van der Sloot *et al.* 2003), both Liège and Remouchamps also provided evidence for spatial structuring.

5.6.4 Features and 'investment'

Next to site location choice and internal settlement structure, 'investment' in structures, facilities and places in general has also been mentioned as an important factor for determining the degree of mobility (*e.g.* Binford 1980; 1990; Chatters 1987; Kelly 1992; 1995; Kelly *et al.* 2005; Kent 1992; Rafferty 1985). This factor is also correlated to a significant extent to the environment. Basically the availability of resources at a certain location determines the sustainability of its occupation (see Rafferty 1985, 119). In forager systems resource deficiencies are solved by residential mobility. Diminishing returns, especially with respect to subsistence, form a major incentive to move (Sahlins 1972; Kelly 1992; 1995, 132-141). In collector systems the problem of diminishing returns is tackled by logistical mobility. Task groups move out to procure specific resources which are brought back to the residential camp (Binford 1980, 10). These may be bulk resources and storage may be necessary (Binford 1980, 15; Chatters 1987, 337). From this it follows that the residential base thus functions as a 'hub' or central node within the logistical system (see fig. 5.42). Since residence is changed less frequently it becomes worthwhile to invest in more solid structures, dwellings, facilities, storage capacity etc., all the more since these locations would be used frequently over time. Special notice should be made of so-called 'anticipated mobility' (Kent 1991; 1992; Kent/Vierich 1989), related to Binford's 'planning depth' (1976; 1979 (1983)). This is the hypothesis that the length of time people *plan* to occupy a camp is an important determinant of factors such as site size, number and size of dwellings, structures and facilities.[64]

Late Mesolithic features and investment in relation to mobility and settlement system

Based on a review of the variety and quantity of features and artefacts present at sites, the southern coversand locations studied are characterised by short-term occupations with a limited degree of investment. The opposite could be concluded for the wetland locations of Hardinxveld-Polderweg and De Bruin and the southern river valley sites. Information regarding hearthpit sites and other locations is more difficult to interpret. Hearthpits may have formed a specific facility as well as the investment in stone pavements at the sites in the Meuse valley near Liège.

In the following a number of characteristic aspects of 'investment' will be discussed in more detail. These are subsequently followed by a (brief) discussion in relation to the evidence provided by the studied sites and its repercussions for Late Mesolithic mobility and the settlement system.

5.6.4.1 Dwelling structures

Cross-cultural studies demonstrate that investing labour in dwelling structures is often related to reduced residential mobility (Gillman 1987; Kelly 1992).[65] Kent (1992) provided links between population size, anticipated mobility and number and size of houses, while Rafferty (1985) acknowledges a certain connection between sedentariness and housing, but also stresses the various nuances in it. Binford (1990) stresses the strong link between the type of housing and its environmental setting. He suggests that there is generally an inverse relationship between mobility and investment in housing (1990, 120) and further distinguishes some broad patterns. A first concerns the fact that among modern hunter-gatherers shelters are almost always found at residential sites. However, since shelters are often expediently constructed they might leave no trace in the archaeological record, often leading to misinterpretations in site typology (*ibid.* 120). Binford (1990, 123-130) introduces several broad patterns observed in housing among almost 200 groups of historic and proto-historic hunter-gatherers, related to different systems of mobility. The most important trends have been summarized in table 5.15.

Several trends can be noted. Very mobile people tend to construct circular or semi-circular dwellings, while elliptic forms are characteristic of semi-nomadic groups. Rectangular forms seem associated with more sedentary communities (Binford 1990, 123). This could be related to the fact that more mobile dwellings such as tents and some huts tend not to be rectangular. Rafferty (1985, 130, based on Flannery 1972) adds that rectangular shapes increase flexibility in the use of walls and addition of new rooms. These are features that might be of importance when structures are inhabited for a longer time.

The investment in placement of the dwelling increases with sedentariness. Very mobile groups tend to place their structures on the ground surface, while less mobile groups increasingly invest in preparation of the house site. This also relates to the portability of dwelling structures (*e.g.* hides, posts etc.) and the availability of local materials around the site location. Low investment is related to the scale of mobility and transport costs, while high investment is related to the planned duration of stay or planned reuse (Binford 1990, 124; see also Janes 1983, cited in David/Kramer 2001, 288).[66] Other evidence is provided by the similarity in wall and roof material in primary and alternative housing, which is related to either a very homogeneous type of mobility or almost no residential mobility at all. Seasonal contrasts in mobility and social and activity-related variability tend to yield greater numbers of alternative housing (*ibid.* 127). Wall and roof material in mobile groups are often the same (*e.g.* hide tents or ephemeral structures of branches), while roofing material is either transportable (*e.g.* hides), or locally accumulated (*e.g.* vegetation or bark). With less mobile groups there is more

Table 5.15 Major correlations between housing and mobility. Based on Binford (1990).

mobility **housing aspects**	**fully nomadic**	**semi-nomadic**	**semi-sedent.**	**fully sedentary**	**comments**
ground plan	(semi)-circular	semi-circular/elliptical	rectangular	rectangular	
structure placement	ground surface	ground surface/semi-subterranean	semi-subterranean/ ground surface	semi-subterranean	
investment	low, related to mobility/transport costs	intermediate	intermediate	high, related to planned duration and re-use	
wall and roof material in primary houses	same	same	different	different	
wall and roof material in alternative houses	same	same	same	different	
roofing material	hides/grass/bark	grass/earth/mats	wood/earth/ grass or bark	wood/bark/grass	related to transportability and environmental productivity
interpretation primary roofing material	transportable	locally accumulated	increased investment	increased investment	
alternative housing	mainly absent	present	present	mainly absent	characteristic of semi-nomadic and semi-sedentary hunter-gatherers
roofing material alternative housing	grass/bark/earth	increase in hides	bark/mats	increase vegetative material	related to productivity environment

difference between wall and roofing material and the latter might require more investment. Alternative housing is most common in semi-nomadic groups and it is here most differences are noted between primary and alternative houses. In very mobile groups the same type of housing is used in all seasons, while in sedentary groups there might be a difference in roofing of summer and winter houses (*ibid.* 129-130).

One important trend emerging from the hunter-gatherer dataset used by Binford (1990) is the unmistakable relationship between a dependence on hunting and the portability of primary housing (*cf. supra*; see Binford (1990, table 11)). Binford (1990, 137) argues that since prey animals move and are differentially responsive to shifting productivity in plant communities, as well as more difficult to kill, this ensures that hunters of these animals exploit larger ranges and will be quite mobile. In short, terrestrial hunters make many more residential moves per year, travel much greater distances over an annual round, and in turn exploit vastly larger areas than do aquatic resource exploiters (see also Kelly 1995, 130-131). This would potentially lead to (archaeologically) traceable differences in housing.

Implementation: dwellings and mobility in the LRA Late Mesolithic

The ethnographic framework presented above only provides general trends in correlation between housing and mobility, but the information is of some value for the sites studied here. First of all, for the LRA and to a certain extent Northwestern Europe in general, there is little evidence for (Late) Mesolithic dwelling structures with a rectangular shape (*e.g.* Grøn 1995; 2003; Hamburg/Louwe Kooijmans 2001; Karsten/Knarrström 2003).[67] On the other hand rectangular shapes do occur in the slightly later Swifterbant culture as for example demonstrated at Swifterbant-S3 and perhaps at Hüde I (see Appendix I) and the subsequent Hazendonk group (see Houkes/Bruning 2008; Kampffmeyer 1991; De Roever 2004; Raemaekers *et al.* 1997; Stapel 1991). They are therefore potentially related to changes in social structure and mobility patterns, possibly related to the incipient stages of agriculture.

Based on this data it is more likely that the evidence for dwelling structures in the Late Mesolithic should be attributed to fully mobile or semi-nomadic groups (see table 5.15). Within the Late Mesolithic some differentiation is visible. The absent or vague indications for dwelling structures provided by sites in the southern coversand landscape (see 5.4.4.5) may point to the existence of ephemeral dwelling structures, which were either transportable (tents) or made expediently of locally available resources (see Binford 1990, 122-124). Sites such as Meeuwen and Weelde provide limited evidence for this (Pilati 2001; 2009). Potentially increased investment in dwelling structures is provided by sites located in rich environments allowing for longer site duration and thus investment. The sunken dwellings of Hardinxveld-Polderweg and De Bruin and the energetic investment in stone pavements and dwelling structures at Liège and Remouchamps provide the best example for this.

It is not possible to directly associate the general absence of structural dwellings on the southern coversand with a fully mobile settlement system, or for that matter the more structural evidence for dwellings, including the semi-subterranean dwellings, with semi-nomadic groups. It can, however, be assumed that the absence of structural dwelling structures is related to a higher residential mobility, including factors such as portability and expedient use of materials. This would be in line with the character of occupation established so far for sites in the southern coversand landscape as well as several other locations. Conversely it is likely that structural investment 'pays off' in a situation where an increased sustainable occupation is possible. Extensive wetlands and larger floodplains are the most likely settings for this scenario.

5.6.4.2 Burials

Burials may form a further indication of investment in distinct places and reduced residential mobility. Binford (2004) was able to distinguish several universal trends between beliefs about death, mortuary practices and the character and mobility of hunter-gatherers.[68] One of the clearest important trends is the relationship between disposal area, group size and mobility. Binford (2004, 7) suggests that burial, or mortuary practice for that matter, might occur at any given moment and is thus not necessarily related to archaeologically detectable places such as settlements. Disposal of the deceased is thus not geographically and temporally bound, or not very much so. According to Binford (*ibid.*, 10) this observation is most consistent for hunter-gatherers with a high degree of mobility, *i.e.* foragers. On the other hand, the use of small cemeteries for disposal of the dead, often associated with traditional family space, is most common among groups of hunter-gatherers where extended families form the core unit of the group (Binford 2004, 7). These groups are associated with a lower degree of residential mobility and generally comprise collectors (*ibid.*, 10-11). Choice of burial location is therefore related to both the degree of residential mobility and population density (*ibid.*, 8, 9). There is thus a correlation between settlement pattern and disposal practices, whereby the use of small cemeteries or specific locations is inversely related to residential mobility.

In addition Littleton and Allen (2007, 294) argue that cemeteries might have been less planned than is often assumed and their development and maintenance is interwoven with the perception of certain locations as 'persistent places'. The existence of burials at these sites might have structured subsequent actions, creating a meaningful landscape (Littleton/Allen 2007, 295). Burial areas therefore are created by *'a process of accumulation over time, and may in turn, by becoming mortuary landscapes, structure human activity and contribute to the landscape of meaning.*' (*ibid.*, 295). There might thus be a difference of degree between isolated burials and cemeteries. Which locations developed into 'persistent places' and were seen as suitable for burial of course remains unanswered. Nevertheless, there are ethnographic as well archaeological indications for a correlation between ritual activities such as deposition and burial and specifically wet locations, or wet margins (Koch 1999; Larsson 1990[a,b]; 2004; 2007[a,b]; Littleton/Allen 2007; Nicholas 1998[a,b]; Nicholas 2007[b]; Peeters 2007; Zvelebil 2003[b]). In this respect it need not only be down to taphonomy that the best indications for Late Mesolithic burials have until now been found in wetlands.

Implementation: burials and mobility in the LRA Late Mesolithic

The overall evidence for Late Mesolithic burial and cremation, let alone cemeteries, is not unambiguous and restricted to only a few sites (see section 5.4.4.6; see also Louwe Kooijmans 2007[b]). The evidence is restricted to calcined but undated remains at Hoge Vaart-A27 (Peeters/Hogestijn 2001), disputed (see Louwe Kooijmans 2007[b]; 2012[b]) sitting graves at Mariënberg (Verlinde/Newell 2006; *cf. supra*), loose and undated bone material at several other sites, including Swifterbant locations (Constandse-Westermann/Meiklejohn 1979) and inhumations as well as stray bone material at Hardinxveld-Polderweg and De Bruin (Louwe Kooijmans 2003; 2007[a]). The latter two sites provided most evidence for structured and continued mortuary practices of both humans and dogs (see Appendix I; Louwe Kooijmans 2007[b]).[69]

Overall, burial practices only form a limited indication for investment and restricted residential mobility. There is no evidence to suggest that burial locations were only maintained in places with increased duration of occupation, or that the deceased were specifically brought to these sites. If evidence from the preceding Middle Mesolithic is included then cremation graves are for example known from typical upland locations such as Dalfsen-Welsum and Oirschot V (Verlinde 1974; Arts/Hoogland 1987). Recently another Middle Mesolithic cremation grave has come to light at the river dune site of Rotterdam-Beverwaard (see Appendix I; Zijl *et al.* 2011).

Both ethnographic and archaeological studies indicate that many motivations underlie the eventual outcome of mortuary practices (*e.g.* Binford 2004; Hertz 1907; Nilsson Stutz 2003; Parker Pearson 1999). In spite of this variability in origins it can be suggested that there is a possible reason for the development of small cemeteries within the Early Neolithic Swifterbant communities (see Louwe Kooijmans 2007[b]). The Swifterbant cemeteries are characterised by a distinct uniformity in layout, orientation and tradition, also involving practices of reburial and manipulation of bones. This suggests a certain 'fixedness' of these locations resulting from repeated visits and a possible lower residential mobility. It can be argued that Late Mesolithic burials such as those of Polderweg and De Bruin, under less intense but comparable conditions, were also specifically located at these sites. They may form early examples of mortuary practices that perhaps did not take place in relation to small fixed cemeteries, but represented more than a coincidental burial ground.

Finally it should be stressed that while the limited evidence for mortuary practice in the form of burial may hint at relationships between people and (persistent) places, many of the other disposal practices and forms of body treatment go unnoticed. Their limited visibility and less structured archaeological nature however do not suggest a less intensive potential relation to place.

5.6.4.3 Storage

A further issue that should be addressed with respect to investment and reduced mobility is storage. This is generally perceived as an important mechanism accommodating a lower residential mobility as well as a larger group size and to deal with issues such as scarcity and seasonality (*e.g.* Anderson 2006; Binford 1980; Chatters 1987; Cribb 1991; Jochim 1991; Kelly 1992; 1995; Kent 1992; Smith 2003). Others have additionally interpreted storing as an important feature of emerging complexity (Price/Brown 1985; Keeley 1988; Testart 1982), especially since it might conflict with the basic rule of sharing among foragers (*e.g.* Bird-David 1990; 1992[a]). In this perspective storing is thought to develop in 'rich' environments, where the accumulated resources might lead to the development of social hierarchies. According to Binford (1980, 15) storage enables hunter-gatherers to solve the problem of temporal incongruity of resources beyond their period of availability in the habitat, but it develops mainly as a response to specific environmental conditions. It is thus much more a tactic to insure against consumption shortfalls during the non-growing (winter)season (1990, 140). Binford does agree that storage is mainly (but not absolutely) a feature of logistic strategies (1990, 133, 144-146). These strategies, often characteristic for higher latitudes, cope with the temporal incongruity and increased amount of time spent searching for resources. Storage in this respect can be advantageous since it might prevent high-risk residential moves in the lean season. Storage can thus be seen as indicative of a decreased residential mobility and an increased investment in certain locations and facilities.

Implementation: storage in the Late Mesolithic LRA?

There is no positive evidence for storage at Late Mesolithic sites in the LRA. This may relate to the problems surrounding storage in a temperate climate, but is also importantly a taphonomic problem; cached organic resources will not have been preserved. Pits or other storage structures might not have been preserved or recognized as such either. Furthermore, despite its tough qualities, one of the most suitable staple foods, hazelnut (*Corylus avellana*), has only been found in limited quantities. If their high caloric value formed a substantial contribution to Late Mesolithic subsistence, then it is remarkable that, in view of the storage capacity needed for their use and the amount of waste that might have been produced (see Cappers/Ytsma 2002/2003), no substantial evidence for storage facilities have been found in the Late Mesolithic over large parts of Northern Europe. Only a few secondary indications exist for storage. On the southern coversand burnt hazelnut shells are sporadically found, sometimes in concentrations (see Huyge/Vermeersch 1982). The site of Havelte H1 yielded several small elliptical and circular features which on the basis of their differing fill were interpreted as possible storage facilities (Price *et al.* 1974, 23). Pits were found at Mariënberg, Hoge Vaart-A27 and Bergumermeer-S64B and it is possible that the function of hearthpits, as found at many sites in the north or on river dunes, includes the preparation of food, such as the roasting of hazelnuts. The stone structures of Liège-Place St.-Lambert-SDT could have served as storage platforms (see Cribb 1991), although an interpretation as facilities for smoking fish is more likely (see Marchand *et al.* 2007). The wetland sites of De Bruin and Polderweg also yielded pits and postholes that might point to (storage) facilities. Botanical remains such as hazelnuts, acorns (*Quercus*) and apples (*Malus* sp.) were present there as well. No features or finds, however, yielded positive evidence for storage. Based on the considerations above it is most likely that evidence for storage can be found in locations where increased duration of occupation is to be expected.

5.6.4.4 Boats and canoes

Another element of investment is less obvious, but may involve those aspects of technology that require a distinct investment in time, energy and resources. Of particular importance in this respect is the example of boats or canoes. The importance of wetlands and aquatic resources for a logistical type of mobility and even socio-economic complexity is recognized by Ames (2002). Elaborating on

Binford's (1990) arguments, Ames focuses on the consequences of the development of aquatic technology, more specifically on the impact of boats and transport technology (Ames 2002, 20). Using ethnographic examples of hide and logboats (canoes), three important aspects are discussed. The first involves the increased distance that might be covered by boats. Based on weather circumstances, location (sea, river, lake), current and crew, accounts on average distance per hour diverge, but range between *c.* 3 and 7 km/h. The daily distance covered might amount to as much as 40 or even 90 miles (Ames 2002, 30). Another important aspect involves transport capacity, both of people and freight. Large canoes, exceeding 10 m in length, might carry 10-15 people or up to 5 tons of cargo (Ames 2002, 29). Although the Late Mesolithic canoes found in the LRA are much smaller (*c.* 5 m; see Louwe Kooijmans/Verhart 2007), this does indicate the increased capacity in 'moving goods' compared to pedestrian transport. This not only impacts on weight, but also on 'bulk'. Sizeable goods, such as large quantities of nuts, or complete carcasses, might be transported to the residential base (see also Hodder/Orton 1976, fig. 5.13). This also affects the amount of preparation and processing that needs to take place in the field, rather favouring processing activities at the residential site or destination (*ibid.*, 39). Instead of distance to homebase, the crucial decision in transport might have become the distance to the boat. Another, more typical, example involves the use of canoes in harvesting waterplants. Ames (2002, 29) describes the way in which North American Chinookan women used canoes as 'floating baskets' to harvest corms of *Sagittaria latifolia* (broadleaf arrowhead).[70] Spearing and netting of fish might also have involved canoes (see Louwe Kooijmans 2005[c], 183; Louwe Kooijmans *et al.* 2005, plate 12).

A further aspect mentioned by Ames involves the implications of having and using boats. Canoes (and paddles) require a considerable initial investment as well as a high ongoing one (they might need to be wetted down (on sunny days), covered and repaired). This is costly with respect to time and energetic investment. Using and maintaining canoes is therefore most worthwhile in mobility systems that are fairly stable and rely on fixed points of consistent duration in the yearly cycle. Canoes therefore enlarge the (logistical) foraging radius and transport capacity of hunter-gatherers. This influences their net nutritional gain, and from this perspective also the duration of occupation as well as group size. Furthermore boats, while requiring investment and maintenance, enable hunter-gatherers to reach inaccessible or remote places and facilitate intergroup contact. This of course has advantages for marriage networks, trade and exchange and specialization (Ames 2002, 44).

It might thus be concluded that the presence of boats or canoes most likely indicates a relatively stable settlement system, within a collector type mobility system (goods are brought to consumers), as well as investment in place, facilities and technology.

Implementation: canoes in the Late Mesolithic LRA

The actual evidence for Late Mesolithic canoes is limited. Apart from the rather small early Mesolithic vessel found at Pesse, most Late Mesolithic evidence in the LRA is provided by one complete canoe from Hardinxveld-De Bruin as well as several fragments. Furthermore there are paddles from Hardinxveld-Polderweg and Hoge Vaart-A27. Later evidence includes canoe fragments from Bergschenhoek, the Hazendonk and Wieringermeer, as well as paddle blades from Swifterbant, the Hazendonk and Hekelingen (see Louwe Kooijmans/Verhart 2007). Most of the canoes and some paddle blades show distinct affinities with Scandinavian and western European examples (*ibid.*).

The presence of canoes in the LRA seems to be linked to sites that are located in extensive wetland settings such as those of the Dutch delta. Riverine and coastal transport might also have taken place. Exclusive exploitation of smaller bodies of water such as fens or streams might not have been profitable, keeping in mind the costs of making and maintaining these vessels. From this it follows that canoes, to a certain extent, form an indication for the stability in site location choice and the investment in these places and their facilities (the erratic character of many of the coversand sites do not seem to accord with this). This indicates that they also form a good secondary indication for the trophic richness of the environment. As such, they better fit collector-type mobility strategies.

Louwe Kooijmans and Verhart (2007) reflect on the possible use of these vessels for long distance transport of flint and other raw materials (the site of Polderweg for example yielded a precore of Rijckholt flint weighing 4 kg and other large stones), but they wonder whether the light canoes and slender paddle blades of Hardinxveld were suitable for long distance travel. Nevertheless, while the 150 km journey to the Rijckholt source location might not have been an option, these vessels were capable of navigating the extents of the 'widening' delta, reaching both coastal areas as well as the margin of the coversand and enabling riverine travel. This, in combination with the advantages in food procurement and personal mobility, argues in favour of perceiving canoes both as conductors for contact and exchange and accelerators for increased investment and stability. Because of their range and capacity they might increasingly tether mobility to fixed locations from which to exploit wetlands. Although the archaeological signal is limited, the effects of aquatic transport on communities compared to largely pedestrian hunter-gatherers should not be underestimated.

5.6.5 Toolkit and technology

Aspects of technological choice, toolkit composition and raw material use have been extensively discussed above. This yielded several important considerations with respect to mobility, that may be interpreted in relation to ethnographic models and systems of mobility as well.

5.6.5.1 Technological choices

Concerning technology a distinction was made between emphases in curated technologies as opposed to more expedient technologies. The increased use-life and reliability of the former type (Andrefsky 2005; Kelly 1992; Ugan *et al.* 2003) was mainly associated with (retouched) blade technology and formal tool production of for example trapezes and artefacts such as Montbani blades. This could be correlated to the character of the toolkit and the demands placed on the reliability of hunting equipment, especially on the southern coversand, forming an indication for increased mobility. The main contrasts to this system are again provided by the wetland locations of Polderweg and De Bruin. Curated technology and formal artefacts only formed a minimal contribution to the lithic assemblages of these sites, while expedient technology was favoured most. This could tentatively be coupled with a reduced residential mobility (see section 5.5.3.3).

Additionally, evidence for other technological investments was documented in the wetlands. Arguably this is primarily a taphonomic pattern, since the archaeological record on the coversand is biased towards lithics and will originally also have included an important organic component (of which some evidence remains; *e.g.* Arts 1994). The available wetland evidence includes investment in bone, antler and wooden artefacts such as axes, chisels, awls, hammers, sleeves, points and needles, hafts, shafts, bows, boards, spears, paddle blades, and canoes (see above) as well as rope and fish weirs (*e.g.* Louwe Kooijmans 2003; Louwe Kooijmans *et al.* 2001[c]; Out 2009). The technology required to produce these materials is costly in terms of time and energetic investment. It is difficult to quantify and correlate this, however, it appears that many of the artefacts mentioned above require time, investment and application that is not characteristic of the settlement structure and suggested mobility pattern for the upland coversand area. Moreover, several artefacts (spears, paddle blades, canoes, fish weirs) are typical for a wetland environment. Fish weirs furthermore indicate the existence of passive hunting tactics, involving investment in use and maintenance of untended (trapping) facilities. Other tools such as axes, hammers and chisels also point to activities directed at woodworking, which involve investment in place and a developed degree of environmental structuring and even management. It seems hard to imagine that this complete set of facilities and tools was also common to the base camp inventory of residentially more mobile groups on the coversand, where the available (lithic) evidence mainly stresses investment in (terrestrial) hunting equipment.[71]

5.6.5.2 Typology and resource procurement strategies

From a typological perspective one of the most distinct characteristics is the contribution of points to the assemblages of sites on the southern and northern coversand. A distinct difference of degree could be documented with respect to other sites. The degree of homogeneity documented for the larger set of assemblages on the southern coversand also indicates that over time the generic types of functions these sites had and thus the possible combinations of artefact sets were more limited (see Binford 1980, 12).

Resource procurement theory

According to Binford (1990) the changing variability in plant communities as one moves farther from the equatorial zone induces an increasing focus on animals in order to provide for the food needs of human communities. Furthermore, the presence of foods requiring a minimal search time decreases in a graded fashion. In areas without abundant aquatic resources this means an increased dependence on terrestrial animals, for which the search time and attendant mobility costs increase gradually with latitude (Binford 1990, 133-135). Despite richer locations such as the ecotones formed by peat fens (meres) and the margins of small stream valleys, no elaborate wetland resources are available on the coversand uplands, such as the Campine region. This substantiates the importance of terrestrial resources in these areas and a more homogeneous composition of the range of resources available (see also Brouwer-Burg 2012).

Bow-and-arrow hunting predominantly aims at procurement of terrestrial fauna in the form of larger ungulates such as red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), aurochs (*Bos primigenius*), and wild boar (*Sus scrofa*).[72] A useful concept in this respect is predation mode. In general there is a distinction between 'pursuit modes' in which (a group of) specific prey items is hunted and other species are ignored, and 'search modes' in which any acceptable prey item is targeted in an opportunistic manner (see Chatters 1987, 350). The latter strategy is similar to Binford's 'encounter strategy' which is most typical for foragers (1980, 5). A more general distinction that can be made is between active and passive hunting strategies. The former refers to both forms of predation mode mentioned above, while passive strategies involve a time delay and placement of (costly) facilities such as nets, fish weirs and traps.

Shott (1990, cited in Kelly 1992, 55) argues that groups with a higher residential mobility, such as foragers, would produce assemblages with a more homogeneous spectrum (strong positive correlation). This limits site variability and enables a classification of these locations as base camps with, in this case, a distinct 'hunting character'. This raises the question what this means for issues such as mobility and investment.

Implementation: evidence for patterning?

Assuming that the composition of the mentioned assemblages is indeed equivalent to the relative importance of certain activities within the overall spectrum, then the consistent contribution of points (and artefacts such as Montbani blades) can only reflect the importance of terrestrial hunting for locations on the (southern) coversand (see Chatters 1987, 342). This is supported by the specific role of GQW in the fabrication of points and Montbani blades at sites on the southern coversand (see section 5.5.5.3). This contrasts with the broader, more general and expedient character of the assemblage spectrum at other places, most notably at both Hardinxveld sites where the toolkit is distinctly characterised by retouched flakes.The absence of informative faunal data for sites on the upland coversand prevents an adequate assessment of prey spectrum and predation mode being made. General inferences as to the most likely strategy, based on the site characteristics analysed above, may, however, be drawn. There is no evidence suggesting that only one or several species were hunted. This argues in favour of a more opportunistic search mode of predation. Supposing that comparable environmental conditions existed on the coversand a similar strategy might be expected for different locations, which would be in line with the level of homogeneity in site structure and artefact assemblage. In view of the indicated degree of residential mobility, it is unlikely that passive predation techniques formed an essential element of the subsistence strategy on the (southern) coversand. In the case of frequent residential moves and absence of elaborate aquatic resources, investment in the fabrication, use and maintenance of facilities and implements is a less viable option. From this it follows that the predation strategy most in line with the structural character of the sites and their assemblages within the environmental context, would be an active search or encounter strategy, predominantly focusing on the above-mentioned ungulates.

5.6.5.3 Raw material use

Within larger areas individual but associated bands use the available resources within the limits of their own territories, which may overlap (Kim 2006). The use of specific 'exotic' raw materials has regularly provided useful clues for both the range of these groups as well as the composition and extent of larger territories (see Lovis *et al.* 2006; Pasda 2006; Randolph Daniel Jr. 2001; Rensink 2005; Whallon 2006; Yven 2005; Zvelebil 2006). The range and character of mobility and territoriality is often interpreted, not only from an economic perspective, but also as a social 'safety net' (Whallon 2006, 260; see also Zvelebil 2006). This may be for biological reproduction or in case of resource shortage. Exotic materials such as Wommersom quartzite, phtanite, or, with the arrival of farming, *Breitkeile*, might serve as 'currency' within and between these systems (see Dennell 1985; Mauss 1950; Verhart 2000; 2012). With respect to raw material, implications for mobility are evident, both from the perspective of embedded procurement (Binford 1983(1979)) or specific expeditions for resources (Gould/Saggers 1985).

Implementation: different systems

There is a distinct difference between the character of the mobile procurement strategy underlying the assemblages on the southern coversand and the logistic strategy at the wetland sites of Polderweg and De Bruin. Raw material procurement on the southern coversand involved an important 'exotic' component, in the form of GQW, which implied a considerable and consistent intrinsic mobility, next to the practice of exchange. This contrasted with other sites where the contribution of 'exotic' raw material was limited as well. It distinctly contrasted with the wetland locations of Polderweg and De Bruin, which yielded clear evidence for logistical mobility in that raw material from various sources was continually transported to these locations.

Apart from differences in the degree of residential mobility this may also be associated with differences in territoriality. As is evidenced by the dispersal and use of Wommersom quartzite and its singular outcrop, the main area of distribution is often interpreted as belonging to a single dialectic tribe, within which the territories of bands and macrobands might be found (*e.g.* Gendel 1984; Verhart/ Arts 2005). Other non-related indications for the existence of such areas are for example formed by the distribution of characteristic point types such as *feuilles de gui*, or traits such as lateralization of arrowheads (see Löhr 1994).

While 'exotic' materials have also been found at Polderweg and De Bruin, or even, in the case of GQW, at Hoge Vaart, their contribution to the assemblage is small compared to the southern coversand and especially the Campine area. This involves the increased distance to the source, but might additionally be explained by differences in mobility. This relates to the natural environment and interwoven with this, differences in demands of the existing social network, maintained by long(er) distance mobility and exchange. In the case of the trophically 'rich' wetland environment of the Dutch delta, the specific distribution of resources enabled a more extended stay, probably with a lower degree of risk. This enabled the development of a different (logistical) system of mobility, which provided for needs not entirely comparable to those of hunter-gatherers elsewhere. Both the necessity and the possibility to participate in a more mobile system such as the one characterised by the distribution of GQW might not have existed. This hypothesis might be substantiated by (ethnographic) evidence existing for the general decrease in territorial size in wetland environments as a result of this decreasing mobility (see Ames 1991, 939; Nicholas 1998[a], 728; Nicholas 2007[a], 48; Nicholas 2007[b], 246, 250; Zvelebil 2003[b], 14). These smaller territories and the social changes involved with them may lead to increased territoriality and definition of boundaries (*e.g.* Kelly 1992, 58; 1995, 308-311; Price/Brown 1985, 11). There are thus broad correlations between the environment, mobility strategies, raw material procurement and territorial size. It is likely that along the forager-collector continuum there was a general decrease in annual territorial size, related to an increase in logistical mobility and a different participation in raw material networks.

5.6.6 Interpreting mobility and settlement systems

Little is known about the ecological character of the coversand environment in relation to the distribution of its resources, although there is evidently a considerable difference of degree between areas such as the northern or southern coversand landscape, the vast wetland area of the Dutch delta and, to a lesser extent, the floodplains of medium to large rivers. The structural aspects and lithic assemblages of sites on the southern coversand area argue in favour of the importance of terrestrial hunting. There is no evidence for any distinct structural investment, which mainly points to short-term stays. However, while Binford (1983(1979); 2001) makes an initial distinction between terrestrial and aquatic hunters, based on a general supraregional analysis, the actual situation need not have been that simple. Seasonally based combinations of strategies were possible as well, involving both terrestrial and aquatic components. This will be further discussed below.

Because of the potentially considerable differences between the environments available to hunter-gatherers we should suspect the existence of regionally specific settlement systems and mobility rounds, the characters of which will have differed under influence of the relative importance of aquatic and terrestrial resources. The band of hunter-gatherers occupying Polderweg might have been quite different from the hunter-gatherers that camped at Merselo.

The considerations above suffer from insufficient (organic) data and lack of spatio-temporal control. Clearly there is need for further research, yet the firm rooting of hunter-gatherer settlement systems in their natural environment strongly implies that differences in these environments will lead to differences in the settlement system. Based on this assumption a brief characterization of larger trends in Late Mesolithic mobility in the LRA might be given. This characterization can only be of a preliminary nature and it should be considered that the wetland perspective centres on the information produced by the Hardinxveld sites.

5.6.6.1 Wetland and upland environments: a continuum of possibilities with a wet advantage

The Late Mesolithic landscape provided a series of environmentally determined opportunities, whose composition, constraints and possibilities influenced mobility. Binford (1990) and others (*e.g.* Ames 2002; Keeley 1988; Nicholas 2007[a,b]; Zvelebil 2003[b]), have stressed the importance of aquatic resources in enabling a lower degree of residential mobility. Binford (1990, 147) sees the expansion of diet breadth to include aquatic resources and the development of technology for their exploitation as important factors for reducing residential mobility. According to him this is the result of the increasing costs in procuring terrestrial resources in higher latitude environments. While the temperate Atlantic setting of the Late Mesolithic in Northwestern Europe might not have given rise to an irrevocable 'aquatic shift' in diet, full-time terrestrial hunter-gatherers will have been rare (see Binford 1990, 137; see also Binford 2001, table 5.1 and 212-222). Incorporation of aquatic resources seems to have been an often favoured addition to the diet (Binford 2001, 210). Binford (1990, 147) argues that the 'access windows' for 'penetration of the aquatic biome' are less ubiquitous and more reliable than those of terrestrial resources. Therefore strategic site locations, in combination with the productive capacity of aquatic species, led to a tethered system of mobility, corresponding with a high degree of repetition. This in turn might have led to an increase in investment, which in fact is more or less a reversal of the relationship between hunting and portability of primary housing stated above. Eventually the reliance on aquatic resources provides opportunities for many other changes in society, as for example permanence in settlement and increased group size (*e.g.* Binford 2001; Pálsson 1988; 1991).

The importance of aquatic environments

The importance of aquatic resources in creating opportunities for investment and spatial structuring, based on the increased static and reliable aspects of wetland resources, is evident. There are, however, differences in the definition of wetland or aquatic resources. Binford (1990), for example focuses on aquatic hunting and fishing, Kelly (1995) distinguishes between fishing and sea mammal hunting, while Ames (2002) argues water should be the main determining principle for food and resource procurement as well as transport. It is also possible to argue in favour of an even broader definition, extending primary wetland resources, such as fish and aquatic plants, to include for example otters (*Lutra lutra*) and beavers (*Castor fiber*), as well as including secondary resources. The latter involve plant and animal species which are typically attracted to wetlands and wetland margins and the biodiversity existing there. This for example includes several species of mammals, such as deer or wild boar, specific plant communities favouring wetland margins, bank or levee settings (see Bakels 1978) and, importantly, various species of (migratory) aquatic birds. Rather than the presence of typical wetland species it is the constellation of aquatic and terrestrial resources converging in these areas that made them attractive to prehistoric hunter-gatherers. As argued by Binford (1980; 1990; 2001) the incorporation of aquatic resources enables communities to become more sedentary and group size to increase. Apart from seasonality evidence, indications for a lower residential mobility have been provided by the site use and structuring and lithic characteristics of distinct wetland locations such as both Hardinxveld sites. Within such settings where resource distribution is diverse and heterogeneous a collector-type system of logistical mobility is most plausible.

Upland terrestrial characteristics and mobility

Although a whole range of intermediate environmental settings will have been present in the LRA, the aquatic biome and the distribution of resources in it contrasts most with what may be expected from the upland coversand landscape.

Characterised by a largely closed canopy forest, areas of diversification would mainly be formed by streams, lakes or peat fens (see section 5.3.2). Around these, natural diversity may have increased, but it may be argued that terrestrial resources and fauna formed an important component of the diet (see also Binford 2001, Chapter 6). Resources on the whole were probably less diverse in comparison to wetland locations and more homogeneously distributed at these locations. This would have required increased mobility and more residential moves (see Binford 1980; 1982), which fits the characteristics of site use and material assemblages in these environments. The smaller extent of the areas where resources diversify would become depleted much quicker in comparison with (the delta or large river valley) wetland environments, necessitating more frequent residential moves between such locations. Binford (1980, 5, 10) has argued that base camps are moved when resources get depleted. Depending on the extents of the available resource patches, the number and distance of residential moves and the size of the groups involved might differ (see also Kelly 1995). Furthermore the focus on terrestrial fauna species such as red deer, roe dee and aurochs involves dealing with the dispersed and unpredictable nature of the distribution of these types of animals, indeed necessitating frequent moves and a higher mobility (Crombé *et al.* 2011[b], 467). In this sense one could envisage the coversand areas as relatively homogeneous with resource clustering and diversification in specific areas that formed the most favoured locations for settlement.

5.6.6.2 Diversity and combined systems

While the contrasts between both settings are distinct it is not always useful to interpret them as a context for mutually exclusive types of hunter-gatherer mobility and resource procurement. Rather, instead of distinguishing between terrestrial and aquatic hunter-gatherers (*sensu* Binford 1990), or assuming an evolutionary or logical development from one to the other, it might be more profitable to qualitatively aim at establishing the contribution of a 'wet aspect' and aquatic resources in Late Mesolithic settlement systems.

Based on the evidence available, a description of the precise mobility regimes and settlement systems for the Late Mesolithic is not possible. However, based on the arguments advanced, an approximation of the diverse strategies existing and how these may have been combined is possible.

Implementation: diverging strategies

There are distinct differences between sites that might be hypothetically interpreted in terms of past settlement systems. As stated earlier, there is a considerable difference between sites in the southern coversand landscape and sites in wetland settings. The latter were probably inhabited for more extensive periods during the year, involving investment and structuring, and using a broad spectrum of, especially aquatic, resources. The former yielded evidence for repeated, but limited occupation with a focus on terrestrial hunting. While both systems are not necessarily exclusive it is evident that their relative importance to the yearly cycle largely structures the mobility of a group in a given area. Especially occupation of sites in extensive wetland settings often involves a certain degree of stability, arguing in favour of collector type strategies. This contrasts with the supposedly higher residential mobility of sites in the southern coversand landscape.

There are however also indications for a complementary function of sites within a settlement system with different regional and ecological components. Evidence for such a combination may be found in the similarities between some of the sites on the southern coversand and the technological (contribution of blades), typological (contribution of retouched flakes and blades) and raw material (*e.g.* Wommersom quartzite) characteristics of the three southern river valley locations near Liège. Although these may not themselves have been part of a settlement system incorporating the southern coversand area, they do perhaps represent a seasonal component that is typical for larger river valleys and floodplains, in this case the Meuse. Especially the latter element (GQW) might indicate comparable groups, or that members of the same wider community occupied sites in both settings.

The contrast between the investment and structuring characteristic for the river valley sites and its absence on the upland, may relate to resource procurement. Apart from the availability of stone, the river valley sites yield evidence for the exploitation of various resources in the rich floodplain settings, including aquatic resources such as fish. These especially might have formed an important contribution to the diet in winter (Binford 1990). This is potentially supported by the evidence for seasonality at the wetland site of Polderweg (see Louwe Kooijmans 2003), although the seasonality of fish in both environments need not have been the same.[73]

Another example is formed by the Hardinxveld sites. Especially the seasonality evidence available for occupation at Polderweg during several months in the winter period (see Louwe Kooijmans 2003; Appendix I), indicates that these wetland sites formed stable longer-term base camps.[74] These may have been part of a system in which wetland margin sites played a complementary (summer?) role. The existence of such sites is suggested by locations in the wetland margin such as Maaspoort (see Louwe Kooijmans 2001[a]). The presence of tools such as axes and worked pieces made of auroch bone and the relative absence of this species in the unworked bone assemblage as documented at Polderweg supports the idea of non-local hunting or procurement (Louwe Kooijmans *et al.* 2001[b]).

A combined system?

The implications of the existence of diverse and potentially complementary strategies points to the possibility of combined mobility strategies, perhaps including different regions and a more or less distinct aquatic component. Such as system would be attuned to the spatio-temporal consistency and predictability of the environment. In other words when 'risk' and 'cost' of moving are high, it is likely that hunter-gatherers will opt to remain longer at locations with a more predictable level of resources and use logistical means to obtain additional food or resources (see Binford 1990, 132; Kelly 1992, 47). Binford (1990, 131-132) also relates the increased use of aquatic resources to the effective temperature and the patchiness and productivity of resources. From this expectation it follows that: '*aquatic resources are the target of exploitation for winter stores*.' Wetlands and to a lesser extent floodplains could thus have been specifically used as buffer environments in the lean seasons.

Such a difference in sustainability of environments may also have had repercussions for group size. According to Kelly (1992, 47) hunter-gatherer social units can have an extremely fluid composition. Groups may split in order to relieve social tension often caused by subsistence stress. This is largely dependent on the degree to which everyone's subsistence is dependent on the same resource.

Implementation: potential complementary systems

As argued earlier the specific taphonomic characteristics of the studied sites preclude an in depth analysis of (regional) procurement strategies and seasonality. The available information is limited.

While for the Polderweg site the use of a winter base camp during phase 1 is confirmed (*e.g.* Louwe Kooijmans 2003), evidence for a similar use of coversand and river valley sites is very limited. It has been argued that the coversand (peat fen) area was used seasonally (*e.g.* Crombé *et al.* 2011[b], 468; see also Vermeersch (1989), but there is little archaeological evidence for this as most organic seasonal indicators are not preserved. Finds of hazelnut at for example Weelde-Paardsdrank or Jardinga may point to a presence in autumn, but the limited numbers and the fact that hazelnuts are suitable for storage (see Cappers/Ytsma 2002/2003) prevent a clear seasonal indication. At the river valley site of Liège-Place St.-Lambert (sector SDT and DDD), there are, however, minor indications for a predominant presence in deep winter and early spring, based on a study of the eruption of teeth in wild boar and the characteristics of the antler fragments found (see López-Bayón 1994, 133). Clearly a strong and consistent seasonal signature, as could be established for the Hardinxveld sites, indicates a strong association, between place, time and activity. If the weaker information at Liège is interpreted along the same lines, this might form an indication for a strategy whereby wetland or floodplain environments were used specifically in winter.

Arguably the stable character of wetland resources would also have allowed for a larger group size. In this respect Louwe Kooijmans (2003, 619) argued that several households or a microband might have inhabited Polderweg. Kelly (1992; 1995) further indicates that regular, non-aggregated, groups of hunter-gatherers comprise *c.* 25 individuals. Aggregation might occur in order to maximize the exploitation of aggregated resources, such as for example fish. Predictability also forms an important factor (see Kelly 1995, 214-216). Apart from fish and migratory species of birds one could also envisage seasonal migration of species such as red deer in this respect (see also Brouwer 2011; 2013; Jochim 1976).

In case a combined system of mobility existed, it is thus likely that group size was larger in the wetland or wetland margin settings, compared to dryland locations. Smaller groups and more frequent, but short visits would be in line with the erratic and homogeneous patterning of Late Mesolithic sites in the southern and perhaps northern coversand area. The artefactual similarities between the river valley sites and the upland coversand locations in the south and the way these differ from wetland sites such as Polderweg and De Bruin, may, amongst others, relate to a difference of degree in intensity or duration of wetland or floodplain occupation. In the latter case, of the Hardinxveld wetland sites, it is evident that the occupation lasted at least several months and may have been combined with a wetland margin setting such as that of Maaspoort where seasonal occupation is plausible as well. This, in combination with evidence for investment in aquatic technology (canoes, paddles, fish weirs etc.), argues in favour of a strong emphasis in wetland occupation and aquatic orientation of these communities. When hypothesizing a similar model involving sites in the (southern) coversand landscape and (Meuse) river valley sites the current evidence points to a more distinct terrestrial component, at least for a significant part of the year when communities moved between sites in the coversand landscape, and a more limited floodplain aquatic orientation during sojourns in river valleys.

Modeling mobility

The available evidence for the studied sites only allows for a hypothetical modeling of both of the situations sketched above. These hypothetical systems have been depicted in fig. 5.43.

The upper section demonstrates the potential relationship of two mobility cycles (A-H and I-Q). It consist of a residentially organized system with frequent moves between habitation or exploitation areas and fewer, mainly logistically organized stays in the river valley. These may have been especially attractive in the leaner winter season and allowed for greater aggregation. Note the larger logistical range in the river valley as opposed to the coversand area.

The lower section depicts a logistical system, based on the Hardinxveld sites, in combination with a wetland margin location (as the aforementioned Maaspoort site). Both sites were inhabited seasonally during several months. Exploitation of the environment was distinctly logistical and focused on the central sites. Other site types such as fieldcamps and caches are more dominant features of this type of settlement system, although distinct evidence for these types of sites has so far not been documented for the Late Mesolithic.[75] The wetland margin sites enabled a continued exploitation of the wetland area as well as the upland hinterland. A potential combination existed with a residentially mobile system (X). This could be envisaged when part of the group would split and lead a more mobile existence, for instance focusing on terrestrial hunting, in the summer months.[76]

Of course both systems remain simplified models and reality, including diverse relationships of exchange and interaction, is infinitely more complex. They demonstrate the existence of two different and potentially complementary systems of habitation that may be substantiated by the character of the sites documented, especially when contrasting sites on the coversand with distinct wetland locations such as those of Hardinxveld.

5.6.6.3 Diverse systems of mobility: other approaches

It can be concluded that despite the deficiencies in the data available there are clear indications for diversity in the uniformity of the Late Mesolithic. The characteristics of some of the landscape and ecological settings defined argue in favour of different mobility strategies and economic emphases, and, in turn, of diversity within Late Mesolithic groups. These are most distinctive between sites in the coversand landscape (especially those on the southern coversand such as the Campine region) and typical wetland locations such as the Hardinxveld sites. These conclusions are supported by the scaled approach presented in the analysis. The lithic comparison in particular provides a comparative perspective that is only influenced by site formative processes to a limited extent.

The emphasis in this study of Late Mesolithic sites was placed on diverse structural and artefactual aspects of (mainly) excavated sites. A number of other types of studies have partially supported the perspective offered. These will now be briefly discussed

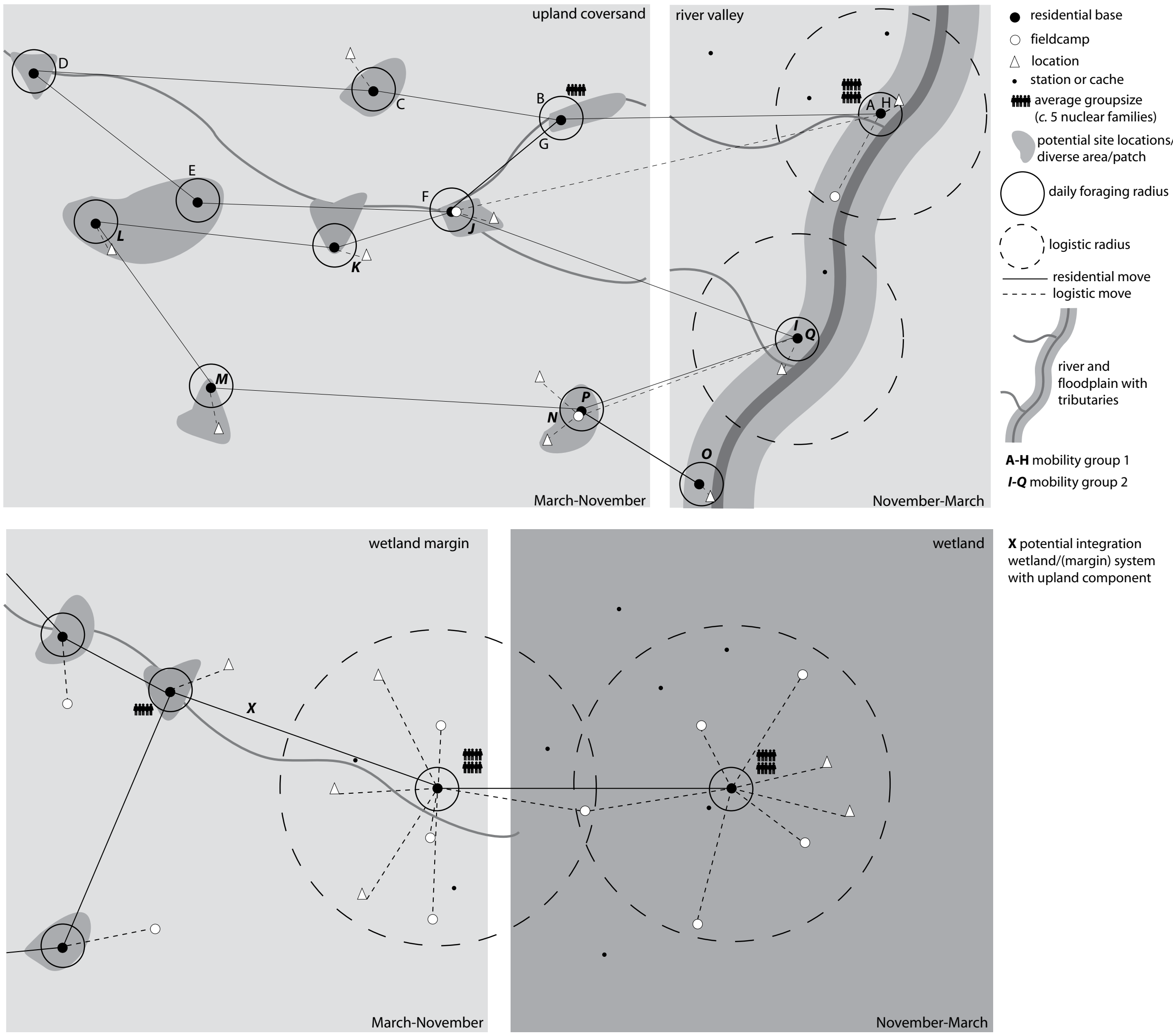


Fig. 5.43 Hypothetical model of combined mobility cycles in upland coversand and river valley settings as well as wetland and wetland margin settings.

Isotopic perspectives

Research into the isotopic signatures of bones of Mesolithic hunter-gatherers in the upland area of the Meuse Basin clearly indicate the predominance of terrestrial resources (Bocherens *et al.* 2007) in comparison with for example hunter-gatherers in coastal and wetland settings, including those at the Hardinxveld sites (Richards *et al.* 2003[a,b,c]; Richards/Schulting 2006[a,b] ; Smits/Louwe Kooijmans 2006; Smits *et al.* 2010).[77] Since this reflects on the emphases in diets it largely confirms the distinctions made earlier, especially if the upland Meuse Basin area and the coversand areas may be deemed similar in terrestrial nature. While it is not possible to demonstrate that the differences recorded for the sites analysed above in fact relate to different Late Mesolithic groups with different subsistence strategies on the basis of the data available, it is likely that there was a considerable degree of variation, which would also be reflected in isotopic signatures as supported by the studies mentioned above. On a gradual scale there probably were groups more oriented towards the exploitation of wetlands and groups with a larger terrestrial component.

A diachronic perspective

Recently Crombé *et al.* (2011[b]) have also discussed aspects of hunter-gatherer diversity based on a study of Final Palaeolithic to Final Mesolithic land-use in northwest Belgium from a diachronic perspective. They indicate the existence of a sequence of human responses to environmental change during the Pleistocene-Holocene transition. Over time regional site densities and mobility tended to decrease, while site size increased and hunter-gatherers in the later Mesolithic tended to favour wetter locations along rivers in relation to the increasing water table as a result of the inundation of the North Sea (*ibid.* 454, 468-469). They also argue that there is evidence for frequent reoccupation of locations and rapid mobility in the earlier Mesolithic and indications for an increased spatial structuring and more rigid organization of residential sites in the Middle and Late Mesolithic (Crombé *et al.* 2011[b], 454, 469; see also Amkreutz 2009).

As noted by Crombé *et al.* (*ibid.*) there appears to be a contrast between the diachronic land use trajectories in Sandy Flanders and the southern Netherlands, whereas Verhart (2008) notes a contrasting development and potential decrease in complexity and larger sites over time. One could question whether these regional difference arise from different choices made by different bands of hunter-gatherers, or the same group executing different mobility strategies in different landscapes.

Although interesting new trends are outlined, the nature of the research conducted is of a large chronological and general scale and mainly based on surface survey sites. Where Crombé *et al.* (2011[b], 467) detect a general trend towards decreasing mobility over a long time span and an increase in prolonged residential positioning, this study demonstrates and adds that reality is even more complex and that even within the Late Mesolithic there is much variability to be accounted for. Different groups of hunter-gatherers made variable and flexible use of a diverse set of environments and a number of co-existing or even complementary mobility systems may have been in use at the same time. The study by Crombé *et al.* (2011[b]) does, however, support the main argument presented in this study, that the focus on aquatic resources and a wetland setting distinctly influences site use and mobility patterns.

A modeled land-use perspective

A complementary point of view, along the lines of earlier studies (*e.g.* Jochim 1976), was provided in a recent study focusing on modeling the economic potential and environmental characteristics of different environments in the central river valley area (roughly the delta area, eastern river valley area and adjacent Pleistocene uplands) in the Netherlands with Mesolithic sites dating to the Early, Middle and Late Mesolithic (Brouwer 2011; Brouwer-Burg 2012). The aim of the study was to detect whether the changing environment of the lower Rhine river valley which in 4000 years (between 10.000 and 6000 cal BC) shifted from polar desert [sic] to closed Atlantic forest with a deltaic environment also linked to changes in human behavior (Brouwer-Burg 2012, 25). A multi-criterion decision-based model was devised for three case-study areas and landscape reconstructions were made for 500 and 1000 year intervals (Brouwer-Burg 2012, 25; Brouwer 2013). This was combined with decision-making objectives and criteria that influenced how people mapped themselves onto landscapes in view of resource acquisition strategies and settlement placement practices (*ibid.*; Binford 1980).

Important behavioural rules that were defined included securing sufficient subsistence and raw material resources, while minimizing risk (see also Kelly 1995). What was deemed the most important criterion for site location choice involved finding reasonably dry locations with ample shelter (Brouwer-Burg 2012, 26). The subsequent modelling that took place focused on a number of adaptive foraging and collecting strategies with respect to large game, non-specific or wetland resources. These were subsequently combined with the modelled landscape for 25 x 25 km surface units and analysed for suitability, which was then compared to the archaeological evidence available (*ibid.*, 27).

The model confirmed the notion also mentioned here and in ethnography (see Binford 1990) that distinct wetland habitats were best exploited through a collector-type strategy. According to Brouwer-Burg (2012, 27) this accords well with the archaeological evidence from the Hardinxveld-Giessendam sites (see also Amkreutz 2009 for similar conclusions).

The study indicated that an inverse relationship exists between the patchiness of an area and the degree of organizational flexibility of hunter-gatherers in terms of procurement and mobility strategies (Brouwer-Burg 2012, 27). Highly patchy and heterogeneous habitats, such as wetlands, allowed only a small amount of organizational flexibility, were best exploited through collector strategies, characterised by decreased residential mobility and increased storage. Satellite-type configurations of camps should be expected with multi-family bases anchoring the settlement system. Conversely, areas with low patchiness and homogeneously distributed resources allowed hunter-gatherers far more leeway and enabled them to switch back and forth between collecting or foraging strategies. This may have involved fluid group membership and aggregation and fissioning occurring on an *ad hoc* basis. Settlement patterns are expected to be less 'neat' than in wetland contexts (*ibid.*, 28).

Different lines of evidence

The studies mentioned above differ in approach and data. To compare them directly would neglect the pitfalls existing in the analyses themselves (*e.g.* Bickle/Hofmann 2007; Milner *et al.* 2006) and the limited detail provided by long-term perspectives and modelled landscapes. In the last study the discussion on the 'patchiness' of landscapes for instance (see also Kelly 1995) should focus on contemporaneous areas and generates questions about what patchiness means. It is likely that the distribution, type and seasonality of resources coalesce into interesting regional combinations with characterizations that may either be homogenous, heterogenous, or both at the same time. Despite these shortcomings they fit the general approach adopted above with respect to the distinction between wetland and upland type of mobility and settlement system. In view of this, future research would benefit from a more close combination between these different sources of information in order to be able to present a complementary and more holistic idea of past behaviour.

5.6.6.4 Conclusions on mobility and settlement system

The approach of this study, comparing different scales of evidence for Late Mesolithic sites in the LRA, with respect to settlement location choice, site structure and lithic assemblage composition, clearly points to diversity in the way these hunter-gatherers used the landscape. Although not all sites yielded qualitative information, it was possible to elucidate one general distinction. This distinction is based on the contrasts existing between sites situated on the southern coversand, mainly in the Campine area (as well as a number of sites on the northern coversand) and those in true wetlands, most notably, in this case, both Hardinxveld sites in the western part of the Dutch delta. Differences with respect to site location choice, site structure and investment in facilities were complemented by differences in the characteristics of the lithic toolkit. These pointed to a more expedient technology and structured site use and investment at wetland sites and a more curated technology and short-term, less structured behaviour at the upland coversand sites. At the latter sites the fabrication of lithic hunting equipment (points) was also distinct. Furthermore the role of the Wommersom quartzite and its distribution pattern may be interpreted in relation to its qualities for making reliable components within a (curated) tookit. Taken together these different strands of evidence support the existence of different mobility and settlement systems. For the (southern) coversand sites a forager-type mobility system is suggested while the wetland occupation may best be characterised by a collector-type of mobility system (see also Binford 1980; 1982). These would fit the general landscape characterizations presented earlier. Activities on the (southern) coversand may have been more aimed at the hunting of terrestrial fauna, with increased mobility and movement between locations offering an expected range of resources (see also Crombé *et al.* 2011[b], 467). The aquatic wetland environment (see also Nicholas 2007[a,b]) offered far more opportunities for longer stays, lowered mobility and favoured a collector-type of mobility system.

Information for sites in the other defined groups is more limited. Based on the available data it is likely that the northern coversand landscape due to similarities in natural environment and landscape, may have offered similar opportunities for occupation as the southern coversand landscape. Hearthpit sites and other sites may be interpreted along similar lines, although certain differences in their location and the existence of hearthpits as such should be taken into account with respect to for instance site function and occupation duration. In contrast the river valley sites around Liège and to some extent the wetland margin sites (for instance Hoge Vaart and Swifterbant) point to similarities, albeit on a lesser scale, with wetland sites. Especially the sites around Liège point to investment in places, structures and activities such as fishing. The sites and information available are, however, not sufficient at present to further elucidate these similarities.

To what extent the sites functioned in settlement systems is difficult to attest. For the winter occupation at the wetland sites of Hardinxveld it is plausible to assume a complementary wetland margin counterpart for occupation during the summer half of the year. It is also possible that groups may have split up and effectively combined aspects of mobility systems (see also Brouwer-Burg 2012). Based on similarities in lithic toolkit composition such a hypothesis has also been generated for the southern coversand landscape in tandem with sites situated in the river valley (*cf. supra*). It is plausible to assume that the delta and river valley wetland locations in particular offered an interesting site location choice in the lean winter seasons, when aquatic and associated resources could complement the diet.

Finally, there is little information regarding the extent to which systems of mobility differed, whether they could operate complementarily or were rather archetypical for most of the mobility and settlement system of a group. Overall the degree of investment in wetland occupation as witnessed at the sites of Hardinxveld is distinct and points to communities that for an important part of the year lived in, invested in and focused on exploiting these wetland areas and did so for a considerable time. This indicates that a combination with an opposite and diverging lifestyle such as the one posed for the southern upland sites appears less likely, especially taking into account the distinct differences in toolkit composition and raw material procurement, housing and mobility. While the flexibility in these communities to combine and adopt different types of mobility and resource procurement should not be underestimated (*e.g.* Lovis *et al.* 2006[b]), the wetland and coversand sites presented here should perhaps best be understood as opposite ends on a hunter-gatherer settlement system continuum. These ends do not preclude combinations, as sketched earlier, but do support the existence of certain emphases that characterise the communities involved and define the diversity present.

5.7 Implications for Neolithisation

> *'It is increasingly clear that the study of the food producing transition requires understanding the foraging populations that formed the context of the transition… Further, the relationships between early horticulturalists and foragers are likely to involve connections which constrain and shape the decisions of both…Existing adaptive diversity among these* [forager] *groups ensured that decision-making was variable in the face of agriculture arriving…'.*(Madsen/Simms 1998, 258-260).

In this final section the repercussions of the diversity sketched will be briefly interpreted with respect to their importance for understanding the process of Neolithisation in the LRA. Since the data is qualitatively limited and data-points (sites) are relatively few and far between only some preliminary remarks are in place.

5.7.1 Theoretical background: Mesolithic influence and complexity

In detecting diversity with respect to Neolithisation, the main premise is that the differences in character between Late Mesolithic groups will have contributed to differences in development of the process of Neolithisation. In this respect it was argued by Zvelebil (2004[b], 45) that the direction and pace of farming reflects as much the existing Mesolithic social context as it reflects the conditions of Neolithic communities and regional ecological circumstances. Another important factor in relation to this is the actual distance involved in the interaction between hunter-gatherers and early farmers. This will also be touched upon below.

The role of complexity

In the past the discussion regarding the 'influence' of the Mesolithic substrate on Neolithisation focused on the multi-facetted topic of complexity. Over the years many scholars have tried to define complexity, which mainly refers to aspects of social organisation with repercussions for group size, subsistence, mobility and social 'stratigraphy' (*e.g.* Keeley 1988, 373; Neeley/Clark 1990; Price/Brown 1985, 4-7; Testart 1982, 523). Based on a wide array of ethnographic studies a number of causes (often demographic and environmental pressure or societal change), consequences and conditions have been identified (Price/Brown 1985). Important changes associated with increasing complexity include intensification of production and technology, changes in the settlement system (reduction of mobility) and different structures of decision making, or increased hierarchy and differentiation (*ibid.*; Keeley 1988, 404; Kelly 1995). Archaeological discussions regarding complexity mainly focused on the Scandinavian Mesolithic and the development of the Kongemose and Ertebølle communities, often in relation to the importance of marine exploitation (Andersen 1994; 2004; Bailey/Milner 2003; Grøn 1987; Larsson 1990[a]). It has been argued that an increased dependence on aquatic resources and increased complexity could have facilitated the adoption of farming due to increased sedentism, reduced risk and logistical strategies of procurement (Price 1996, 359). Others have argued that the same factors might have prevented hunter-gatherers from going over, 'buffering' any necessity to do so (*e.g.* Binford 1968; Price 2000[c]; 2003; Rowley-Conwy 2001; Zvelebil/Lillie 2000).

Abandoning complexity

Over the past years the polarized debate concerning complexity among hunter-gatherers has been nuanced. Rowley-Conwy (2001) points out that there is no evolutionary trend from egalitarian OAS groups (Original Affluent Society) towards more complex groups of hunter-gatherers and criticizes the theoretical underpinnings of the above-mentioned causes of complexity. He also argues against the idea that complexity would form a logical step towards agriculture (as for example stated by Hodder 1990). Drawing amongst others on case-studies dealing with the Jomon culture, the Natufian and more recent groups of Arctic hunter-gatherers it becomes clear that (aspects of) complexity need not necessarily lead to incipient agriculture (*ibid.* 58-64).

For the LRA there is virtually no evidence for complexity among hunter-gatherers (*e.g.* Verhart 2003, 442; see also Raemaekers 1999, 184), although this depends on the extent to which the classical denominators of complexity are used and interpreted (see also discussion in Crombé *et al.* 2011[b]). There is little or no evidence for status differences, specialisation, a rich ornamented material culture, cemeteries or a sedentary lifestyle. Yet, despite the extent to which taphonomy has rendered the identification of some of these factors impossible, the existence of characteristic differences between communities of Late Mesolithic hunter-gatherers with respect to settlement, mobility and food procurement has been demonstrated. These differences arose as a result of different necessities in adaptation (see also Rowley-Conwy 2001).

5.7.2 Interpreting diversity and Neolithisation

The above means that the aim is to define, or postulate to what extent the diversity existing would have facilitated aspects of Neolithisation. As argued above the main difference was that between the upland coversand area with its terrestrially oriented, residentially mobile communities and true wetland locations characterised by an aquatic economy, increased site investment and lowered mobility. Although there will have been a gradual transition between delta-based communities with an important wetland component and upland communities with a more limited wetland component, the characteristics of the communities towards either side of the spectrum will probably have formed a variable background with respect to the development of Neolithisation.

As evidenced by a number of archaeological and ethnographic studies, the economic potential and buffer capacity of wetland areas is substantial (Binford 1990; Nicholas 1998[a,b]; 2007[a,b]; Van de Noort/O'Sullivan 2006; Zvelebil/Lillie 2000). As a basic hypothesis one could propose that in the absence of stress over area (territory) or resources, the characteristics of wetland settings offer a reliable and rich background for hunter-gatherer communities and no economic incentive to adopt aspects of agriculture. In line with this it was argued by Binford (1990, 149) that aquatic resources would first be used under conditions of demographic packing, while agriculture would only appear after substantial periods of time. In settings with little aquatic potential relatively quick moves directly towards agriculture could be expected under packed conditions. Apart from the qualities of the environment, Binford distinctly adds a factor of stress (demographic or resource related) to the mix.

In light of these considerations the LRA situation may now be characterized.

5.7.3 Aspects of diversity and distance

A crucial factor of importance involves distance, combined with intensity in contact and a potential pressure or stress with respect to resources. These factors in combination with the characteristics of the communities involved defined the trajectory of Neolithisation in the LRA.

A southern perspective

While some of the wetland communities were already in contact with fully Neolithic farmers from early on (Louwe Kooijmans 2003; 2007[a]) as attested by the exchange of objects such as flint and later on pottery and *Breitkeile* (Raemaekers *et al.* 2011; Vanmontfort 2008[b]; Verhart 2012), interaction was most likely indirect and not regular. Interaction will have been more direct and probably intensive in the south due to the immigration of LBK farmers into the loess area there around 5300 cal BC. Although the evidence is limited (Amkreutz *et al.* 2009) interaction may have been of a mutual or antagonistic character (Gregg 1988; Vanmontfort 2008[a]). Of importance will have been the extent to which their livelihood as hunter-gatherers could continue. Continuation of terrestrial hunting and possibly seasonal floodplain use might over time have become fraught with competition over resources. The focus of these communities on terrestrial species in combination with the unpredictable and dispersed character of their distribution would have necessitated a higher degree of mobility and frequent moves (Crombé *et al.* 2011[b], 467), making them more vulnerable to competition.

While there are indications for avoidance and conflict in some areas (see Golitko/Keeley 2007; Vanmontfort 2008[a]), overall there is little evidence on the nature of interaction, including the role played by groups such as the La Hoguette communities (*e.g.* Manen/Mazurié de Keroulin 2003). Despite developments noted for western Flanders with respect to site use and structure (Crombé *et al.* 2011[b]) there is no evidence for distinct changes in behaviour or economy for Late Mesolithic sites over time (for instance those incorporating 'Final Mesolithic' elements such as LBK-like points). This may point to a continued consistency in mobility and subsistence during the introduction of agriculture in the area. The actual shift towards an agricultural existence may therefore have been of a short-term nature when economic or social (see Verhart 2000) competition arose.

The evidence for the degree and nature of interaction between the hunter-gatherers in the south and the Neolithic arriving there is limited. After the sudden collapse of the LBK communities and somewhat later the Blicquy communities in the southern loess zone, new qualitative evidence for occupation dates mainly to the Middle Neolithic Michelsberg culture. This type of Neolithic is characterised by a different type of settlement system, including central sites and flint mines. Apart from the loess region other areas (sandy soils, Meuse valley) are now occupied as well. This also points to changes in the agricultural system and crop spectrum (*e.g.* Vanmontfort 2004; see also Bakels 2003; 2005; Crombé/Vanmontfort 2007; Lüning 1968; Schreurs 2005; Verhart 2000). This type of settlement system and economy was probably better adapted to settle and farm other areas compared to the more rigid extensive LBK economy (see also Bogaard 2004). It is generally accepted that by the end of the 5th millennium the Mesolithic and Neolithic lifeways south of the Rhine-Meuse delta and in the Meuse valley had coalesced into the Middle Neolithic Michelsberg culture. This shift echoes other shifts towards the Neolithic in Europe, particularly in Great Britain and Scandinavia (Price 2000[b]; 2003; Sheridan 2004; 2007).

A wetland perspective

This development contrasts with the well-documented steps in the development of Neolithisation in the wetlands of the LRA. As argued above the communities there came into contact with the farming communities from early on. The evidence available indicates a very slow and gradual transition, starting with the procurement of foreign flint and artefacts, through the piecemeal introduction of pottery and domesticates to experimentation with crop cultivation (see De Grooth 2008; Louwe Kooijmans 1998[a,b]; 2007[a]; 2011; Out 2009; Raemaekers 1999; Vanmontfort 2008[b]). At no stage is there evidence for drastic change or the sudden introduction of elements of the Neolithic package. While they thus engaged in interaction, the effects on society were probably less intense, indirect and, importantly, self-imposed.

The above-mentioned factors, distance and intensity of contact as well as the applicability of ‘upland’ farming to these areas, are defining characteristics of the development of Neolithisation in this area. Crop cultivation in many of the wetland areas (excluding the coastal ridges and upland margins) could only take place on a limited scale (see Bakels 1986; Out 2009). Furthermore as argued above the wetland communities had a lower residential mobility and a stable resource base which incorporated aquatic resources. This allowed for the investment in traditional settlement locations and territoriality. This position of relative wealth and stability might have mitigated the need to incorporate other resources or intensify contact (*contra* Price 1996). Everything points to a very gradual and *internally* controlled introduction and a process whereby much of the character of the initial Late Mesolithic communities remained unchanged for a long time.

5.7.4 Conclusion: diversity and Neolithisation

It is more than likely that the differences that existed between Late Mesolithic communities of hunter-gatherers in the LRA, aspects of which have been demonstrated above, will have significantly contributed to the eventual outcome of the process of Neolithisation. In general this resulted in two different trajectories of Neolithisation.

In the south the interaction with the LBK and subsequent Neolithic groups ultimately led to the disappearance of hunter-gatherer communities with the development of the Middle Neolithic Michelsberg culture (see Vanmontfort 2004; 2007). Interaction and contact could have swiftly led to acculturation, transformation or abandonment of previous lifeways, especially if competition over resources or territory, combined with economic or social incentives were a factor in this. The proximity between farmers and foragers could have placed a strain on resources and space, at least in some areas. Becoming a farmer or moving away were probably the two main options and eventually the decreasing margins for the latter and the benefits of the former will have brought about the end of a purely hunting and gathering existence. Unfortunately the archaeological resolution of contact and interaction in the south remains limited, preventing a proper analysis and comparison (*cf.* Amkreutz *et al.* 2009).

The wetland and wetland margin areas are characterised by a different trajectory. The impact that the Neolithic had and the change it brought was absorbed and incorporated much more gradually. One factor will have been distance; it is only after the Early Neolithic that the upland coversand areas bordering on the delta and the northern wetland areas were inhabited by agricultural communities. Another factor must have been suitability. The dynamic aquatic environment will not have been suitable for large-scale agriculture. Furthermore the agricultural system of the Early Neolithic (LBK and Rössen communities) only gradually developed into a more mobile, flexible and versatile system in the following centuries. Last but not least the communities of originally hunter-gatherers living in these parts will have formed an important factor in determining what new knowledge, practices, techniques and products would have been acquired and incorporated. Much points in the direction of a very gradual and internally controlled introduction. The characteristics of these developments, the communities living in these wetland areas and their long-term relationship with their surroundings (landscape and environment) will form the focus of the following chapters.

Notes

1 Important in this respect are for instance the !Kung San points reported on by Wiessner (1983) that potentially signify a strong regional identity, while on the other hand the almost complete absence of trapezes at the stratified Late Mesolithic wetland site of Polderweg (Van Gijn *et al.* 2001[a]) may very well relate to functional issues, such as an economy focused on wetland exploitation.

2 It should be noted that in Belgium the Swifterbant culture is more often classified as Final Mesolithic, whereas in the Netherlands 'Neolithic' is more often used (*e.g.* Crombé/Sergant 2008, 76).

3 It is argued here that the meagre evidence existing for violence and conflict rather reflects the repeatedly documented intra-cultural violence between LBK communities (*e.g.* Price *et al.* 2006), than perhaps incidental conflicts with hunter-gatherers.

4 For further information regarding La Hoguette, Limburg and *Begleitkeramik*, the reader is referred to the following publications: Aimé/Jeunesse 1986; Amkreutz *et al.* 2009; Bakels 1992; Behre 2007; Van Berg 1990; Brounen 1999; Brounen/Hauzeur 2010; Brounen *et al.* 2010; Constantin 1985; Constantin *et al.* 2010; Gehlen 2006; Heinen 2006; Jeunesse 1986; 1987; 1994; Kalis *et al.* 2001; Lüning *et al.* 1989 Manen/Mazurié de Keroualin 2003; Modderman 1974; Schütz *et al.* 1991.

5 In this respect it should be questioned though to what extent radiocarbon dates and numbers of sites form proxies for population dynamics.

6 The site of Doel-Deurganckdok is not included despite its roughly similar position on a coversand ridge when compared to Melsele. This is based on the fact that the hearthpit features date to the transition of the Middle to Late Mesolithic (Van Strydonck/Crombé 2005). The Late Mesolithic trapezes, Montbani blades and Wommersom quartzite probably date to the same period as the Swifterbant pottery (Crombé *et al.* 2000). There is therefore not enough evidence to isolate an unambiguous Late Mesolithic occupation or set of artefacts.

7 During the Neolithic the landscape consisted of dry and sandy ridges of up to 10 m wide and of humid lows. One of these (depression B) may have contained the actual stream of the Scheldt (Parent *et al.* 1987[a], 7-9; see also Parent *et al.* 1987[b]).

8 During the completion of this manuscript a new site was discovered at Well-Aijen. Preliminary research at this location in the form of contract archaeology demonstrated an interesting potential. Atop an old Meuse stream ridge a number of Mesolithic and Neolithic sites was discovered. Some of the sites demonstrated the existence of internal stratification. Furthermore, an ancient gully fill may shed light on the ecological and organic component of this type of occupation next to the Meuse. The site promises to yield interesting data on the Mesolithic occupation next to the Meuse at different time intervals including the Late Mesolithic. Furthermore there are indications for Early Neolithic and early Middle Neolithic occupation of Bischheim and/or MK affiliation. The site has only been investigated preliminarily with additional fieldwork planned between 2012 and 2014. The RCE has valued the site as being of regional and national importance (see Appendix I).

9 Models for the Mesolithic in Northeast Belgium indicate that, next to continued occupation locations near peat fens, there is an increase in settlement locations near streams in the Late Mesolithic. This might be correlated to the increased and more permanent discharge of lowland rivers from the Boreal onwards, making these reliable sources of water. It should however be noted there is an average error in the modeling of *c.* 200 m in determining the actual location of sites (Vanacker *et al.* 2001). For the region of Sandy Flanders Crombé *et al.* (2011[b], 463) indicate a more a general move towards wet places in the Late Mesolithic.

10 This resulted in the asymmetric shape of the dunes and water situated on one side (pers. comm. B. Vanmontfort 2012).

11 No intensive study has been undertaken yet on correlating the location of Late Mesolithic sites with outcrops of rolled nodules from fluviatile deposits or the main terrace underneath the Campine plateau. This would form an interesting avenue of research for gaining a better understanding of the motivations underlying settlement location choice (see also Van Gils/De Bie 2008).

12 At Liège-Place St.-Lambert these were fossil channels of the Légia, at Remouchamps-Station LeDuc a smaller channel associated with the Amblève and at Namur the site was situated at the actual confluence of the Meuse and the smaller Sambre (*e.g.* Gob/Jacques 1985; Mees *et al.* 1994; Remacle *et al.* 2000). The former site was situated at the exact point where the Légia crossed the small valley of the Pierreuse and entered the wider floodplain of the Meuse (see Van der Sloot *et al.* 2003, 81). Remouchamps-Station LeDuc was positioned at the point where the Amblève emerged from the Ardennes Massif and entered the wider floodplain before joining the Ourthe (Gob/Jacques 1985, 163-164).

13 The moving average method is a filter technique supported by Surfer 8.0. Using grid-based data the technique averages the counts of adjacent cells in order to 'smoothen' possible taphonomic or methodological inconsistencies. The segments selected for smoothening can be adjusted, for example for 2 x 2 or 3 x 3 m intervals. To prevent a biased averaging of neighbouring cells (disproportionately favouring and enhancing low counts in proportion to high counts), there is the possibility of adding a weight to the selected cells. Used in this way the smoothening technique is very suitable for detecting and revealing trends in distribution patterns (see also Wansleeben/Louwe Kooijmans 2006). The technique is not useful for analysing spatially limited excavations. Problems related to the limited extents of excavations have been noted by *e.g.* Hodder/Orton 1976 and Cziesla 1990[a,b]).

14 Although it is not possible to prove the existence of a clearly delimited Late Mesolithic and Early Mesolithic zone, the existence of the former is reasonably well established through the distribution of trapezes and several groups of raw material as well as through refit data (see Verhart 2000, 69-123). In this sense the Late Mesolithic delimitation is accepted here. Since the different concentrations (Verhart uses the term clusters) form functionally different and related aspects of what was supposedly one site, the combined extent of these and their accompanying scatters is taken as the site extent. The resulting scatter is of a roughly ovoid shape. While Verhart (2000, 116 and fig. 2.26) defines five concentrations within the Late Mesolithic zone, three of these are accepted here. Concentration 5 is related to a combination of backed blades and might therefore be evidence of an event of abandonment (of a composite tool) (*ibid.* 123). It is however not of any dimensional value and therefore cannot be defined as a concentration here. Despite their isolated occurrence concentrations 3 and 4 are taken together here because of their spatial proximity and functional

correspondence. Although there is no conclusive explanation for interpretation of the empty zone between both clusters (*cf. ibid.* 126), it is believed here, also considering the distribution of finds surrounding the concentration, that both likely formed part of one whole. The empty space might have a taphonomic or functional explanation. Finally concentration 6 is added, consisting mainly of burnt flint associated with hearth 4.

15 This problem also occurs at sites where finds have been recorded three-dimensionally. The effects of bioturbation and superposition not only hamper the definition of spatial clusters as such, but also their delimitation, even at those few locations where all finds (instead of a selection) are point-referenced such as at Brecht-Moordenaarsven (Vermeersch *et al.* 1992, fig. 23). As was argued in the preceding, the use of statistical analyses can often do nothing to further unravel this.

16 The terminology including concentrations, clusters and scatters is often used indifferently. Here the terms have spatial connotations and are characterised by a difference in density.

17 Unfortunately the quantity and density of lithic remains proved less helpful in delimiting and characterizing concentrations. No counts were available for the individual concentrations selected. Artefact counts per excavated sector or trench moreover yielded highly variable results. This can partly be explained by taphonomic conditions and excavation strategy, but may also reflect occupation intensity. For example, at Helmond-Stiphoutsbroek (Arts 1994) the artefact density in the only trench (of 224 m^2) that yielded a concentration amounted to 0.77 artefacts per m^2, while the density of sector 1 at Weelde-Paardsdrank (129 m^2 and containing 3 concentrations) amounted to 51 artefacts per m^2, when only counting the *in situ* remains. The low counts at Helmond may relate to the location of the trenches south of the main concentration of artefacts in combination with the mechanical removal of the medieval arable layer.

18 At Merselo-Haag a distinction could be made between concentrations 1 and 2 dominated by debitage activities, and concentrations 3 and 4 with evidence for retooling, maintenance, processing and consumption (Verhart 2000, 116), all within 9 m of each other.

19 The presence of burnt flint and charcoal in the activity areas at Merselo-Haag cannot be directly related to the hearths in view of their disparate distribution (Verhart 2000, 79). Although this may be explained taphonomically it is also likely that the burnt flint and charcoal form the remnants of dumps. Meeuwen-In den Damp yielded evidence for a secondary displacement of both knapping waste and a hearth, the waste apparently being pushed outward in a centrifugal process (Pilati 2001). At Weelde-Paardsdrank sector 5 (Huyge/Vermeersch 1982, plan 7), there are several partially overlapping concentrations of organic remains (*i.e.* charcoal, burnt bone and hazelnut shells). They may be interpreted as secondary refuse, since they cannot be associated with a distinct hearth.

20 Binford (2002, 184-187) for instance noted an area of increasingly specialized activities away from the core residential area. Some of these activities required considerable space (dog tethers, a stone boiling hearth). He also noted specific clean-up strategies, such as preventive maintenance in order to dispose of items away from intensively used areas (*ibid.*). Such peripheral activities may often be classified as dangerous or dirty, yet it should be realised that this argumentation is based upon our *etic* perspective of these activities (Sommer 1991, 67-73). David and Kramer (2001, 259, 279) point out the multitude of motives underlying spatial separation including gender and ritual behaviour.

21 The project was initiated after the finishing of this chapter and initial results could due to time constraints only be incorporated to a limited extent in the appendix (see Appendix I).

22 Only H1:II yielded sufficient spatial information. Several spatial units can be detected within the artefact density contour pattern of this site, composed of circular shapes and measuring *c.* 1 to 3 m (see Price *et al.* 1974, fig. 4). In this sense H1:II can be understood as a cluster composed of several concentrations. Since similar clusters have been found along the circular ridge at Havelte and elsewhere an analogous situation seems to exist to the preferred settlement locations in the southern coversand landscape.

23 The estimated dimensions are based on both the general distribution and the extent of the trapeze distribution (see Beuker 1989, fig. 3 and fig. 32). Although the densest of concentrations can be attributed to treefalls, the remaining accumulations, as well as the distribution of the natural stone (see Beuker 1989, fig. 40), indicate the existence of minor concentrations, and hence use moments within the zones defined.

24 The absence of hearthpits cannot be explained taphonomically: surface hearths could have been missed on the northern sandy soils, but hearthpits would have shown up in the south. As argued earlier (Chapter 4) specific research traditions may be of influence here as well. Crombé *et al.* (1999) for instance argue that the absence of hearthpits at most of the Belgian Mesolithic sites might be due to the limited area that is usually excavated.

25 The description of the distribution of organic remains on page 151 does not match the symbols used in Plan 7. According to the text the lozenges in the southwest should be squares representing charcoal, while bones and hazelnuts should spatially co-occur to the north of this.

26 A rather questionable Mesolithic hut feature was discovered at St.-Oedenrode (Heesters 1971). It provides a clear example of the difficulties in distinguishing between anthropogenic and natural features.

27 It is also possible that the huts of Polderweg might have been made in treefall features (see Crombé 1993). On the basis of the fact that the documented size differs from the treefalls analysed by Newell (1980), this is deemed unlikely by the excavators (Hamburg/Louwe Kooijmans 2001, 96). However, Bubel (2002/2003) has argued that the sizes documented by Newell are remarkably homogeneous.
28 Cribb (1991, 84-96) gives several examples of nomadic stone-based structures, including hearths, storage platforms and dwellings.
29 In the case of the non-megalithic burial practices in the LRA the existing evidence of mortuary practices points to a very diverse spectrum (see Louwe Kooijmans 2007[b]).
30 A distinct number of Late Mesolithic dog burials have been documented (see also Morey 2006). One example is the Scandinavian site of Skateholm (Larsson 1990[a,b]).
31 Other cremation graves are known from the coversand area at Dalfsen-Welsum and Oirschot V, both probably dating to the Middle Mesolithic. One Dalfsen grave concerns an elderly female with possible trauma to her head. The other was a 13-14-year-old child. In both cases other bones were also found, either human or animal (Verlinde 1974). In Oirschot, located in the southern coversand landscape, important parts of the body also seemed to be missing. The concentration of the bones there suggests that they were collected after burning and placed together (Arts/Hoogland 1987; see also Louwe Kooijmans 2007[b]).
32 The reference to Binford 1983 with the original year of publication in brackets points to the papers mentioned as compiled in the 1983 volume 'Working at Archaeology' (Binford ed.). The original publications are listed in the references as well. The page numbers refer to 'Working at Archaeology'.
33 No technological information was available for Brecht-Moordenaarsven 3, Tietjerk-Lytse Geast I, Havelte-De Doeze-H1-I, and Swifterbant S11-S13. These sites yielded typological information.
34 It should be noted that the composition is partially influenced by the fact that flakes are themselves a waste product of blade production as well as by the standards used in the initial analysis for distinguishing between both.
35 The technological counts of blades, flakes, cores and core elements at both Hardinxveld sites differ from the published counts due to the incorporation of tools as 'groundforms' there. This has been correlated for. See Appendix II for further details.
36 One could think of a limited importance of microlith production and retooling and the effects of a focus on activities such as fishing and trapping.
37 Excluded are Brecht-Moordenaarsven 3, Meeuwen-In den Damp 1-1b, Hardinxveld-Giessendam-De Bruin, Swifterbant-S83 and Jardinga-Johannahoeve. The site of Tietjerk Lytse Geast I has been excluded because of differences in the system of artefact recording. It is the only site for which no retouched blades and flakes have been recorded. Rather than this representing the actual situation, informal tools have been incorporated in the counts under miscellaneous (pers. comm. B. Huiskes 2007). Unfortunately this prevents a comparison of the percentage composition of the tool assemblage with other sites. For Bergumermeer some information on number and percentage of tools is available from percentage counts in Newell and Vroomans (1972) and actual counts in Huiskes (1988, table 10). Points comprise *c.* 21% of the tool assemblage, scrapers about 20 % and borers and burins 5-6% each.
38 Next to debitage in the *style de Montbani* (*cf.* Rozoy 1968), Montbani blades form an important and characteristic aspect of sites on the southern coversand. These blades have either one or more unilateral notches, or show unilateral and irregular secondary retouch (*e.g.* Huyge/Vermeersch 1982, 191), often on the dorsal side (Robinson 2010, 141). Retouch may sometimes be inverse or alternating and on some occasions the opposite edge is worked. Often there is a degree of lateralization to one preferred side of notches and retouch (see Vermeersch/Lauwers 1982, 16). Frequent reworking of the edges may partially obliterate the difference between notched and retouched blades (Escalon de Fonton (1979) in Huyge/Vermeersch 1982, 181). It is not clear for what purpose these blades were used exactly (*ibid.* 191), but they have been associated with an increased utilization of plant resources (Gob/Jacques 1985, 175; Price 1987, 260).
39 The high number of 'other tools' at Lytse Geast is related to the many miscellaneous tools identified, which will probably incorporate retouched flakes and blades as well as notched and denticulated artefacts.
40 Counts for retouched flakes and blades at Helmond-Stiphoutsbroek include artefacts with 'steep' retouch as well as flakes and blades with use retouch.
41 Microlithic backed blades or bladelets might be interpreted as small inserts in composite hunting tools (Barton *et al.* 1995, 109). They are usually discussed or interpreted in association with points and other microliths (see De Bie/Caspar 2000; Huyge/Vermeersch 1982; Verhart 2000).
42 The upper half of the distribution within the second group (northern coversand landscape), can partially be attributed to the contribution of backed blades to the assemblages at Nieuw-Schoonebeek and Havelte-H1-I. Since backed blades are composite tools, these may skew the distribution in the combined graph.

43 Montbani blades, as well as knives, have also been associated with a greater utilisation of vegetative resources (Gob/Jacques 1985, 175; Price 1987, 260). The evidence for this is, however, mainly based on their generally late introduction within the time span of the Mesolithic and is thus not of a primary nature.

44 There are several statistical methods for interpreting site assemblages (Andrefsky 2005; Chatters 1987; Price 1978), also from a spatial perspective (Huiskes 1988; Newell/Vroomans 1972; Newell/Dekin 1978). Most of these require more detailed analytical data, or an existing subdivision into site types. Unfortunately many approaches are based on chronologically and spatially unreliable assumptions.

45 These communities could be interpreted as belonging to RMS groups (see Gob 1985; Heinen 2006)

46 Van Oorsouw (1993, 45) also argues that some Wommersom quartzite might have been present in Meuse gravels. This, according to her, could explain a higher percentage of GQW in Southern Limburg. Crombé and Cauwe (2001, 56) furthermore identify a shift in raw material use during the Mesolithic. The source of Tienen quartzite was mainly exploited during the Early and Middle Mesolithic, while Wommersom quartzite abruptly gained importance from the Middle Mesolithic onwards. This is a further refinement of the study by Gendel (1984).

47 At Polderweg, phase 1 yielded 7 GQW artefacts, including several blades (Van Gijn *et al.* 2001[a]). De Bruin, phase 1 only yielded one artefact of Wommersom quartzite (Van Gijn *et al.* 2001[c]). Further north the site of Hoge Vaart also yielded one artefact of Wommersom quartzite (Peeters *et al.* 2001, 22-23).

48 Since the (either/or) composition with respect to raw material is less influenced by lower numbers than in comparison to the typological and technological range of site assemblages, both Brecht-Moordenaarsven 2 and Meeuwen-In den Damp-1-1b are included when informative.

49 Van Oorsouw (1993, 10) argues that the specific debitage and use of GQW in the Netherlands might have differed from that at locations closer to the source. The evidence of the Dutch sites studied here, however, still seems in line with the presented Belgian evidence. Furthermore, the dataset used by Van Oorsouw is predominantly based on surface collections, also including other periods (*ibid.* 13-14). Although the number of Dutch sites in this study is much lower, the difference in procurement of GQW, does not necessarily seem to indicate a difference in use.

50 Further west in sandy Flanders, grey-spotted flint was more important than Wommersom quartzite in the production of armatures (Robinson 2010, 180). It should be noted that many of the sites in this study are surface complexes.

51 The presence of small quantities of GQW in the form of blades or tools at considerable distances from the Wommersom source (for example at Hardinxveld-Giessendam-Polderweg and Hoge Vaart-A27) might be indicative of this character of valued and sought-after exchange commodity.

52 At the river dune wetland site of Hardinxveld-De Bruin, the component identified as northern flint forms *c.* 13% of the assemblage in phase one (Van Gijn *et al.* 2001[c], 161). It is questionable whether the identification as northern flint is correct. If so, it appears that since most of the important resources were located at a distance of *c.* 70 km (see Louwe Kooijmans 2001[a,b]; 2003) and since northern flint is not necessarily of superior quality, this is more informative of a shift in resources, than of a different strategy.

53 At Merselo and Hardinxveld-de Bruin respectively 41 and 3 flints of Hesbaye (light grey Belgian) type have been added to this category. At Hardinxveld-Polderweg and De Bruin, respectively 27 and 1 Rijckholt flints have been added to this category.

54 Currently these sites would be classified as Late Mesolithic without hypothesizing contact. It should be realised that the Hageland study is based on surface collections. There is thus a chance of admixture, even though the sites have been classified as 'Neolithiserend Mesolithicum' (Vermeersch 1976, 237). Vermeersch (*e.g.* 1976, 85 *et passim*) repeatedly mentions the occurrence of white patination on artefacts of Wommersom quartzite, something absent for many of the other sites.

55 One exception is Helmond-Stiphoutsbroek (see Arts 1994, table 1). The contribution of GQW there is 12.5 %, including the surface survey finds. When excluded the contribution increases to over 17%. Concerning the other sites beyond 80-90 km which generally demonstrate lower contributions, it appears Helmond is an exception.

56 Gendel (1984) did not incorporate the available sites from the Hageland in his study, most probably because they were at the time not attributed to a Late Mesolithic *sensu stricto* (pers. comm. B. Vanmontfort 2007). Nevertheless, Gendel suspected percentages nearer to the outcrop to be similar or higher (1984, 142). It should be noted though that Gendel (1984, 152-157) at the time mainly focused on the differences in use of GQW over time.

57 Note that the number of stone artefacts for De Bruin and the total could not be documented due to differences in recording (compare table Van Gijn *et al.* 2001[b], table 7.1 and Van Gijn/Houkes 2001 table 7.1). The entire span of occupation is set at 1000 years since both sites existed partially simultaneously. (Data on flint and stone derived from Van Gijn/Houkes 2001; from Van Gijn *et al.* 2001[a]; Van Gijn *et al.* 2001[b]; Van Gijn *et al.* 2001[c]. Data on distances derived from Van Gijn/Houkes 2001; Van Gijn *et al.* 2001[b]; Louwe Kooijmans 2001[a,b]; 2003; Louwe Kooijmans/Verhart 2007.)

58 This is not meant to suggest the absence of intra-regional site variability (see Robinson *et al.* 2008).

59 The following publications represent a selection: Bettinger 1999; Binford 1980; 1982; 1990; Boaz 1998; Chatters 1987; Cribb 1991; Habu/Fitzhugh 2002; Hayden 1981; Kelly 1992; 1995; Kent 1991; 1992; Lovis *et al.* 2005; 2006[a,b]; Politis 1996; Price 2005; Price/Brown 1985; Rafferty 1985; Smith 2003; Whittle 1997; Wiessner 1982; Woodburn 1980; 1988; Zvelebil 2006.

60 In this system subsistence procurement occurs on a daily basis using an 'encounter strategy' and usually no storage of food takes place. This opportunistic manner of exploiting the environment requires limited planning depth, anticipation and technological investment (see also Chatters 1987, 337; Rensink 1995, 86). Binford distinguishes two main components within this settlement system (1980, 9): 'residential bases' where most activities take place and which are located in the vicinity of resources, and 'locations', used for extractive tasks. Base camps are moved when resource depletion takes place (see also Kelly 1995). Depending on the extents of the available resource patches, the number and distance of residential moves and the size of the groups involved might differ (Binford 1980, 5, 10).

61 Choices in mobility might be strategically planned, or evolve as a reaction to change. They might have an embedded, cyclical character (Binford 1980; 1983 (1979)), but can also be of a singular nature (see Kent 1992, 635-638) or change from year to year (see Jochim 1991, 311). They may be reversible (Habu 2002; Layton 1999; Layton *et al.* 1991; Rowley-Conwy 2001) and need not be purely functional (Kelly 1995, 152-153).

62 Often this space differentiation will be related to the privitization of space (Kelly 1992, 56).

63 The Mesolithic site of Maaspoort near 's-Hertogenbosch in the wetland margin was probably in use at the same time and might have hypothetically fulfilled a seasonally complementary function to Polderweg and De Bruin (see Louwe Kooijmans 2001[a], 459; Verhagen 1991).

64 While in reality 'actual mobility' will be hard to distinguish archaeologically from 'anticipated mobility', and both converge most of the time (see Kent/Vierich 1989), it does imply that the degree of investment at certain sites might be related to 'expected occupation'. From this it also follows that certain short-term sites, such as hunting locations, or temporary camps, might see a considerable degree of investment in case of high anticipated mobility (see also Kent 1992, 639).

65 In the following the terms houses, housing, huts, dwelling structures and dwellings will be used indiscriminately. It should, however, be noted that the terms dwelling and dwelling structure are a more neutral terminology for these habitation structures, at least for hunter-gatherer communities.

66 An extensive study of Janes among the Canadian Willow Lake Dene highlighted the complexity involved in choices between using round tipis or rectangular log cabins and the intricate life histories of the latter. These were often rebuilt, moved about and replaced. According to Janes the choice for log cabins might be related to the certainty of procurement of large amounts of resources. Tipis were mainly used for ideological, aesthetic and functional reasons (see Janes 1983, cited in David and Kramer 2001, 290; Janes 1989). There is clearly no simple evolutionary development from circular to rectangular structures, but only a very general trend.

67 Compare: *e.g.* Andersen *et al.*1982; Andersson 2004; Blankholm 1987; Bokelmann 1991; Bokelmann *et al.* 1981; 1985; Grøn 1995; 2003; Hamburg/Louwe Kooijmans 2001; Karsten/Knarrström 2003; Louwe Kooijmans 2001[a]; Newell 1980; Sørensen 1992; Warren 2005; Woodman 1985).

68 His dataset (see Binford 2001) consists of 293 ethnographically documented groups of hunter-gatherers yielding sufficient information on mortuary practices. The correlations recorded are of course of a general character and variability and differentiation from the norm are present.

69 Recently another Mesolithic inhumation was discovered at the site of Dronten-N23 (Swifterbant-Bisonweg). The burial cross-cut some of the earlier hearthpits at the location (see appendix I).

70 While *Sagittaria latifolia* is indigenous to North America, related species such *Saggitaria sagitifolia* have been found at for example Hardinxveld-Polderweg (see Bakels/Van Beurden 2001; Out 2009). Plants such as waternut (*Trapa natans*) might also have been harvested with the aid of canoes.

71 We should remain aware of over-stressing the contrasts suggested. For instance the axes made of aurochs bone documented at Polderweg must have originated from the coversand area. People may have combined both strategies to a certain extent.

72 Of course bow-and-arrow hunting might also comprise fowling and several fishing strategies, but aside from the fact that these will often have formed a more limited component it is questionable whether flint-tipped arrows would have been used. See *e.g.* Clark 1952 for examples of typical arrowheads for hunting birds.

73 The procurement of terrestrial game might still have been profitable in winter (see Kelly 1995; Kelly/Todd 1988), especially in comparison to botanical resources. Nevertheless, if aquatic resources (*sensu lato*) were available during the winter these might have formed a more predictable and stable contribution to the diet.

74 At Polderweg various species of fish and fowl argue for a presence at least during mid-winter, but the site might have been in use from September to March and was at least visited in early autumn (Louwe Kooijmans 2003, 619). The seasonal signature for De Bruin is less evident, but indicates summer activity during its later phases. The most plausible option is a winter base camp with a logistical function during the summer (Louwe Kooijmans 2001[b], 518).

75 One could argue that a site such as the Swifterbant fishing and fowling camp of Bergschenhoek (see Appendix I) would function as such a field camp in a logistical system.

76 The model differs from the earlier model presented by Verhart (2000; 2003), in that riverine settings are combined with upland locations and presented in a seasonal system. Verhart presents coversand surface sites that are either located at the margin of the Peel or the margin of the Meuse and do not differ in tool composition.

77 Caution is required since istope analysis is fraught with difficulties (*e.g.* Gehlen 2005; Milner *et al.* 2004). In the case of the Meuse Basin (Bocherens *et al.* 2007) it is important to note that most of the Mesolithic skeletal remains are of an early Mesolithic date. Middle Neolithic samples show increased importance of freshwater resources linked to the environmental restraints placed on hunting by the climax vegetation of the Atlantic forest. Later Neolithic bones again show an increase of terrestrial resources. This does not refute the idea that many upland Late Mesolithic sites were situated in suitable locations and that terrestrial hunting was an important activity. Therefore a distinct difference of degree with respect to wetland locations should still be expected.

Chapter 6

Communities in transition: some remarks on aspects of Neolithisation, long-term perspective and change

> *We live in a world where great incompatibles co-exist: the human scale and the superhuman scale, stability and mobility, permanence and change, identity and anonymity, comprehensibility and universality.*
> Kenzo Tange, Japanese architect (Boyd 1962, 113)

6.1 Introduction

The previous chapters (4 and 5) demonstrated that the wetlands and their margins form a distinct landscape region, with respect to both taphonomic processes and methodological approaches as well as regarding the (Mesolithic) communities that inhabited them. In this chapter and those that follow the cultural continuum of communities inhabiting this area will be further examined from a diachronic perspective. This involves the Late Mesolithic, Swifterbant culture, Hazendonk group and Vlaardingen culture. The emphasis will lie on the characteristics of these communities, as resulting from their interaction with the wetland landscape and conditions. This may also inform us on the stance of these groups towards change, eventually related to Neolithisation.

This chapter details the theoretical perspectives chosen. They interrelate and overlap and in combination provide a theoretical frame of reference that may offer new ideas regarding the regionally specific particularities of these communities and their position within the process of Neolithisation. In Chapters 7 and 8 these ideas will be used in the interpretation of different aspects of these communities and their occupation of the wetland area over time.

Towards new questions

The communities in the wetlands and their margins in the LRA have historically been studied intensively as far as material, functional, ecological and economic aspects of their existence are concerned, often incorporating and combining different disciplines (*e.g.* Louwe Kooijmans 1993[a]; 1998[a]; Peeters 2007; Out 2009; Raemaekers 1999; 2003; Van Regteren Altena 1962/1963; 1964; De Roever 2004). These studies in combination with recent site reports (Louwe Kooijmans 2001[a,b]; Louwe Kooijmans 2006[a]; Peeters/Hogestijn 2001), provide a solid basis for understanding these groups, their culture and their position in a period of transition. Building on this, new and different questions may be asked that particularly address the socio-ideological identity of these groups and that may offer new perspectives for understanding these communities and their position in the process of Neolithisation. This does not mean that previous research approaches, be they material, economic, functional or ecological, have become obsolete – in fact the approach chosen here would not be viable without them – but it does mean they answer different questions. This requires brief elaboration.

With respect to the process of Neolithisation in the LRA, the analysis of the evidence hitherto available has quite robustly sketched the development of the transition to agriculture as well as the general outline and sequence of the different stages therein (*e.g.* Louwe Kooijmans 1993[a,b]; 1998[a]; 2007[a]; Raemaekers 1999; 2003; Vanmontfort 2007). It has provided answers as to what changed, when it changed and to what extent it changed. It tracked Neolithisation with respect to actors, technological innovations, objects, subsistence and sedentism, measuring or analysing both contribution and timing and it placed these within a broader European perspective. As a result, the transition to agriculture in the LRA could be characterized as slow, gradual, involving a long phase of substitution (*cf.* Zvelebil 1986[a,b]) and a broad spectrum economy that was 'extended' with domesticates and cultigens (Louwe Kooijmans 1998[a,b]). This groundbreaking work provides the basis to answer different questions, and opens a window on different approaches and new theoretical perspectives. These address questions of 'how' and 'why' instead of 'how' and 'what', and focus on the communities in transition themselves, rather than on the elements that were introduced and their timing. Some new questions have been posed, for instance regarding the agency factor and socio-symbolic aspects (*e.g.* Louwe Kooijmans 2009; Raemaekers 2002/2003), involving new frames of reference, yet there is potential for a more elaborate and encompassing approach. In this study an approach has been selected that emphasises socio-ideological aspects and emphasises these as important long-term factors in (regional) behaviour and community choices. The approach is rooted in analyses of these social and ideological aspects as engrained in the interrelationship between groups and their natural surroundings, without becoming 'ecologically determinist'.

A theoretical context

Such a new approach requires a theoretical framework that deals with these groups from a 'situated', 'emplaced' perspective and focuses on issues of experience and identity, particularly in the long-term. It should be stressed that while such a 'post-processually' oriented theoretical framework may highlight valuable, informative characteristics of these communities, any proposed new ideas and hypotheses need future testing. One cannot therefore declaim a new 'truth'. With this in mind, the central elements in this part of the thesis can be summarized as follows:

- To what extent can the particularities of the various successive communities studied, such as aspects of subsistence and settlement system (mobility), be understood as rooted in the long-term interactive relationship between these groups and the wetland landscape? How were this landscape and environment perceived? And how may this have shaped community identity and *mentalité*?
- How did the long-term involvement of these groups with their surroundings shape their socio-cultural and ideological characteristics and what perspective does this offer on Neolithisation?

The present chapter forms an interpretative background for the approach described and a theoretical context for studying these communities in relation to the particularities of the region they inhabited. Three aspects will be dealt with consecutively. The first is of a general nature and involves the interpretative connotations of Neolithisation and the importance of defining our position with respect to them. It particularly deals with the need for a non-dualist approach towards 'Mesolithic' and 'Neolithic' in this study. Secondly the potential and particularities of a diachronic perspective are discussed, since the study of the continuum of communities involved may benefit from an approach that detects and stresses persistent traits and characteristics. Finally 'Neolithic' changes should be understood in relation to the manner in which the communities involved dealt with them. Conservative elements and new decisions will be studied by analysing the mechanisms of decision-making and change and the way these relate to the manner in which communities inhabited and dealt with their surroundings. It is especially the 'relationality' between people, landscape, places and environment that is of importance in relation to the changes which 'becoming Neolithic' may have brought about.

6.2 Interpreting Neolithisation

Ever since Lubbock's subdivision of the Stone Age into a Palaeolithic and a Neolithic era (1865), the character of the latter and the transition between the two have constantly witnessed various efforts to define a distinguishing and unique criterium (see Chapter 3). After the materialistic scope of the *pierre polie*, pottery and houses, Childe's advancement of food production (1976 (1925); 1958) has remained the most important determinant for the Neolithic and Neolithisation (Zvelebil 1998[b], 3, 26; see also Raemaekers 1999, 13; Chapters 2 and 3). According to Zvelebil and Lillie (2000, 59) it remains the only process which is relatively clearly defined, geographically widespread, and archaeologically detectable, which allows it to act as a key feature. From a *post-hoc* perspective this is of course true; eventually there was a pan-European shift to agriculture. However, although they note some problematical aspects themselves, the arguments defined by Zvelebil and Lillie are not as convincing as they may initially seem. First of all a shift to (agro-pastoral) farming is not a process that is relatively clearly defined. The incorporation of an agricultural way of life can take many forms and is a reversible process, especially in its incipient stages (*e.g.* Habu 2002; Layton 1999; Layton *et al.* 1991; Rowley-Conwy 2001). In ethnography and archaeology it has been documented that quantitatively, farming can both form an essential activity in subsistence modes as well as a minor element within a broad-spectrum economy (*e.g.* Louwe Kooijmans 2007[a]). This varied scale of involvement with agriculture furthermore takes place within societies that are classified materially and socially as ranging from hunter-gatherers to farmers (Gehlen 2006; Kelly 1995; Kent 1989[a,b], Raemaekers 1999, 118-120). Besides, the use of agriculture as a defining criterium is qualitatively hampered by the currently popular concept of 'management' of the environment and its resources. In relation to this it may be viewed as one of several risk-reducing strategies or techniques such as storage, accumulation, intensification and fire-ecology (*e.g.* Ingold 1988; Hayden 1990; Jeunesse 2003;

Mellars 1976; Terrell *et al.* 2003; Zvelebil 1994). Subsistence mode should thus not be defined as an evolutionary concept and at least questioned as the main characteristic of the Neolithic.

6.2.1 Beyond terminology

The considerations mentioned above impede a spatially significant documentation of agriculture and question its impact as a determining principle. It is therefore difficult to distinguish between who is farming and who is not, and to what extent evidence of farming equates to 'being Neolithic'. One should also take into account taphonomic problems (see Chapter 4; Rowley-Conwy 2004).[1] As such, research into these issues focuses on the degree to which a process of Neolithisation and its trajectory can be detached from defining Mesolithic and Neolithic (communities), what the appropriate correlates are for the latter's characterization, whether there is a (single) successful distinguishing criterion and to what extent this is useful regarding the spatio-temporal variability of the many transitions involved (*e.g.* Pluciennik 1998; Tringham 2000[a]).

Defining an approach

From a post-processual perspective there has been criticism of the primacy of subsistence and a singular economic perspective on Neolithisation. Bender (1978), Hayden (1990) and Jennbert (1988), for instance, specifically emphasized social aspects as crucial in adopting agriculture, while for example Thomas (1991) and Whittle (1999) stressed the importance of conceptual and ideological change. The problem with these alternatives is that they too search for one unique feature and fail to incorporate other aspects of becoming Neolithic. Furthermore they are probably even harder to distinguish archaeologically, since they deal with motivations regarding 'becoming Neolithic' and less with distinguishing features. Others have therefore advanced a more polythetic characterization of the process of Neolithisation accentuating its spatial and temporal variability and different ingredients (*e.g.* Czerniak 1998; Pluciennik 1998; Tringham 2000[a]). This approach has been criticized for 'deprivation of a common central characteristic', and accused of degrading Neolithisation to a 'vague and vaporous neologism', obliterating concrete meaning (Zvelebil/Lillie 2000, 60).

Both the monothetic and polythetic approaches are problematic. Defining one principal component within the process of Neolithisation, be it economic, technological or ideological, is more than anything else a contemporary appreciation of past reality. A change in subsistence mode involving agriculture can never be a change in subsistence mode only. It will have had repercussions beyond the economic domain and may, moreover, have received its incentive from outside the realm of economy. Arguing that there were many different Neolithics (*cf.* Pluciennik 1998), on the other hand, demotes a search for common characteristics to a redundant time investment and makes it difficult to trace Neolithisation temporally and spatially.

While the problems sketched above may not be easily solved, one may choose a perspective that avoids these issues by shifting attention from labeling and categorisation to the communities themselves. Several elements are of importance here. First of all the focus needs to shift from the dual perception of what defines or differentiates Mesolithic and Neolithic to the characteristics of the regionally specific process of Neolithisation itself (see also Pluciennik 1998, 79). The most important step is to appreciate that this process is never only about a change in subsistence, although the transition to agriculture may be one of its most salient characteristics. A second step involves an abandonment of the concept of Neolithisation as a process of evolutionary progression, in favour of historicity.[2] Neolithisation is not about a directional development from forager to farmer through mechanisms of diffusion and acculturation. Instead, rather than being gradual and unilinear it is characterized by trial and error, by incorporating new and perhaps alien concepts in familiar practice and by processes of *bricolage* (as defined by Lévi-Strauss 1962). This emphasises the importance of an intensive study of the communities involved, their continuous and changing characteristics, as well as the manner in which they dealt with new elements, over an attempt to fix certain concepts like 'Neolithic' and ' Mesolithic' into place through defining criteria which are of a relative nature (see also Whittle/Cummings 2007, 2). Such a (long-term) study of the communities involved should be positioned within a meaningful regional framework. Within this framework emphasis should lie on analysing the interrelationship between communities, landscape and environment. Coming to terms with what it meant to live in certain areas may shed light on both practical as wel as socio-ideological aspects of society and in turn on the way communities may have dealt with new elements and change.

6.2.2 Against dualism

The focus on communities is at the same time a focus on continuity and change. It deals with aspects of society that remain the same and interprets change not as an extraneous development, but as the result of implementation in existing community structures. Since the communities involved in the process of Neolithisation in the LRA wetlands and their margins may be perceived as culturally subsequent (*e.g.* Louwe Kooijmans 2007[a]), the element of continuity and maintenance of societal stability (*e.g.* Bourdieu 1977; Sommer 2001) will have been an important factor. It further underlines the idea that we should understand both the developments taking place and the communities involved from the same perspective. This should be stressed because many studies into the topic of Neolithisation work within a certain framework of fixed assumptions and hypotheses that are often based on a dualist perspective. The main premise often boils down to the idea that during the transition to agriculture there is an overall decrease in mobility related to an increase in settlement permanency. This is combined with population growth, increased territoriality, and aspects of social differentiation and structuring of the landscape. The nature of the discussion surrounding these parameters is often encased in an atmosphere of unilinear directional development and progress. Becoming Neolithic is then also defined as the developmental changes within these areas, most of which generally overlap with the different subsystems defined by Clarke (1977). In table 6.1 several of the presumed changes have been highlighted.

Both the above-mentioned characterization of the Mesolithic and the assumed changes related to the Neolithic are a generalisation of a situation that is far more complex. Nevertheless many of the elements mentioned are more or less accepted *a priori*, within and beyond the LRA (*e.g.* Clark 1977, 116, but see also discussion in Price 2000[a], 5; Price/Gebauer 1995, 8; Thomas 1999, 16; Whittle 1999, 6-7).

Themes	Mesolithic situation	'Neolithic changes'
subsistence		
economy	hunting and gathering	reliance on domesticates and cultigens
procurement strategy	'living off the land'	producing
material culture		
tools and equipment etc.	predominantly mobile (microlithic) toolkit, bone, antler, wood	site furniture, pottery, polished stone axes
dwelling and investment	light-weight, temporary dwelling structures, tents, huts, little planning	sturdy structures, houses, outbuildings, complex technology, fixed design
settlement system		
mobility	residential or logistical mobility	decreasing mobility, permanency
territory	flexible, possibly 'moving' territories	decrease in size, fixation of territory
(intra)site organisation		
	fairly random, shifting use of space at a location	increased spatial organisation
	predominantly primary refuse	increased secondary refuse
	(hearth-oriented) activities	creation of a domestic sphere
	huts, burials, activity areas	houses, cemeteries, fields, workshops
	open accessible structure	enclosed inward structure, property?
social aspects		
	small groups	increase in group size
	(nuclear) families, bands	(extended) families, households
	generalized/egalitarian, some complexity	increasing complexity, differentiation
	fixed male-female tasks	shift in composition of tasks, decreasing female mobility
	intrinsic mobility and down-the-line exchange	emphasis on exchange and prestige
ideology		
	no or limited deposition	strong increase in deposition
	limited (geometric) decoration	increase in (geometric) decoration, decoration on pottery
mortuary practice		
	incidental burial	cemeteries

Table 6.1 Assumed character of the Mesolithic and of 'Neolithic change'.

In recent years there has been an increasing awareness of this dualist approach and, partly inspired by the re-appreciation of hunter-gatherers an increasing criticism of thinking in classic Mesolithic-Neolithic dichotomies has been voiced (see *e.g.* Barnard 2007; Czerniak 1998; Pluciennik 1998; Strassburg 2003; Whittle/Cummings 2007; Zvelebil 1989).

Hodder and the concept of 'domus'

A good example of the problems related to a dualist perspective may be given through a discussion of Hodder's perspective on Neolithisation. His approach towards the process of Neolithisation has been built up around a socio-symbolic and ideological appreciation of the transition to agriculture. Fundamental is the domestication or transformation of the natural and the wild (and also individuality) into culture and society. The control over the wild acts as a mechanism and synonym for control of society and shifts the emphasis from material and economic 'cause and effect' of Neolithisation to a consequence of ultimately social incentives. According to Hodder (1990, 31) domestication in the social and symbolic sense may have occurred prior to domestication in the economic sense, indicating that the agricultural revolution may have been an epiphenomenon of deeper changes. Central to this argument is the concept of the *domus*. Domus in its broadest sense means home. It not only involves the house and its associated activities, but also encompasses tombs and monumental sites such as enclosures. According to Hodder (1990, 38, but see also Hodder 1998) the domus provided a way of thinking about the control of the wild and the greater oppositions between nature and culture, social and unsocial. In this way it became the conceptual and practical locus of social transformation and it was here that the origins of agriculture were conceived. The domus thus acted both as a metaphor and mechanism of change, the former by embodying the drama of emotions inspiring the drive to sedentism and intensification and the latter by forming the locus of production, reproduction, storage, processing and control of the relations between people within society (*ibid.* 41-42).

The concept of the domus provides an interesting way to approach the transition to agriculture. It steers clear of traditional explanations based on ecological or economic factors and focuses on a difference in *mentalité*. This to a certain extent empowers the indigenous groups to adopt or refrain from adopting such a new mentality and its associated concepts. However, while abandoning many of the classic distinctions between the Mesolithic and Neolithic sketched above (see table 6.1), Hodder's work is hampered by its strong structuralist undertones. Hodder juxtaposes many different aspects of the domus (*e.g.* man-woman, life-death, inside-outside, light-dark, wild-domestic etc., pp. 27, 69, 199, 300 *et passim*). These boil down to the main contrast in his work, that between domus and agrios, *i.e.* culture and nature. In Hodder's efforts to interpret Neolithisation on a pan-Europe scale, the evidence is categorically forced into this more or less neo-Cartesian dichotomy. This forms an important shortcoming, in view of the fact that there is a rich body of mainly ethnographic accounts indicating that many groups do not at all rigidly separate nature and wild from culture and society (*e.g.* Descola 1996; Descola and Pálsson 1996; Ingold 2000; Pollard 2004; Jones 2007, 92; Bird-David 1992[b]). Often there is much more of a continuum in which typically cultural and natural aspects of life are interwoven into one seamless web. This means that the worldview or *mentalité* of past communities, including aspects such as myth may not at all have accommodated the suggested contrast between wild and domesticated. The introduction of a Neolithic way of life might by consequence not have entailed a drastic ideological reorientation to the extent sketched by Hodder. This is also important in the debate concerning the concepts of Mesolithic and Neolithic (see also Chapters 2 and 3, Strassburg 2003; Thomas 1988; Zvelebil 1989). In the LRA wetlands and margins we are distinctly dealing with 'hybrid' groups that successfully combined wild and domestic characteristics over a long period. This is why this study centers on a reserved attitude towards opposing the Mesolithic and the Neolithic and adopting dualist perspectives for the area, period, groups and process studied.

Some considerations

The above review leads to several important considerations for this study. First of all, the communities studied are perceived as demographically and culturally continuous and are therefore studied from an unchanged perspective. This means that the presence or contribution of Neolithic elements should not lead to a different approach, or an emphasis on different aspects. Secondly, since these communities can be perceived as successive and taking into account the absence of any clear break or distinct moment of change it may be argued that the original perception of the environment, rooted in the Late Mesolithic and the *mentalité* involved with this, will have remained a strong element in these communities (*e.g.* Barnard 2007; Bird-David 1990; 1992[b]). This contrasts to, for example, the development of the Neolithic in England or southern Scandinavia (*e.g.* Larsson 2007[c]). The absence or limited importance of a distinction between nature and culture provides a different perspective on how Neolithisation developed and how 'Neolithic elements' were understood and incorporated. Thirdly, understanding the socio-ideological aspects of the communities involved may enhance our perspective on Neolithisation in this area. In order to do so the way in which these Neolithic elements are rooted in the interrelationship between communities, landscape and environment should be studied. Furthermore, the approach that needs to be chosen is a diachronic one.

Based on these perspectives this study aims to document the communities in the wetlands and their margins and the continuity and changes that characterise them from a long-term perspective and in relation to the environment. Regarding terminology the incorporation of domesticates and cultigens may be used to classify communities as Neolithic, but this in itself is not (necessarily) informative on the characteristics of the process of Neolithisation and not informative on the perception of, and implementation in the communities involved.

6.3 A long-term perspective

The perspective employed in this thesis to study these changes and their temporality is diachronic and long-term. This is inherent to the scope of a study incorporating the process of Neolithisation in the LRA, encompassing roughly 3000 years. It is also a necessity since site-formative processes operating over the intervening millennia have left us with an incomplete dataset (see Chapter 4). The taphonomically induced absence of certain categories of material, the uninformative character of many upland sites and the sparse well-excavated wetland sites prevent, not including some exceptional cases (*e.g.* Jadin 2003; Lüning 1982[b]; Vanmontfort 2004; Verhart 2000), an adequate appreciation of contemporaneously functioning sites and settlement systems. The main reasonto adopt a long-term perspective, however, lies in the fact that we are dealing with continuous communities in an uninterrupted cultural succession. While the scope is long-term, the emphasis is on continuity in the light of the changes taking place.

6.3.1 Adopting a long-term perspective

The use of a long-term perspective is usually considered one of the major advantages of studying prehistory and 'deep time' (see Bailey 2007; Barrett 2004, 11-12), and in this sense ideally suited to comprehending something as extensive as the process of Neolithisation (in the LRA). What is often lacking in resolution and detail at any one moment is thought to be compensated for by the ability to see and document processes, changes and possibly causality. While this may be true, there are also some problems to be considered. One of the most important concerns the conception of time as chronology that underlies many of these studies. This is problematic since it presents time as a linear and uniform phenomenon divisible into mutually exclusive units and incorporating a certain internal logic.

Time in this totalising directional sense is imbued with explanatory potential. It carries very definite evolutionary implications (Lucas 2005, 9-13). An emblematic example is the study of the spread of agriculture over time by Ammerman and Cavalli-Sforza (1971; 1973). The directionality and simplicity of this 'wave-of-advance' model has been justly criticized (*e.g.* Zvelebil 1986[a,b]; 1998[a,b]), its main fallacy being the lack of appreciation of the internal complexity of interaction and change. Other more recent examples of using a long-term perspective within a purely chronological framework are Gkiasta *et al.* (2003) and Dolukhanov *et al.* (2005). Yet less obvious examples also influence our ideas on Neolithisation, for instance spatio-temporal schemes (*e.g.* Louwe Kooijmans 2007[a], fig. 2) or general cultural overviews. These, often necessarily, focus on definition and succession instead of processes and dynamics. In reaction to this perception of time, the Marxist historian Althusser (1969, in Lucas 2005, 13-14) argues that there is no single continuous time, or universal time frame or reference but, rather, different temporalities, which produce different histories. Any kind of history that attempts to be universal in its coverage, such as a periodization, reproduces the same linear assumption about time. In line with Tringham's thoughts on Neolithisation (2000[a]) as a regional mosaic, we are also dealing with different co-developing temporalities.

Interacting time-scales

In recent years, several contributions have dealt with time and its perception (Bailey 2007; Lucas 2005; Murray (ed.) 1999; Rosen (ed.) 2004[a]; Shanks/Tilley 1987; Thomas 1996[b,c]). Two important non-linear approaches have their origins outside of the field (see also Lucas 2005, 15). The first, catastrophe theory (and related chaos theory), was developed within the natural sciences. These theories gave rise to useful archaeological applications such as complex systems and complexity theory (Bentley 2003, 8-14). At the core of both chaos and catastrophe theory however, is a perception of society as a system characterized by discontinuity and instability. The emphasis is thus on a societal disequilibrium as an explanation for sudden change.[3] Societies are perceived to be in 'active stability', until change occurs 'in rapid events of perturbation' (see Gould 1999, *xx-xxi*). This perspective and the disequilibrious nature of communities as perceived in chaos theory, fail to accommodate for the gradual transition to agriculture documented in the LRA (*e.g.* Louwe Kooijmans 1998[a,b]). There we are faced with LBK and successive communities characterized by a complete and potentially available set of Neolithic elements ranging from pottery production, architecture and polished stone tools, through domesticated animals and crop plants to sedentism and even a changed *mentalité*. Out of this potent reservoir only some elements were initially drawn and incorporated in hunter-gatherer society. Intensification was slow, it was variable, but it was present. Instead of perceiving indigenous communities as mechanical and instable systems with a threshold level above which collapse or transformation takes place, it is, for the LRA, more appropriate to focus on the rationale behind the choices that were made; to question their impact with respect to stability and understand the gradual nature characteristic for the area. In this sense another non-linear approach to time, developed within the historical *Annales* school by Braudel, might provide a better framework.

In order to deal with both continuity and change Braudel (1966) divided time into three different scales, the longterm (*longue durée*), the medium and the short term. The longterm scale deals with slow processes such as environmental change. In combination with the medium term, focussing on *conjunctures* (cycles) of for instance a social, economic, ideological or demographic nature, they form social or structural history. The small time scale refers to events (*événements*), and concerns actions of individuals or groups. The reflection of the medium-term and long-term scale upon the archaeological record might make them more appropriate within the study of prehistory (*cf.* Raemaekers 1999, 21), however it is exactly the dialectical relationship between the different scales that provides insight into the dynamics of change, stasis and transformation (Bintliff 1991; Braudel 1966; Lucas 2005, 15). Since all scales influence each other, it is the articulation of the different scales with respect to each other which is important. Short-term events may therefore form the fabric of long-term developments, but should themselves also be understood from this context (see Foxhall 2000).

For the study of the transition to agriculture in the LRA all three scales are important. The long-term scale is most prominently represented by the changes in environment.These incorporate for instance the rise in sea and related groundwater levels and their subsequent stabilisation around 4000 cal BC and gradual decrease (*e.g.* De Mulder *et al.* 2003), or the impact of the Atlantic forest upon habitation possibilities in the Northern Netherlands (Niekus 2006).[4] It should be realised though that landscape and ecological changes may also be sudden. Transgression for instance represents a series (trend) of extraordinary high tides (events). There is thus a certain embedded relationship between the different time scales. The next level of *conjunctures* could accommodate for a whole range of trends such as the material and economic changes involved in the transition from the Late Mesolithic to the Swifterbant culture, the development and nature of exchange networks or the technological and stylistic development and relations of pottery. The scale of *événements* finally seems appropriate for approaching burials or deposition, but for instance also covers the initiatives leading to the adoption of elements of 'the Neolithic package', or relate to the variability present within one contemporaneous cultural group. The examples above are dependent upon the time perspective chosen to study them, but serve to show that different time scales can be fruitfully applied. What is even more important here is that these time scales are a historicist means of acquiring a grip on the past, but that they interact, are embedded and influence each other's outcome. It is an enhanced understanding of the interrelationship between these temporal scales that offers a clearer perspective on the groups studied here. Since we are dealing with continuous communities it is worthwhile to understand both their short-term as well as longer term characteristics from an interrelated perspective (see Foxhall 2000; Gerritsen 2008).

6.3.2 From time to temporality to memory

While the above might indicate the importance of a long-term perspective and even argue for a *Braudelian* framework, time in itself is non-explanatory. While a diachronic perspective opens a window onto perceiving the characteristics of historicity and interpreting them in terms of societal change, additional insight may be gained form understanding the way the perception of time may have been embedded in the communities involved.

Important in this respect is the addition of another dimension to the archaeological material record. The dichotomy between past dynamic communities and the static nature of the material record resulting from the processual Binford-Schiffer dialectic (see Chapter 4) falls short when trying to interpret the activities of past communities from a temporal perspective. At the heart of this problem is the so-called *Verfremdungseffekt* characteristic for our usual interpretation of the past as 'a foreign country'. The past is seen as something static and objective which is distinctly different and separated, both from the present from which we study the past as from any other 'present' before that. This distinction between the past and the present and its influence on archaeology has prompted some archaeologists (*e.g.* Gosden 1994; Thomas 1996[b]) to draw on the work of Heidegger and his ideas on *Dasein* to come to a different perception of time. This phenomenological approach sees time as actively situated in life and events. Human beings re-encounter and re-evaluate their material surroundings, perhaps alter their significance and reincorporate and reposition them in society, creating a continuous motion of handing itself down to itself (Thomas 1996[b], 60-61).

The importance of this point of view lies in the fact that it does add temporality to the past and so makes it of importance to past communities and their characteristics over time. According to Lucas (2005, 37-38) the past is a multi-temporal event and can be considered a palimpsest. Palimpsest here thus has a positive connotation. Landscapes, sites and even objects consist of these multiple temporalities which, instead of forming a single event or a sequence, are all (inter)active at the same time. In this sense another resolution is added. The site of Bergschenhoek (Louwe Kooijmans 1978; 1986) might serve as an example of this temporal complexity referred to by Bailey as a temporal palimpsest (2007).[5]

Visiting Bergschenhoek

Bergschenhoek was located on the peaty shores of a lake in the coastal area north of the Rhine-Meuse estuary. The small site, consisting of a living platform (12 m^2), a hearth and several fishtraps, is considered to represent a fishing and fowling station. Yet despite the extraordinary clarity of the evidence, the site is also a palimpsest of temporalities. Most striking in this respect is the microstratigraphical sequence of renewed hearths found at the site. In total 38 layers were recovered relating to renewal episodes. These could be grouped into ten to eleven phases of hearth use, probably covering the like number of years (Louwe Kooijmans 1986, 10).

The living platform was renewed at different time intervals. It was reinforced by local products such as bundles of reed and young trees as well as wooden boards, some of which may have had a long previous use-life in a different context (for example as a canoe). The site also yielded evidence for a hut or small construction, yet no renewal phases could be reconstructed. The four fishtraps that were found at the site were probably made locally and may not have functioned as long as the entire use-life of the site. Tools such as leister prongs, antler axes and awls may have been used and carried around for several seasons before being discarded at Bergschenhoek. The baked clay weights and the pottery were not locally made, but originated in other locations. They may have been discarded there and designated for use at the fowling station. The fragment of a stone axe and the scarcity of flint indicate the level of care and curation vested in these lithic objects. They may have lasted a long time before being discarded, while the axe may have accompanied the group of hunters for several generations. Most of the faunal remains indicate a regular presence in winter, while some may point to (shorter?) visits up to May or from October. This again contrasts with the find of several articulated skeletons of young puppies which may have ended up in the water during an unguarded moment.

From time to temporality

Many of the temporalities at Bergschenhoek probably mattered and were meaningful to the group of inhabitants in deep winter. They structured their activities at the small station and they in turn were structured by the material aspects of previous visits (*e.g.* the hearth, hut and platform), at the same time introducing new objects, discarding others and changing and renewing what was there.[6] Bergschenhoek is thus a palimpsest of coexisting time scales, repeated practices and different rates of durability and renewal. Incorporating this multilayered temporality instead of perceiving the past as static broadens our appreciation of what happened in the past and provides a deeper understanding of how people in the past dealt with time and memory (see Ingold 1993, 171; Thomas 1996[b], Chapters 2-4; but see also Louwe Kooijmans 2000, 324). The appreciation of this variety of time scales as well as directing apposite questions at the right temporal scales, has been referred to as time-perspectivism (Bailey 2007; Lucas 2005, 43).

While perception of time is culturally specific and historically contingent (Gell 1992; Munn 1992), an important handle on time may be implicit in the way material culture is organized. The way in which a society views the world is inextricably linked to its material relations with that world which encapsulate conceptual, symbolic or cognitive aspects of society as well as technology or economy (Lucas 2005, 67). In this sense the temporal structure in which past activities (*e.g.* building, harvesting, rituals, mobility, burial) are embedded and recur is also informative on past perceptions (*ibid.* 68-69). The repetitive character and mnemonic aspects of these activities (and related objects, structures, performances and material culture; see Jones 2007; Rowlands 1993), although not easily inferred from the material record, bring us closer to social memory and its role in cultural reproduction over time.[7] In reference to this the example of the site of Bergschenhoek might again be illustrative.

Revisiting Bergschenhoek

The location of Bergschenhoek was probably embedded in cyclical cultural practices as the site was visited for several consecutive winters. These will have been expeditions involving quite some preparation, materialized in practices which were typical for the winter. Being involved in these practices might have been emblematic for and have triggered memories of the lean season, a potential time of hardship. It might have evoked memories of previous years and deceased? individuals and have formed the incentive for rituals.

The frequent renewal of the hearth at the site is related to the daily or weekly repertoire of activities. Renewing the hearth could have marked the beginning of the stay and it formed the centre of repetitive activities such as the curation of tools and the processing of hunted animals, activities which had a temporality and repetitiveness of their own. The hearth might also have formed the focus for the telling of stories and myths about the past or ancestors and thus for a less tangible construction of time related to cosmology.

Activity at Bergschenhoek was not endless, however. The decision to abandon the use of this location may have been down to deteriorating local circumstances (*cf.* Schlanger 1992). It might also have related to a repetitive shift in mobility, involving a large-scale move of the entire settlement system every couple of decennia (see Binford 1983(1983), 379-386). The memory of the use of the Bergschenhoek location or one of its episodes could thus in this sense be linear and regain an aspect of cyclicity at the time the location was visited again (which ceased when the site was abandoned for good). In the same sense the axe fragment was probably part of an object that went through similar cycles of storage, use and curation, eventually ending in broken fashion at the site; again, a linear sense of time. At the same time, however, the 'end of the axe' might have fueled the need to acquire a new one, which was probably dependent on the frequency of exchange relationships and the acquisition of axes through these.

From temporality to memory

It is through the repetition of habitual practice ranging from rituals to ordinary physical tasks that the structure and fabric of society is handed down to and over consecutive generations (see Bourdieu 1977; Jones 2007; Rowlands 1993). Whittle (2003, 22), drawing on Giddens (1984, 50), in this sense speaks of the 'ontological security' embedded in routines. At the same time this repetition and the nature in which both linear and cyclical time are dealt with becomes informative on the character of social memory.

Social memory and a past sense of the past can thus be created and continued both through (often subconscious) habitual practices or deliberate commemorative events (*e.g.* Gerritsen 2008, 144). The character of (social) memory can be complicated and diverse (see Whittle 2003, 107-118). A better understanding of the communities involved is arrived at when we try to perceive and understand the continuity and the change in these repetitive practices (*cf.* Lucas 2005, 83-92). This calls for an appreciation of the past as an active influence instead of a static backdrop (Barrett 2000, 67; Brück 2005) to the various activities and practices performed (including construction, sacrifice, abandonment etc. as well as skills exercised; Rowlands 1993, 146). The physicality of the past in this respect, the material 'traces' that are preserved, may form important references of past events and locations for the orientation of repetitive practice (Jones 2007, 18-23). By triggering memory and forming a focus for actions, objects, structures and places tied people to their past, while repetitive practices formed a strong reiteration or reference between past and present (*ibid.*, 55), forging a sense of identity (see Whittle 2003, 22; see also Thomas 2000[a]).

The addition of this temporal aspect might be informative on the constellation of conservative and progressive elements within the studied communities, something that is elementary in trying to understand the gradual process of Neolithisation in the Lower Rhine Area and the choices for the adoption of certain elements. It emphasizes the relationship between short- and medium-term practices and longer term trends and as such opens a window onto the discovery of long-term *habitus* and a characterization of these communities over time.

6.4 Structure, agency and continuity

> '*men* [sic] *make their own history, but they do not make it just as they please, they do not make it under circumstances chosen by themselves, but under circumstances directly encountered, given and transmitted from the past.'* (Marx 1963, 15 (1869), cited in Dobres/Robb 2000, 5).

The changes and temporality characterising the transition to agriculture in the LRA wetlands need to be understood within the perspective of the (succession of) communities involved. This means a focus on the mechanisms of change and stability in society and the way in which these enabled the incorporation of elements from the Neolithic repertoire. To understand these processes it is useful to focus on the concepts and interplay of structure and agency and their role in societal change.

I will not use structure and agency as synonyms for process and event. While the latter terms help to understand the structure and temporality of history as outlined above, they are not informative as to the dynamics underlying that structuring. In the same manner processes cannot be seen as conditional or causal for events because events cannot be seen as consequential of processes since the latter are generated *through* the working of events. Causes cannot be their own consequences (Barrett 2004, 12-14). From an archaeological perspective this means that a long-term sequencing of material culture cannot be regarded as the structuring of history, since it does not account for the moments in which the structuring is actually realized (*ibid.*). In line with the argument of time and temporality outlined above, Barrett (2004, 15) therefore speaks of a structuring of history *from* which temporalities are formed. As such, process becomes the map of patterns of continuity and changes in events through time (*ibid.*, 20). It is in the dynamics underlying this patterning that structure and agency may provide some perspective.

For most of the previous century, archaeological argumentation for and explanation of societal change has often been based on the 'will of the collective.' Both 'Childean' culture-historical approaches and processual archaeology propagated a top-down perspective of society in which human behaviour and its material reflection were interpreted as socially determined and embedded in various (heuristic) subsystems and normative rules (*cf.* Clarke 1978 as well as Bourdieu 1977, 83). Change, from this perspective, was instigated and directed by adaptive structures within the social system or ecosystem (see Barrett 2001, 144-146; Johnson 1999, 104-108). This means there was little attention for the actual individuals or groups within these systems and the way their actions and choices shaped the structure of society and thus the material patterns we document. To compensate for this lacuna archaeology (mostly within a postprocessual paradigm) reverted to the concepts of 'agency' and 'structure' developed within sociology and anthropology.

Social dialectics

The profuse and often indiscriminate use of the terms 'structure and agency' in archaeology until now presents a problem however (see also Dobres/Robb 2000, table 1.1, p. 9; Jacobs 1993, 336). Structure and agency have often been used as convenient labels and as synonymous with society and the individual. Agency in this sense was used as an explanatory 'way out' for sudden change or particular phenomena, a reading which has little in common with its original conception.

At the basis of 'agency theory' are the works of Giddens (1984) and Bourdieu (1977). Both focus on the *embedded* role of individuals within society and the dialectic relationship between the structures agents both exist in and which they (re)produce. This humanized, dynamic perspective on the relationship between individuals and communities focuses not so much on agency and agents, as it does on practice (Viveiros de Castro, in: Barnard/Spencer 2002, 514-522; Bourdieu 1977, 79-83; Dobres/Robb 2000, 4-5; Giddens 1984, 2). In this sense, understanding stasis and change is thus not so much about 'who', but about 'how'.

The main contribution of Giddens lies in his effort to overcome the pervasive dualism between the totality of society and the experience of the individual by focusing on the relationship between them in the form of 'social practices ordered across space and time' (Giddens 1984, 2, *cf. supra*). These practices are of a recursive nature, meaning that 'in and through their activities agents reproduce the conditions that make these activities possible' (*ibid.*). Structure in this sense can be characterised as recursively organised sets of rules and resources which are bound neither to time nor space. These are embedded within social systems which involve 'knowledgeable activities' of situated human actors or agents (*ibid.*, 25). This perspective is useful when adopting the long-term approach advocated above. According to Giddens the duality of structure lies in the fact that 'the structural properties of social systems are both medium and outcome of the practices they recursively organize' (Giddens 1985, 25). Structure should thus not be seen as constraining, but rather as facilitating (Barrett 2001, 150, drawing on Giddens 1984, 25). In the same manner agency does not stand for the intentions of individuals (for a contrasting opinion see Hodder 2000, 25-26) but for their capability for realizing these (*cf.* Giddens 1984, 9).

Although Giddens acknowledges that the outcome of practised routines may have unexpected consequences (1984, 26-27, 90) his emphasis is on the *knowledgeability* of the actors involved (Jacobs 1993; Baert 1998 cited in Whittle 2003, 10-11). Agents are capable of acting, and possess knowledge of social conventions enabling them to 'go on' (Giddens 1984, 26). In this sense they both reproduce and transform structure. This knowledgeability can be *discursive*, incorporating practices which are objectified and expressed verbally, or through other means (see Rowlands 1993). An example of the latter would be rituals or certain aspects of mortuary practice. Most knowledgeability is however founded upon practical consciousness (*ibid.*). Bourdieu (1977) focuses to a significant extent on this practical non-discursive knowledge as expressed through *habitus:*

'The habitus, the durably installed generative principle of regulated improvisations, produces practices which tend to reproduce the regularities immanent in the objective conditions of the production of their generative principle, while adjusting to the demands inscribed as objective potentialities in the situation, as defined by the cognitive and motivating structure making up the habitus' (1977, 78). The *habitus* controls the actual practice (*praxis*) through which it is defined.[8] In this sense it is a 'structuring structure' based upon imitation and socialisation (see Jacobs 1993). Bourdieu's *habitus* is dialectically bound to 'fields' (see Bourdieu 1977, 95). These can be defined as social theatres marked by their own sets of rules and codes which

regulate what is perceived as sociable behaviour. In this way the field structures and is structured by the *habitus* (see Jacobs 1993, 340). Intuitive 'know-how' enables agents to 'attune' their *habitus* to the demands of the field enabling them to become successful participants.

Both Giddens' and Bourdieu's ideas are in concordance concerning the recursive nature of the relationship between structure and agency, although Bourdieu has a more restrictive perception of the knowledgeability and intention of agents (see Jacobs 1993). It is the emphasis on social practices, however common or 'domestic', in the recursive interplay between individuals and communities that shapes and consolidates social systems.

6.4.1 Agency and archaeology

It is thus possible to interpret the developments characterising the transition from the Mesolithic to the Neolithic from the perspective of agency. This opens up an opportunity for a bottom-up perception of the process of Neolithisation in the LRA. In addition to documenting the material reflection of processes and events and correlating those to 'cultures' and 'groups', this approach focuses on the dynamics behind becoming Neolithic and subsequently the way agency influenced this process. This is not yet informative on the character and scale of agency, nor on the way archaeology might be able to deal with it. The latter issue has been of concern to archaeologists. The use of agency theory in archaeology has been hampered by the lack of application in the form of case-studies and by the abstract terms used (*cf.* Whittle 2003, 11-13). While case-studies remain limited, Barrett's programmatic papers on agency in archaeology (2000; 2001) provide some useful handles, notably in the form of *structural conditions* and *structuring principles* (see fig. 6.1). By structural conditions Barrett (2000, 65-66) implies all conditions which agency may once have 'inhabited', such as certain landscapes, environments, material structures, resources, available technologies and systems of symbolic order. These conditions have their own historical development and significance, generated through (often repetitive) practices and implicitly meaningful to the participants. Although these (archaeologically perceivable) conditions ordered the world agents lived in they themselves did not *do* anything. Structuring principles on the other hand are the means or ideas that developed over time for successfully 'inhabiting' or 'negotiating' these structural conditions. They are based on the knowledgeability of the actors to work on their conditions in order to reproduce their identities and conditions of existence (*ibid.*). Structuring principles might thus be seen as the knowledge, motivation, skill and level of self-determination enabling agents to reproduce (or sometimes change) the structure within which they operate. Within this setting an acceptance or boycott of (divergent) *habitus* is dependent upon the reaction of the community, either enabling or rejecting change. The influence necessary to establish this comes from control over resources and influence over others. It is the ability to objectify the conditions within a certain field and discursively and strategically act upon them (see Bourdieu 1977, 184, but also Barrett 2001, 154 and Giddens 1984, 14-16). Giddens (*ibid.*) refers to this as the capability of agents to 'make a difference' within a 'dialectic of control'. Barrett (2001, 161) further mentions that fields and their resources might be vertically differentiated and therefore involved differentially empowered

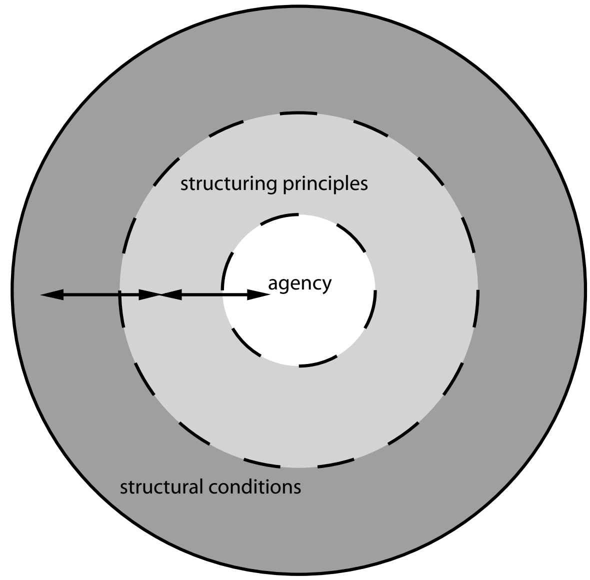


Fig. 6.1 A visualisation of the recursive relationship between structural conditions, structuring principles and agency.

agents. Since this study deals with largely egalitarian small-scale communities the existence of stratification and differentially empowered agents should not be overestimated.

Structural conditions comprise the inhabited and historically significant spaces and facilities which are both medium and outcome of agency (Barrett 2000, 65-66). These facilitated certain social practices and can be documented archaeologically. The archaeology of structuring principles (or fields of social practice, *cf.* Barrett 2001, 158) is more complicated however, since it involves the way in which structural conditions were inhabited. We cannot excavate structuring principles but have to infer them by analysis of the data. This might, for example, involve enquiries into a mobility cycle, a *chaîne opératoire* or mortuary practices, but also encompasses other ways in which agents might have perceived or dealt with their structural conditions and especially how they perpetuated them. These perspectives border on phenomenological approaches (see Barrett 2001, 158) and become more speculative when their archaeological footing becomes less clear-cut. A long-term perspective, however, from which characteristics at different time scales may be analysed, combined and related, may provide a more solid basis for documenting structuring principles, because of the longer scope available to document recurrent patterns and continuity.

6.4.2 Agency and scale

While the above indicates how change may take place, the discussion on agency theory has so far not discussed the level at which change is instigated. Agency has often been used from the analytical perspective of the individual and the body (see Dobres/Robb 2000; Hodder 2000; Nilsson Stutz 2003). Although legitimate, this approach is also partly problematic since it is based upon a western perspective of individuals and individualism (Whittle 2003, 52). A considerable body of ethnographic case studies shows that our western androcentric perception of a largely autonomous individual is just one of many possible perspectives (*e.g.* LiPuma 2000; Strathern 1996).[9] The way in which individuals are perceived in their societies' cosmovision and their relation with for example the natural world (*e.g.* Descola 1994) therefore nuance our idea of individuals and hence the appropriate perspective of agency and idiosyncratic behaviour. It is thus questionable to what extent agency theory should focus on the level of individuals. The perspective of structure and agency is on practice, on the 'how', and the way in which society gives leeway, enabling agents to perpetuate or change and establish new *habitus*. It is also about how a sense of 'groupness' is constructed, negotiated and transformed (Dobres/Robb 2000, 11). It is a communal process (Barrett 2005, 118). If we also consider the fact that acceptance (*cf. supra*) is a major constitutive element of change then it might be more important to focus on the progressive and conservative aspects of groups and the way in which they promote or boycott change. Several scholars have worked with group level agency (*e.g.* Wobst 2000; Sassaman 2000; Chapman 2000; Louwe Kooijmans 2009) and although their scope is variable it provides an apposite approach for further research.

Group agency

The reason for addressing the issue of scale is related to the groups involved in this study. Without wanting to touch upon the issue of complexity in hunter-gatherer and early farming communities here, most evidence pertaining to the structure of Late Mesolithic and subsequent communities suggests they may be characterised as small-scale and largely egalitarian (*e.g.* Louwe Kooijmans 1998[a,b]; Raemaekers 1999). There are no unambiguous indicators of hierarchy or rank in the archaeological record of the communities involved.[10] Differentiation was probably not entirely absent, but potent individuals such as chiefs or Big Men are unlikely to have been a feature. Power and influence might rather have been linked to specific age groups such as elders, to gender or skill in for example hunting. The fact that adopting domesticates and cultigens requires information and contact through *e.g.* exchange, raids and the like, implies a strong role for mobile members of the community, most likely the younger adult males. They can be seen as potentially influential players within their 'field' of interaction and exchange and as such structure which foreign elements were introduced. This is however not informative on the mechanisms of sanctioning of these new elements and changing *habitus* within the community. Women may have had an important hand in this (see Dusseldorp/Amkreutz in prep.). Overall however the egalitarian character was pervasive, which has led some to propose primitive communism as an appropriate model for society (see Raemaekers 1999; Tilley 1996).[11]

Presuming an absence of dominant agents on the level of the individual, a conceptual approach of structure and agency might be more effective at the encompassing level of the group or community involved. Through the sanctioning of *habitus* and structuring principles, (new) structural conditions, which can be documented archaeologically, are created within those already present. These in time, recursively, condition behaviour within the groups involved. By comparing and contrasting the temporality and nature of change and the degree of stability and continuity within, and between the cultural groups in the Late Mesolithic and Neolithic, a more detailed perspective of their involvement in, and perception of, the transition to agriculture may be given. This is furthermore informative as to the way in which the behaviour of these groups contributed to the character of Neolithisation in the LRA.

The ideas presented above provide a perspective on the structure of communities and the way in which a dialectic within groups perpetuates their socio-ideological characteristics and structuring principles. However, in order to understand these mechanisms, they need to be placed within their historical, long-term context, under structural conditions.

6.5 Towards a dwelling perspective?

A major critique of agency theory is the difficulty of its application (*e.g.* Brück 2005; for an exception see Sassaman 2000). This is partly due to its abstract character, which requires a historical (temporal) and physical (spatial) context. The workings of *habitus*, individual or group knowledge and their recursive character have however been made more comprehensible through the notion of the 'dwelling perspective'. This perspective is grounded in the phenomenological approaches of Heidegger and his work *Sein und Zeit* (see Berghs 1997, 165-179) as well as Merleau-Ponty and his *Phénomenologie de la Perception* (Merleau-Ponty 2002 (1945); Reynaert 1997, 321-336). The ideas expressed in these works gradually found application in archaeology (see Ingold 1993; Thomas 1996[b]; Tilley 1994). Thus, the reflective and reflexive aspects of Heidegger's *Dasein* (being-in-time) have been used by Thomas (1996[b], 41) to stress the fact that individuals, while gaining self identity and classifying their surroundings, become increasingly aware of the fact that they are 'thrown' into an already existent world, enmeshed in (historical) series of social and material relationships.

While the influence that this realisation has on the disposition of the individual (or group) is comparable to Bourdieu's *habitus* (*cf. supra*), it is the reflexivity and self-awareness of *Dasein* which adds a specific temporal aspect to its existence. The individual is aware of past, present and future, and of their unified role in the here-and-now (Heidegger's ecstasies and *Zeitigung*, see Heidegger 1967, 388-390, 394; see also Berghs 1997). *Dasein* is to a significant degree informative on the way in which people perceive of and deal with the world surrounding them and as such forms an important aspect of the dwelling perspective. This offers a potential for studying social dynamics within communities in relation to their life-world, landscape and environment.

Dwelling, attending, moving along

The dwelling perspective focuses on the relational involvement of residing, dwelling, inhabiting and being accustomed to a world (Thomas 2001, 173, referencing Heidegger (1962)). According to Ingold it treats the immersion of the organism-person in an environment or lifeworld as an inescapable condition of existence, implying that '*…the world continually comes into being around the inhabitant, and its manifold constituents take on significance through their incorporation into a regular pattern of life activity*' (Ingold 2000, 153). Of importance in this respect is that it refrains from employing a dualist perspective in which individuals confront and oppose a world, since it is exactly the (phenomenological) idea of being-in-the-world that makes the world comprehensible. This implies an absence of a distinct Cartesian divide between culture and nature, markedly present in Ingold's discussion of the temporality of the landscape for example (1993; 2000). Instead of perceiving the landscape as either a natural backdrop to human activities, or as a cognitive ordering of space, the dwelling perspective focuses on the landscape as an enduring record of the activities and material manifestations of past generations (Ingold 2000, 189).

Within the dwelling perspective approach, the human and natural factors are combined. They are part of one (experienced) existence. Nevertheless, their mutual involvement is difficult to characterize. Ingold does so by introducing the concept of 'taskscape' within his dwelling perspective (Ingold 2000, 199). The taskscape comprises the ensemble of activities involved in dwelling in the same manner in which the landscape comprises an array of features. Therefore the taskscape cannot be seen as a constellation of separate (technical) performances, but must be viewed within its social setting. Society in this sense consists of the interplay of people engaged in their tasks and thereby involved with each other. The temporality involved in this array of tasks is therefore essentially social (Ingold 2000, 195), much like the routines described by Whittle (2003, Chapter 2), is perpetual and never static and may comprise the totality of rhythmic phenomena, whether animate or inanimate (Ingold 2000, 200). A crucial aspect of this idea is the fact that both nature and culture merge. The activities of agents, their mobility and their engagement with their environment are not inscribed upon the landscape and upon nature, but interwoven with it (see Ingold 2000, 198-199). In this sense landscape and taskscape are aspects of the same 'current of activity', comprising for example the mobility cycle of foragers, the migratory movements of animals, the changing of the seasons and the time of harvest.

This approach stresses the 'rhythmic' aspects of human life and activity and the way in which these are interwoven with natural cycles. In this continuous relationship, agents do not act upon, but rather dwell within, attend to and move along with a world in which transformation and change develop recursively, instead of just having an anthropogenic origin (*cf. infra*; Ingold 2000; Lefebvre 2004). Dwelling and more specifically the social and natural aspects constituting it are both ongoing and dynamic. However, they also comprise an essential historical aspect, since practice and activities are shaped by the past and have an effect on the future.

Criticism and potential for Neolithisation research

Theoretically the dwelling perspective forms a useful approach, but its potential should be reviewed. Criticism of the dwelling perspective and the taskscape mainly focused on the workability of these concepts within archaeology. The nature of archaeological evidence often seems too incomplete to reconstruct embedded routines, perception of the environment, the recursive cycle of daily life or the incorporation of new elements. Other criticism (Whittle 2003, 14-15) focused on the insufficient attention given to more discursive aspects of society contrasting with being-in-the-world, such as learning, the impact of distinct life stages and *rites de passage*, or collective tradition. According to Whittle (2003, 15), the dwelling perspective is good at giving a sense of the general flow of life, but lacks explanatory potential for diversity, innovation and change.

In line with the criticism discussed above, the introduction of the dwelling perspective is not meant to provide a new framework, but is inspired by the scope that it offers for studying the prehistory of small-scale communities and the transition to agriculture in relation to aspects of environment and time. Three elements are important. The first relates to the abstract concepts of structure and agency. While these provide a useful approach for understanding the dialectical and recursive relationship responsible for stasis and change, they also provide a mechanistic picture of society and social transformation. They should be re-embedded in a dynamic setting. One might argue there is a recursive relationship between the dwelling perspective and *habitus* (*cf.* Bourdieu 1977), event and structure, and the material world (comprising landscape, material culture, bodies etc.) is at the heart of it (Mlekuž 2010, 195). The dwelling perspective situates communities spatio-temporally and captures the complex interaction between structure and agency in relation to the physical environment.

The second aspect relates to time and is important in the light of the long-term approach used in this study. Archaeology is often inclined to think in structured units of time and space, delineating cultures, groups, pottery styles and resource networks. Although these provide a useful framework for studying the character and interaction of past groups and their material culture, they often fail to accommodate for the continuity that exists between them. The dwelling perspective specifically stresses this continuity existing in the relationship between human society and its environment (see Ingold 1993; 2000). It acknowledges the importance of historicity (both in the temporality of landscape and taskscape) and the way in which this influenced behaviour and it is sensitive to the concern and involvement of communities with their past and the way they are, for example, bound to certain places.[12] According to Barrett (2000, 67) each age confronts the debris of its history, material and traditional, as a way of finding a home for itself. In the perspective of the process of Neolithisation this boundedness to the past is an important element to deal with when interpreting stasis and (lack of) change.

The last aspect involves the way in which the dwelling perspective stresses the 'interwovenness' of human action and the natural environment. Instead of perceiving human behaviour as culture within nature the dichotomies are broken down and the connections between the two are emphasised. By refraining from contrasting culture and nature the dwelling perspective enables a nuanced approach of what changed and what did not during the transition to agriculture. In contrast to the domestication of the wild and society as a condition enabling the transition to agriculture (*cf.* Hodder 1990), such a perspective might be able to document stasis or change without categorically opposing culture and nature. This might be a valuable approach towards understanding Neolithisation from a more indigenous perspective.

6.6 Archaeologies of inhabitation

In his 'Fragments from Antiquity' Barrett (1994, 4, 36) argues that the link between action and its residue which essentially is the object of archaeological enquiry, should be abandoned in favour of questions concerning the ways in which lives were constituted as 'knowledgeable' and motivated. This demands an understanding of how in any particular period the lives of people were created by their engagement with material conditions: '*we move away from asking 'what kinds of people made these conditions', to an understanding of what the possibilities were of being human within those material and historical conditions*' (*ibid.* 5). Barrett (1994; 2005) stresses that archaeology should steer clear of interpreting the motivation of an action by its material outcome. These are usually taken to represent the purpose of action, which then replaces intention as the object of archaeological enquiry. Behavioural change is perceived as 'problem-solving' and agency as acting 'in response' as attested by the consequences of their behaviour. This *post-hoc* reasoning has also influenced studies into the process of Neolithisation.

Re-addressing questions

Change during the transition to agriculture has often been addressed from an either/or perspective focusing on economic or social motivations (see Chapter 2; Binford 2002; Thomas 1999). This has often been based on the assumption that categorisation of behaviour by its outcome yields different kinds of motivation. According to Barrett (2005, 117), however, neither economic or social, nor any functional type of consequence of behaviour, tell us very much about the motivations of people to do or continue to do certain things. While Barrett may be too rigorous in dismissing the value of more traditional questions for answering how patterning in the archaeological record is structured, his approach is useful in broadening our perspective on Neolithisation and the communities involved. The scope of archaeology is re-adjusted by arguing that there is not a single kind of agency underlying the cause of history, but that human agency develops by being in the world. In this respect things do testify to human existence but the attention shifts to '*the way each kind of humanity was able to emerge by finding a location for itself in a world that nurtures it and upon which it could act*' (*ibid.* 118). Instead of treating humanity and agency as abstract values, this perspective stresses the importance of the 'material reality' that past communities inhabited and we as archaeologists study. History in this sense must not address why people did things, but how the conditions of possibility enabled humanity to constitute itself in historically specific ways (Barrett 2005, 119).[13]

This implies a need to readjust the 'why-question' in studying the process of Neolithisation. Instead of focusing on singular causal aspects of why the transition to agriculture took place over time, increased understanding is gained if we turn our attention to the continuum of small-scale communities involved in this process and the way they 'got on', renewing, reinventing and restructuring themselves. As argued above, to understand the agency behind societal stability or change there is need for its 'embedding' within elements and factors that govern and influence 'structure' over time. This calls for a focus on the material conditions, their dynamics and the way these were inhabited. The dwelling perspective (Ingold 1993; 2000) was introduced as a means to contextualize the way in which these structuring principles 'inhabited' structural conditions (*i.e.* often material conditions) over time. This implies an archaeology, not of abstract dwelling, but of 'inhabitation' focusing on the active and recursive relationship between humans and their (natural) environment (including the landscape) and specifically stressing the 'situatedness' and historicity of this relationship.

6.6.1 Phenomenology, experience and archaeology

An archaeology of inhabitation or 'dwelling' (*sensu* Ingold 1993; 2000) is rooted in the philosophy of phenomenology. This school and its main advocates (Husserl, Merleau-Ponty and Heidegger) try to understand human existence, or 'being' from the perspective of the subject and the way in which it understands the world and its place in it through active engagement. This latter self-reflexive aspect was mainly introduced by Heidegger (1967) and Merleau-Ponty (2002 (1945)). Both argued against the existence of an object-subject divide. Heidegger's notion of *Dasein* or 'being-in-the-world' (Berghs 1997; Thomas 1996[b]) and Merleau-Ponty's focus on the body and sensuous experience (2002) specifically stress that it is through our embodied actions within an already existing world that we become aware of our own place in it and our role in social and material relations.[14] Its potential in the field of archaeology, in particular with respect to the topic discussed here, will be assessed in the following.

The importance of a phenomenological approach for archaeology resides in what may be termed a principle of actuality. This specifically refers to the ontological primacy of phenomena, or as Merleau-Ponty (2002, 348) puts it, the 'perceptual constants'. He argues that there is a fundamental relation of unity between perceiver and perceived in all acts of perception. As argued above this transcends a distinction between object and subject and actually enmeshes the perceiver in the world he is part of (Merleau-Ponty 2002, Chapter 3; Tilley 2004). In the act of perceiving there is also a reflection, or effect on the receiver. This is referred to as the reversibility thesis (Dillon 1983). As a result Merleau-Ponty argues that 'flesh' is the most elementary element in perception and more or less forms a constant in time. It enables experiences based on the same premises. The value of phenomenology for archaeology then lies in the consistent and continuous commonality between everything (people, places and objects) of sensory value. Perception, rather than being hyper-subjective, is interpreted as fundamentally worldly. What is perceived is as such invested with humanity, a coition of our body with things (Merleau-Ponty 2002, 373; Reynaert 1997, 329).

Tilley (1994) was one of the first in archaeology to advocate the use of a phenomenological approach with respect to landscape. Instead of an objectification of landscape, he argued for a re-engagement with the qualitative aspects of it, experience mediated through the body (1994; 2004; see also Brück 2005).[15] This would imply that our own being-in-the-world and (physical) engagement with it provides a valuable window upon past perception of landscape, objects and persons. While Tilley (1994; 2004) draws heavily on Merleau-Ponty, others, most notably Gosden (1994) and Thomas (1996[b]), focus more on the work of Heidegger (1967). This adds a specific temporal and historical aspect to the discussion (see also Brück 2005, 49) in that (portable) objects and structures encountered are conceived of as having mnemonic values and of evoking the past as well as being projected forward into future projects (Jones 2007; Thomas 1996[b], 81). Phenomenology and its role in the dwelling perspective are of importance for understanding the approach chosen here, but difficulties in application should be taken into account.

Application, problems and perspective

In recent years archaeological research from a phenomenological perspective has mainly focused on an elaboration of the sensory and embodied approach advocated by Tilley (*e.g.* Cummings 2002; Edmonds 1999; Watson 2001; Tilley 1996). Several critical observations should however be made. First, there is a tendency to focus on vision-oriented studies. These make it difficult to judge whether certain characteristics noted today in (in)visibility held the same importance in the past (Brück 2005, 51). By extension other sensory aspects like touch and smell (*e.g.* Tilley 2004) face the same problems of subjectivity. This is also germane to many current studies concerning materiality (*e.g.* Bradley 2004; Renfrew

2004; Tilley 2004; see also Ingold 2007). As a result phenomenological accounts also often tend to be more descriptive than explanatory, lacking substantiating evidence or a demonstration of regularities. Application is often limited to a few 'convenient' case-studies (see Brück 2005, 53). Other criticism may be levelled at the supposed universality of the human body and its sensory experience. Several authors have stressed that the physical variability in humans may have led to diverging experiences (Brück 2005; Fowler 2004; Hodder 1999). Others, most notably from an ethnographic perspective, have pointed out that the body next to being a universal entity is also very much a cultural product. This differentiation, already pointed out earlier, comprises features such as the 'dividuality', 'partibility' and 'permeability' of people in certain societies (*e.g.* Busby 1997; Fowler 2004; LiPuma 2000; Strathern 1996; Whittle 2003). The construction of the 'self' is thus also a product of the relationships between people, but may even comprise things, places and events beyond the limits of the human body (Brück 2005, 61; see also Mauss 1990(1950); Thomas 2000[b], 151-152; Weiner 1992). Evidently these aspects considerably broaden the array of experiences that may mediate through the body. Moreover these experiences are not universal. From a physical perspective, material aspects of landscape and objects are likely to have changed considerably over time. Brück (2005, 56) stresses that the material properties of landscape, and objects, are often made intelligible within a particular socio-cultural context (see also Feld/Basso 1996). This also once more underlines the importance of historicity and temporal connotations (Brück 2005, 56; Sokolowski 2000, 130-143; Thomas1996[b]; 2000, 148).

These observations demonstrate the difficulties associated with adopting a phenomenological approach in archaeology. Thomas (2000[b], 149) criticized the use of phenomenological perspectives from a specifically humanist or individual point of view and the existence of an actualistic character to embodied experience. Instead he argues for a focus on the relational. The network of existing relationships forms the most important potential for action that is implicit in the connections among people and between people and things (*ibid.* 150). Rather than entering into relationships, human beings emerge from a relational background (reflecting their enmeshed historical position). These relationships are furthermore not mere connections among human subjects, but heterogeneous networks that bind people, things and places together (*ibid.* 152-153; Tilley 2004, 217). The social in this sense is a relational field, not an object engineered by human minds, comprising both human and nonhuman elements in a hybrid fashion (Latour 1993; 2005; Thomas 2000[b], 153). One way of studying this relational field and the interplay of its human and nonhuman connections is by developing an archaeology of inhabitation, attuned to the nature of the study area and period.

6.6.2 Relationality and networks

Instead of focusing on the embodied experience of monuments and landscapes from an individual perspective, an archaeology of inhabitation employs a broader scope. Phenomenological approaches are used to understand social relationships and development from the perspective of day-to-day practice. The embedded sensual inhabitation of meaningful landscapes plays a crucial role in the creation of social identity (Brück 2005, 62; Pollard 2000, 363) and an understanding of the engagement in routine practice and the changes therein is central to an enhanced understanding of past societies. From this perspective there is a distinct focus on the active and recursive relationship between humans and their (natural) environment (*e.g.* Barrett 1994; Gosden 1994; Pollard 2000; Whittle 2003; see also Descola 1994). Human practice and historic process form main issues within a landscape interpreted as something worked and lived in, stressing the importance of relations between people, places, the material world and the realm of spirits and supernatural powers (Pollard 2000, 363). This has been aptly phrased by Giles (1997, in Chadwick 2004, 9; see also Giles 2000): '*To inhabit the world is to experience the world bodily and to act in the world knowledgeably. Habit itself implies routine and thus reproduction; it is a social process carried out by people who are intricately bound in webs of relationships. Inhabitation must therefore be situated not only within the historical materiality of those lives, but it must also deal with social memory and the way in which identities are reproduced and transformed over time*'.

Central to archaeologies of inhabitation is a notion of 'dwelling' (*cf. supra*), which emphasises these relationships and implies an embodied and embedded engagement of people with and in their world (Heidegger 1967; Heidegger (1962) in Thomas 1996[b], 89). Ingold (2000, 186), refers to a current of 'involved activity' within the specific relational contexts of practical engagement of people with their surroundings. The human condition is immersed from the start in perceptual and practical engagement with constituents of the dwelt-in world, '*apprehending the world is not a matter of construction but of engagement, not of building but of dwelling, not of making a view of the world but of taking up a view in it*' (2000, 42). It is thus about the way people 'attend' to their world (Whittle 2003, 14).

From this perspective, meaning and significance come into existence through their incorporation into a regular pattern of life activity (Ingold 2000, 153). Engagement in the form of regular patterns of movement and routine practice becomes the focus of interest.They create the embedded links between people, places and objects and shape identity (see Brück 2005, 62). In this respect networks comprising both human and non-human, living as well as inert components are constructed (*cf.* Latour 2005). Thomas (1996[b], 237) stresses this notion of relationality and argues that human identity emerges out of this connectedness: '*Human identities, material objects, and places all develop from a background of relationality. Certain social phenomena such as power, agency, care and concern are best considered as attributes of relational networks, rather than as things which issue out of individual isolated intelligences.*' This relationality is at the heart of 'dwelling' and thus the main theorem underlying an archaeology of inhabitation.[16] Crucial to this understanding is also a focus upon manners in which the world was 'attended' to. As argued above, these specifically involve patterns of regular movement and routine practice, long-term ways of interaction between communities and their environment. They are a means of understanding these relationships over time.

6.6.3 Rounds, routines, rhythms: adding time

Communities living in a (regional) landscape and interacting with(in) a specific environment achieve a certain 'resonance' based on being 'attuned' to their surroundings and other people's mutually attentive engagement. These repetitive rhythms, daily and yearly cycles may be studied from an interpretative perspective which portrays them as an ecological backdrop, structuring human activity in a timeless manner. However, for answering questions at the level of involved communities a more active and recursive dynamic may be more apt (see Mlekuž 2010, 193). A long-term perspective focusing on this engagement indicates the existence of a certain temporality characterized by cycles and repetitions with a certain 'rhythmicity' to it.[17] This emerges both from the interweaving and mutual responsiveness of human movement and activity, as well as from the way these movements resonate to cycles of the non-human environment. Ingold (2000, 325) argues that: '*…people had to fall in with the rhythms of their environment: with the winds, the tides, the needs of domestic animals, the alternations of day and night, of the seasons and so on, in accordance with what the environment afforded for the conduct of their daily tasks.*' The totality of rhythmic phenomena, whether animate or inanimate is involved (*ibid.* 200). In practice all of these rhythms are enmeshed. Mlekuž (2010, 194) argues that the temporality of the tasks involved is inherently social, since it emerges from attending to and timing our actions in relation to other human and non-human agents. This also means that the environmental rhythms are not imposed from the outside, but become interwoven into the 'melody' of social life (*ibid.*). Places in this sense become relational webs of meaning and material (Thomas 1996[b], 91). Rhythms converge upon them and they may be documented over time.

This indicates the importance of rhythms. Some, such as the turn of the seasons, migratory movements of animals, or the ripening of the fruits of the land are obvious, although archaeological detection is often conditioned. From the social perspective of the communities we study, rhythm is also very much about the daily and yearly round, about the existence of routines. Whittle (2003, 22) argues that routines comprise the things that have to be done for life to go on, their very repetition creating a sense of 'ontological security'. Many routines, though not all, are probably 'hardwired' into our daily existence which is why they are carried out unwittingly. Their existence and execution lead to reproduction of the existing structures of society (*ibid.*), thus providing a further embedding of the workings of agency and change, touched upon above. According to Edmonds (1997, 108) a better understanding of the tempo and character of these routines (within the taskscape), enables us to explore how concepts of identity, community and authority were carried forward. This is especially important in times of potential change as for example during the transition to agriculture.

Routines comprise a wide array of recurrent activities in different fields and with different frequencies. They may include the seasonal movement of base camps, the annual period of harvest and the communal building of new houses, as well as raids, cattle treks, raw material expeditions, disposal of the deceased and ritual activity. The way in which these routines were 'inhabited' and executed and their 'attunement' to the rhythms of nature provide an interesting perspective on the workings and stability of the communities involved. With respect to the process of Neolithisation the presence or absence of change in the 'rhythmicity' of routines and cycles becomes specifically interesting.

Understanding rhythms

Rhythms form a binding element between community *habitus* (*cf.* Bourdieu 1977; Mlekuž 2010, 195) and the dwelling perspective. It is through rhythmic patterns of involvement between (what we perceive as) the natural and cultural world that the structure of society comes into existence and is handed down through time. Understanding rhythms (as well as routines, cycles etc.) requires an intimate knowledge of lived space and time and forms an important perspective on the character and constitution of past communities (see Barrett 1994; 2005; Edmonds 1997). One of the foremost scholars working with rhythms from an analytical perspective has been Henri Lefebvre. Lefebvre argues that in life rhythm raises questions of change and repetition, identity and difference, contrast and continuity. Instead of merely documenting rhythms he aims to use them as an analytical tool to examine a variety of issues. In line with thoughts expressed by Merleau-Ponty (2002) Lefebvre sees the body and its perception as the main point of reference, as a contact zone as it were between biological rhythms (sleep, hunger, thirst etc.) and the social rhythms of the outside world (2004, *xii*). Natural rhythms are also part of this. Lefebvre goes on to dissect some of the rhythms we experience (2004, 8) and distinguishes between cyclical repetition and the linear repetitive.[18] The former originates in the cosmic, in nature and comprises days, nights, seasons, waves, tides, monthly cycles etc. The latter originates in social practice and human activity and involves the monotony of actions and movements. Both are in a reciprocal relation: '*Time and space, the cyclical and the linear, exert a reciprocal action: they measure themselves against one another; each one makes itself and is made a measuring-measure; everything is cyclical repetition through linear repetitions*' (*ibid.*). Both aspects are thus used in perception and making sense of the world. Lefebvre argues that this unity gives rise to compromises and sometimes to disturbances. Many rhythms will not be indefinite and new events may introduce themselves into the repetitive and form a difference (*ibid.* 6-7). It is likely that at these moments the existing structures of society are questioned and there is an opportunity in the dialectic of structure and agency for change (see above). Novelties may be introduced into society and these in time will also acquire repetition and rhythm. Change in this sense is brought about by the imprinting of new rhythms, the results of which may only be visible after a while (see Lefebvre 2004, 14). Clearly the transition to farming will have instigated many of these changes in rhythm. By studying their impact on existing rhythms and the way they were incorporated and integrated into existing practices we may learn more about how the process of Neolithisation was negotiated from the perspective of the communities involved and the long-term characteristics of their inhabitation of the wetlands and their margins.

Lefebvre's rhythmic typification ties in with the workings of structure and agency. It forms a link between the way *habitus* works and recursively interacts with its surroundings (Mlekuž 2010, 195). It embodies the existence of a network (*cf.* Latour 2005) and the interaction going on within it. As such, it enables an alternative perspective on the changes involved in the process of Neolithisation. Using Lefebvre's terminology, these may disturb (arrhythmia), or be brought in 'attunement' (isorhythmia) with the existing hunter-gatherer rhythms (eurhythmia). Focusing on the presence and absence of rhythmic changes in these communities will increase our understanding of how the various workings of Neolithisation were integrated and perceived in society.

6.7 Converging thoughts: research aim and outline

This chapter has sketched a theoretical outline for dealing with some of the incompatibilities and scales involved in studying the process of Neolithisation. On the one hand the process of Neolithisation is about the suprahuman scale, about far-reaching societal and economic change involving abstract cultural connotations such as Swifterbant, Michelsberg or Hazendonk. In this sense it covers an enormous temporal dimension, in the case of the LRA up to 3000 years. The study of this process deals with documenting change by mapping and dating the presence and absence of cereals, domesticated animals, or for example *Breitkeile*, pottery and sickle blades. It focuses on the universal character of transformation in society (we all became farmers) and on the temporality of the changes taking place. Diffusion models such as those of Ammerman and Cavalli-Sforza (1973) or Dolukhanov *et al.* (2005) are typical examples of this. On the other hand Neolithisation is also very much about the human scale, about the local communities and their differing trajectories. To try and understand their role an alternative approach is necessary that is directed at the structure of these indigenous societies and the way in which they incorporate or refrain from incorporating the new. Archaeology needs to study the historicity of human agency and as such confront the lives of people and communities, since the social systems we recognise have come into existence through their inhabitation of a certain materiality (*i.e.* structural conditions; Barrett 2001, 157). While both approaches to Neolithisation are worthwhile and complementary, the latter is of more importance to the scope of this study. Instead of focusing on change and transition it deals with the stability and identity of the communities involved and the way in which they perceived their contact and exchange with farmers and structures change while simultaneously maintaining traditions. Elemental in this is trying to understand the indigenous manner of localisation, of making comprehensible and integrating the potential of change available.

Building a framework

This chapter has discussed a number of related theoretical approaches for arriving at such a bottom-up perspective. First, both from a taphonomic and interpretative perspective, the process of Neolithisation in the LRA should not be dominated by an economic approach. The appearance or contribution of Neolithic elements should not lead to a different approach to the study of these societies, or to an emphasis on different aspects. This is based on the idea that the communities involved may be perceived as culturally continuous and should therefore be studied from a similar (unchanged) perspective. This approach refrains from making a clear Mesolithic-Neolithic distinction and primarily studies the communities involved, stressing their (Late) Mesolithic roots. This more indigenous approach also presumes the absence of a strong distinction between nature and culture, which in turn provides a different perspective on how Neolithisation was 'negiotiated' and how Neolithic elements were incorporated.

Secondly, to understand the way these communities dealt with new Neolithic elements and the gradual transition in the research area, the interrelationship between communities, the landscape and the environment should be targeted from a diachronic perspective. The introduction of Braudel's (1966) division of time was intended to stress the recursive relationship between process and event, and by adding the idea of a multitemporal past (Lucas 2005), or temporal palimpsests (Bailey 2007), the complexity of time and memory was emphasized. This is important in understanding the way in which routine practice and ritual perpetuated indigenous way-of-life and to what extent societal structure influenced this. A major benefit is the fact that since we are dealing with cultural and regional continuity the various characteristics of the groups involved, both concerning short-term as well as longer term behaviour may be understood from within this context. Characteristics of short- and medium-term practices and longer term trends may therefore be related (Bailey 2007; Foxhall 2000; Gerritsen 2008) and informative on each other. This opens a window on the discovery of long-term *habitus* and perception and stresses the importance of repetition and memory (see Jones 2007). This perspective, however, should be integrated with the environmental and landscape context and the workings of socio-ideological and cultural continuity.

Thirdly the concepts of structure and agency were introduced. While the use of these concepts has been manifold, their original basis (*sensu* Bourdieu 1977; Giddens 1984) continues to offer a good framework and syntax for explaining change and diversity. Elemental in agency theory is the idea that change of *habitus* can be initiated on the level of the agent. Through subsequent societal sanctioning, idiosyncratic behaviour might thus influence the structure of fields in society. It is important to stress that the main emphasis here is on the recursive interplay between structure and society, not on one-sided individually instigated developments. While individuals, notably influential players within a certain field, have the ability to introduce new elements and *habitus*, the absence of essentially dominant individuals in the largely egalitarian communities studied here, implies that change and social sanctioning are essentially a 'group thing.' In this sense it was argued that the agency of groups might be the most apposite level to study societal change.

The workings of structure and agency need to be embedded within other elements and factors influencing societal structure and change. Therefore the notion of the dwelling perspective was introduced (*cf.* Ingold 2000) and eventually the idea of an archaeology of 'inhabitation'. Various factors were introduced that stressed the importance of a bottom-up, situated approach which tries to understand these communities from within their inhabited historical conditions, rather than by the outcome of long-term processes (*e.g.* Barrett 1994; 2001; 2005). These factors included the incorporation of historicity and the active interaction between humans and their environment (Ingold 2000) as well as the way in which this influenced societal structure over time and should be seen as existing within relational networks that incorporate animate and inanimate entities, landscape, environment, places and communities (Chadwick 2004; Latour 2005; Thomas 1996[b]). It is these networks that over time create and form individual and social identity. These hybrid webs, moreover, are not managed by humans, but these are 'thrown' into them. Of importance in this respect is also the spatio-temporal manner in which these networks and their associated structural conditions were inhabited. This stresses the importance of rounds, routines and cycles as ontological, often implicit ways of handing down the structure of society across time.[19] Finally, the work of Lefebvre (2004) and his focus on rhythms and certain states of rhythm was touched upon. Analysing rhythms draws out the importance of everyday non-discursive, routine behaviour. This approach stresses the interaction between the dwelling perspective and *habitus*. Furthermore, by acknowledging the historicity, temporality and rhythms involved, *habitus* may be understood and analysed from a long-term diachronic perspective. Rhythm in this sense is the key to understanding the interwovenness of temporalities in many different fields. This also accentuates the fact that Neolithisation may imply a range of 'rhythmic' changes and that the way communities deal with and attune to these is informative on them and their transition to agriculture. Changes may have been avoided or conditioned to match the already existing beat of society.

Defining perspective

The theoretical framework presented above provides a basis for studying the process of Neolithisation in the Lower Rhine Area from the perspective of inhabitation. It also forms a theoretical background and starting point for the approach adopted in the following chapters. There I will focus on the character and identity of the small-scale communities in the wetlands and wet margins of the LRA, during the process of Neolithisation. This will involve the ways in which material conditions were inhabited and the existence and character of social and economic routines. Changes or stasis in rhythm over time and the nature of their incorporation will be documented in the light of the process of Neolithisation and its local implications. This essentially means a focus on the way these groups were embedded in their environment and how developments may be understood from this 'inhabited' perspective. From this a better understanding of the 'cadence' of Neolithisation in the Lower Rhine Area may be achieved.

The focus in Chapters 7 and 8 will be on mobility, land-use and procurement. It involves 'dwelling' in its broadest geographical sense.[20] It is about the structure and structuring of the landscape and its environment over time and the way it was experienced, attended to and dealt with. The analysis attempts to gauge to what degree landscape and environment actively influenced the economic choices and social structure of the communities inhabiting them. This forms a background for a more general and broad-scale analysis and synthesis of both the communities involved in this process of Neolithisation in the LRA (Chapter 9) and the workings of this 'situated' transition itself (Chapter 10).

Notes

1 For the LRA this for example ranged from the metric aspects of pig bones (Hogestijn/Peeters 1996), through the meaning of the presence of *Cerealia* pollen and chernels (Bakels 1986) to the credibility of features interpreted as ardmarks (Peters/Peeters 2001).

2 Evolution is used here as it is often used outside of current biological or palaeo-anthropological studies, as a logical one-way development from one state to another, *i.e.* from forager to farmer. This anagenetic mode of evolution, also affiliated with culture-historic evolutionism (Lucas 2005,7), contrasts with current developments in the field (see Gould 1999). Evolution merited for its own complex character is in fact much more similar to the process of Neolithisation (*e.g.* Gould 1999; Layton 1999; Sheratt 1996; Simmons 1999).

3 This touches upon recent ideas of the application of 'structure and contingency' in the archaeological field (see Bintliff (ed.) 1999). Gould (1999, *xvii*) rightfully comments that the use of these concepts of structure and especially contingency is strongly dependent upon our perception of the rate of change. What is considered gradual and stable on the level of generations might appear sudden and swift from a chronologically wider perspective. In this sense I would also agree with Simmons (1999, 124) that the actual domestication of plants and animals, and the numerous 'try-outs' leading up to it, might not be detectable in the archaeological record. In the same manner we must undoubtedly fail to grasp many of the intricacies of becoming farmers in the LRA. Although contingency theory and related approaches can be useful, their application seems particularly suitable for spatially and temporally large-scale investigations. Furthermore, their line of reasoning is neo-evolutionistic, *i.e.* expecting a certain progress and development, and their explanatory value is often of a 'post-hoc' nature.

4 If perceived from the perspective of habitation instead of geological time, several of these long-term scale effects might be of a different nature. The tempo of subsidence of several 'donken' for instance could have been a quite dramatic and perceivable event for past communities. The chosen perspective is important for the interpretation and spacing of the Braudelian tripartite scheme.

5 Bailey (2007) distinguishes between 'true palimpsests' in which successive layers are superimposed in such as way as to remove most evidence of previous activity and 'cumulative palimpsests' in which layers are reworked but information is still retrievable. The latter is more marked by loss of resolution than loss of material.

6 Attaching new meaning to existing objects and places, *e.g.* the cultural biography of Stonehenge, is referred to by Bailey (2007) as palimpsests of meaning.

7 An important subdivision that can be made here is the one between a linear and a cyclical sense of time. Rosen (2004[b], 2, 5) argues that a consciousness of 'self' implies a consciousness of mortality and thus of linear time. This earthly mutability is however situated within the temporal markers of nature, such as seasonality, which are repetitive, cyclical and (often) stable (*ibid.*; Gosden 2004, 30). Similar cyclical structures can also be found in past culture, *e.g.* the seasonal use of a site, yearly rituals, repetitive mortuary practice or the temporal developmental and cyclical structure of households (*e.g.* Barrett 2004; Gerritsen 1999; 2003; Nilsson Stutz 2003). Both linear and cyclical time and the way these are materially accentuated are informative on past time perception and social memory in the past.

8 In essence *habitus* is a complicated concept. Often mistaken for the routines of everyday life, *habitus* is actually the articulation of dispositions in social space (Lechte 1994, 47). By this Bourdieu meant a kind of expression of (unconscious) investment in the social space and the elements of power therein. In this sense *habitus* is a grammar of actions differentiating different classes from one another. It thus reflects upon the conditions and diversity of discourse in society (Lechte 1994, 47-48).

9 From a Melanesian perspective for instance, individuals are not unique and also embody a generalised reflection of society (see LiPuma 2000; Strathern 1996). Individuals also represent a collectivity and contain both male and female elements; they are mosaically constructed (Busby 1997, 274). In this sense part and whole are the same and Busby relates to this as partible persons. In India on the other hand the individual and the body are intact but permeable. Through substance flow between persons, connections are made and in this sense persons have fluid boundaries (*ibid.* 275). An overarching characterization of these heterogeneous persons has been the concept of 'dividuality'. In contrast to western individuals there are thus also 'dividuals.'

10 Except for some amber beads, pendants of jet or animal teeth associated with skeletons in the cemeteries of S2, Schipluiden and Ypenburg (De Roever 2004; DeVriendt 2013; Smits/Louwe Kooijmans 2006; Koot 2005; Koot *et al.* 2008), or for example the arrow shaft sharpeners, allegedly indicative of status, found at Mariënberg (Verlinde/Newell 2006), there is no evidence for distinct status. Also imported flint, jadeite axes and *Breitkeile* may point to individually acquired status, but not to any hierarchical system.

11 Raemaekers (1999, 189-190), drawing on Tilley (1996) proposed to introduce the idea of primitive communism for the Swifterbant communities. He based this on the conservatism in adopting new elements and the difficulties in establishing complexity in the Swifterbant communities. Raemaekers argues that the social consensus needed to sanction change is a further indication of primitive communism. The latter argument is not directly relevant since these mechanisms also operate in other less egalitarian social constellations (see Bourdieu 1977). According to Maddock (in Barnard/Spencer 2002, 451) primitive communism is a state of affairs which has never really existed. Instead it is much more a (moral, political and social) tool to conceptualise tension in society. Not denying the largely egalitarian character of the Swifterbant communities, there are some indications which might refer to a level of social differentiation. It is evident that Swifterbant communities are for example not entirely on the egalitarian level of, for example !Kung San Bushmen.

12 This essentially relates to the structural conditions and structuring principles introduced by Barrett (2000), the former forming the historically continuous background with which agents and their structuring principles engage.

13 Needless to say this also has important repercussions for studying the transition to agriculture. Instead of focusing on the processes change and their supposed motivations, it is the historical and multidirectional making of humanity itself, instead of the transmission of agriculture, that becomes subject of investigation. The actual change was not in the adoption of new elements, but in the way the humanity of the period created itself out of the new connections that it established. The Neolithic became possible by a restructuring of these connections through *practice* (see Barrett 2005, 120-121).

14 Merleau-Ponty argues that: 'All knowledge takes its place within the horizons opened up by perception (2002, 241).' The body in this sense may take on an important role as a medium through which we perceive this world and as a result also become subject of perception itself (*ibid.* 239). This corporeal aspect of perception thus denies a true distinction between mind and body, and by extension nature and culture, as advocated by Descartes (see Casey 1996; Lechte 1994; Merleau-Ponty 2002 (1945)). There is as it were an integration of body and environment (Casey 1996, 22). The very imbrication of the perceiving organism and its surroundings is what lies at the basis of perception (Lechte 1994, 30). Heidegger's 'Being' or *Dasein* also stresses the idea that experience or

perception rather than being intentional and directed (as advocated by Husserl (see Gosden 1994, 104) is the core condition of *Dasein*, an existentialist aspect as it were. *Dasein* is thrown into an already existing world and in the act of finding its identity finds itself already enmeshed in a series of social, cultural and material circumstances (Thomas 1996[b], 42). This continuous engagement with a world coming into being and the notion that *Dasein* cares about its presence in the world, makes it aware of its past, present and future (Heidegger's ecstasies) and adds a distinctly temporal aspect to the core of its existence (see Berghs 1997) and abstains from a strong dualist perspective between individuals 'opposing' the world and argues much more in favour of an interwoven relationship.

15 Tilley (2004, 10) argues that the manner in which an artefact or place is encountered very much depends on the structure of the encounter, on the use of our senses. This approach emphasizes the intertwining of subject and object and therefore denies the possibility of an objective approach. Instead of lapsing into subjectivity, Tilley (2004, 29) argues that *'the groundedness of meaning in the sensuous embodied relation between persons and the world forms an invariant ontological ground for all feeling and all knowing taking place through persons with similar bodies'.*

16 In light of Heidegger's *Dasein* it is only this combination of being-in-the-world and its caring nature that is able to make sense of the world through these webs of relations (see Berghs 1997, 173). Furthermore, since objects, places and substances form part of a web of relations, these offer archaeological 'windows' for studying those aspects of society that did not materialize. While certain aspects of inhabitation will always elude interpretation, an increased understanding of these relationships will allow us to arrive at a more contextual and substantiated notion of past social identity and livelihood in general (see also Gosden 1994, 194; Thomas 1996[b], 88-89).

17 In relation to this Ingold (1993; 2000) formulated the term 'taskscape' to indicate how social relations may have been attended to by an ensemble of mutual interlocking tasks, embedded in 'the current of sociality'. It comprises the array of activities involved in dwelling and as such cannot be seen as static. He argues that the temporality of the taskscape is essentially social, because people in the performance of their tasks also attend to one another (1993; 2000, 196).

18 Lefebvre points out the importance of detecting repetition, the interference of linear processes and cyclical processes and the recurrence of birth, growth, peak, decline and end. In so doing he draws upon musical theory for the understanding of time, space and rhythm (see Lefebvre 2004, *xi*; compare Ingold 2000, 197; Mlekuž 2010, 194). The flow of tasks, routines and cycles can be understood as a melody. Lefebvre identifies certain states of rhythm. *Polyrhythmia* represent the multitude of simultaneous and diverse rhythms taking place. *Eurhythmia* represents their association in a normal state of health; the motion of normal everyday life. *Arrhythmia* represents the state where rhythms break apart. There is no synchronization anymore (evidently the implications of agriculture imply a number of such *arrhythmia*). Finally there are *isorhythmia*, which contrast with *eurhythmia* in that they are rare and stress equivalence between rhythms (Lefebvre 2004, 67).

19 In this sense the temporality of structure and agency (and thus society) is interwoven with the temporality of the landscape in a model that transcends the nature-culture opposition. It is exactly this situatedness of the apparatus of societal stasis (and change) that can be informative on the mosaic of the transition of agriculture in the LRA.

20 This involves aspects of mobility, subsistence, reclamation, tenure and interaction, but also very much involves the existence and character of the rounds and routines, the day-to-day practice.

Chapter 7

Unsettled issues: a long-term perspective on aspects of mobility, land-use and livelihood (5500-2500 cal BC)

7.1 Introduction

The geographical and organizational diversity within Late Mesolithic communities preceding and during the initial phases of the adoption of agriculture in the Lower Rhine Area (LRA), as discussed in Chapter 5, formed an important factor conditioning the nature of the transition to agriculture. The specific constellation of wetland resources and the exploitation of the aquatic biome provided a different context for the process of Neolithisation in the wetlands and wet margins of the Dutch delta and comparable areas in Northern Germany and the Scheldt floodplain, compared to developments on the loess and sandy soils. These areas with an increased distance to and 'filtered' contact with the immigrant Danubian Neolithic have provided substantial evidence for a gradual introduction and incorporation of 'Neolithic elements' within a continuous cultural framework (*e.g.* Raemaekers 1999; Louwe Kooijmans 2007[a]). This (cultural) continuity in occupation from the Late Mesolithic to the Vlaardingen culture (see Chapter 3), within a favourable preservation context, provides a good opportunity to study the character of the process of Neolithisation. Here I focus on the nature of the potential changes this brought about and the consistent characteristics of the communities involved, from a long-term perspective. An important premise of the analysis is that we are dealing with communities that spent a significant part of their yearly round in wetlands or wetland margins. While this does not mean that upland occupation was uncommon, it argues that the balance in livelihood and settlement was centred on wetland environments. The communities involved are, therefore, wetland-oriented.[1] Evidence for this, from the Late Mesolithic and later, is convincing (see Chapter 5; Amkreutz 2010[b]) and will be discussed and substantiated further by ethnographic and theoretical data in the following chapters.

Based on the theoretical underpinnings introduced earlier (Chapter 6), the emphasis in Chapters 7 and 8 now shifts to the long-term characteristics of the cultural succession of the communities involved in the process of Neolithisation in this area. It addresses aspects that expectedly changed *with* the Neolithic, focusing on the temporality and character of economic, organizational and material change. This involves an assessment of mobility, food and non-food procurement and land-use in general, with an emphasis on the way in which they were incorporated in the everyday 'rhythms', or practical routine of the indigenous communities and whether they altered the existing modes of inhabitation. Distinct emphasis is placed on the embedded character of these practices and routines and therewith on the recursive relationship between communities, landscape and environment.[2] Chapter 7 focuses on the long-term characteristics of mobility, land-use and livelihood in relation to the occupation of the wetland environment. Chapter 8 integrates some of these ideas with respect to the development of settlement systems as well as in relation to the characteristics of Neolithisation in the study area.

7.2 The rhythms of the land

Over the past decades landscape has received widespread attention in archaeological literature. Ecological approaches, focusing on aspects of exploitation, risk and sustainability (*e.g.* Bakels 1978; Clarke 1977; Waterbolk 1979), were followed by more postprocessual studies focusing on social aspects and dimensions as well as experience. These drove home the many complex meanings that may be given to landscape as a concept, ranging from topography and terrain, to object and experience.[3] Here I focus on the approach advocated by Ingold (1993; 2000), that landscape is not something created or endowed with meaning, but something experienced and dwelt in. This presupposes a recursive relationship between the landscape and its dwellers; a lived environment that is not a totality covered with meaning, but understood intrinsically (see Ingold 2000, 207). Time and 'rhythm' are important too, highlighting the existence of natural cycles, as well as the way these resonate with social cycles (Ingold 1993, 159). This essentially social character of dwelling places an emphasis on the 'cultural valuation' of material or structural conditions (*e.g.* Barrett 1994) by successive generations and forms a diachronic reflection of people's relationship with the dwelt-in landscape (see Gerritsen 2008; Ucko/Layton 1999, 12).[4]

Community-landscape interaction

Although landscape has become a rather contentious term in archaeology, this biographical perspective offers a valuable insight into its layers, historicity and the way it was experienced (see Barrett 1994; Gerritsen 2001; 2008; Roymans 1995; Tilley 1994). Until recently much attention focused on the monumental aspects of ideological landscapes (Brück 2005; Hind 2004), yet dwelling in a landscape pregnant with both discursive and implicit meaning encompasses the ritual but also the mundane aspects of life and may even break down the perceived boundaries between both. Landscape thus offers an integrated framework for archaeological understanding, contextualising dispersed human acts and accommodating activities that are usually assigned to different categories (Thomas 2001, 175). From this perspective the relations between people, places and landscape are stressed, while the historical dimension both contributes to and incorporates the rhythms and changes therein.

The approach adopted here is to discuss landscape and its environment as something dwelt-in and experienced that is more than an abstract physical and ecological background. It offers a spatial perspective for situating diverse economic activities, while at the same time its nature is essentially temporal, linking people to continuous cycles in their environment and their own (constructed) past (see

Cooney 2000; 2004; Edmonds 1999; Ingold 2000). This highlights the role of landscape as a constitutive agent in creating and shaping the social identity of its inhabitants.

Perspective

It is important to note that the approach above should not be understood as a post-processual 'version' of an ecologically determinist perspective. While I understand landscape and environment as physically and economically restrictive, human activity is not 'dictated' by them. The behaviour of communities, however, is also influenced by their surroundings at a different level. The historical connotations embodied in the dwelling perspective and the long-term characteristics of the landscape and its environment influence the communities inhabiting them. People work with or live within their perceived understanding of a real environment, which is the result of a long-term cultural construction (Brück/Goodman 1999[b], 8-9). The relationship between communities and their dwelt-in landscape and environment is therefore recursive and also shapes the socio-ideological aspects of the groups involved. This is not in conflict with, or superior to, other more functional or ecological approaches. Instead, it aims to offer a more relational interpretation based on our current understanding of past perception. This also means it is of a relative nature and less grounded in archaeological fact. It serves as an interpretative framework, offering a complementary and more 'indigenous' perspective on past behaviour, providing additional insight into community choices and characteristics. People in traditional societies in the past are not likely to have separated ritual and habitual actions (Bradley 2005; Cooney 2004, 323; McNiven 2004, 329), suggesting that a functionalist, economic or technological perspective only reveals part of the picture.

In the following I will focus on the relationship between landscape, environment and inhabitants in the wetlands and wet margins of the LRA. I aim to move away from a one-way relationship between humans and the landscape in which nature is objectified, detached from history and manipulated as a means of maximizing economic return (Brück/Goodman 1999[b], 8). The emphasis, instead, is placed on change and continuity over time with respect to land-use and interaction and subsequently on the manner in which the recursive relationship between communities, landscape and environment shaped socio-cultural identity.[5]

7.2.1 Land, water and change: an impression

To understand the various ways the communities living in the LRA wetlands and their margins used the land and were influenced by it, we have to understand what the land was like and how it evolved (see fig. 7.1). Since the following provides only an impression, the reader is referred to Chapters 3 and 5 and the references for a more elaborate description.

The character of the wetlands differed considerably from east to west. The eastern riverine area formed a dynamic environment of deposition and erosion contrasting with extensive bodies of Pleistocene upland to the north and south. West of this area, wetlands comprised riverine elements as well as lakes. Over 80 outcropping tips of river dunes, or *donken*, of Pleistocene origin formed the dry elements in what must have appeared as an archipelago (see Verbruggen 1992[b], 119). To the west of this area, salt marshes transected by creeks could be found in an intermediate position between the *donken* area and the coast. Separated by tidal flats, coastal barriers with low dunes and wide estuaries characterised the coast (Westerhof *et al.* 2003; Louwe Kooijmans 1993[a]). Elsewhere, such as in the IJsselmeer basin, the Scheldt valley or lake Dümmer, water equally formed a dominant feature of the landscape (see Crombé 2005[b]; De Roever 2004; Kampffmeyer 1991). The importance of water in this complex of landscapes provided a rich and varied palaeo-ecological substrate, which left a dominant mark on mobility and subsistence (*e.g.* Nicholas 1998[a,b]). Vegetation reconstruction based on macro remains and pollen studies reveals diverse settings (*e.g.* Bakels 1986; Out 2009). Salt- and freshwater marsh vegetation, including open stretches of grassland and low dunes with dune shrubs, were found at Schipluiden (Bakels 2006; Kubiak/Martens 2006), while a different open landscape including levees and backswamp vegetation with dispersed trees was present at Hekelingen-III (Prummel 1987) and Vlaardingen (Groenman-Van Waateringe/Jansma 1969). Peat growth, open marshes and alder carr further characterised these areas. Open water in the form of channels and lakes, swamps and reed marsh characterised the surroundings of the Hardinxveld sites, while deciduous trees grew on the river dunes and on the upland margins (Bakels/Van Beurden 2001). Around the Swifterbant levees a somewhat similar situation existed with upland vegetation and alder carr in the transition to the wetter zones (Van Zeist/Palfenier-Vegter 1981). Upland vegetation including oak and lime was, of course, more prominent on the Swifterbant river dunes as well as on boulderclay outcrops such as at Schokland-P14 (Gehasse 1995) and could also be found on the extensive coversand areas in the east of the riverine region.

Rich resources

Some of the landscapes lack modern analogues (Louwe Kooijmans 1993[a], 75), but a broad range of settings harbouring rich botanical and faunal resources has been documented. Wood remains at several sites point to the selection of various species of wood for structures and tools (*e.g.* Louwe Kooijmans/Kooistra 2006). Remains of nuts, fruits and berries indicate the collection of hazelnut, acorn, apple, hawthorn, blackberry and of wetland species such as waternut and tubers of (white) lily. The wild faunal remains comprise species such as wild boar, red deer, elk, roe deer, aurochs, brown bear and wild cat. Typical wetland species such as otter and beaver formed occasional rich additions to the diet and important sources of fur. Fish formed another important resource, especially species such as pike, perch and carp. Anadromous species such as salmon and the catadromous eel are less common except at sites located in the vicinity of estuaries and the coast. Several sites showed an important contribution of sturgeon (*e.g.* Brinkhuizen 2006), although the many bony plates of this species may lead to its overrepresentation. Typical saltwater species of fish are uncommon, although bones of sea mammals such as seals, dolphins and whales regularly occur in low numbers.[6] Both native and migratory birds form another major subsistence-component; of these, waterfowl are dominant (especially various ducks, grey lag goose and swans; *e.g.* Louwe Kooijmans 1993[a]).

More details may be found in Appendix I. However, it is evident that from an economic and functional perspective the wetlands and their margins formed a very rich environment, as do many wetlands (*e.g.* Van der Noort/O'Sullivan 2006; Nicholas 1998[a,b]; 2007[a,b]). The quantity and diversity of biomass in this area are important aspects that set it apart from upland environments such as the coversand areas.

Time and geographical change: a summary

One aspect which also will have affected the communities living in these areas is the dynamic of wetland environments (see fig. 7.1). The postglacial rise in seawater led to an invasive coastline and associated high groundwater levels. Until *c.* 4000 cal BC this involved an inward shift of the coastline and development of peat further inland, related to the high groundwater levels in regions of non-clastic sedimentation. In the western part of the delta some of these peat swamps eventually developed into lagunas. These developments also entailed shifts from fresh to brackish conditions. In the lower-lying areas extensive systems of tidal gullies and creeks were responsible for coastal influence further east, although freshwater was prevalent in the southern part of the Rhine-Meuse estuary (Van Gijssel/Van der Valk 2005, 68). There was only limited deposition of clay and sand in the western tidal basins, but in the east the larger rivers deposited their load, leading to the formation of the river clay area. Over time the entire system of a discontinuous, narrow beach barrier with associated lakes, lagunas and, further inland, peat formation, slowly shifted eastwards (see Van Gijssel/Van der Valk 2005, 67; Louwe Kooijmans 1985; Vos/Kiden 2005; Westerhof *et al.* 2003). This was accompanied by more localized shifts, for example involving the transition from meandering to anastomosing streams around 6000 cal BC and avulsion of river beds in the downstream parts of rivers around 4500 cal BC (Westerhof *et al.* 2003, 221). It is important to note that recent investigations demonstrate that these developments are regionally heterogeneous, depending on local conditions, relief and sedimentation regimes (Van Gijssel/Van der Valk 2005, 68; Vos/Kiden 2005, 27).

A reversal in these dynamics took place at the turn of the 5th millennium cal BC. The rise in relative sea level decreased which resulted in a shift in sedimentation balance. Tidal influence in the low-lying basins waned and the extent of dry land increased. This led to an increased influence of freshwater in the delta plain and

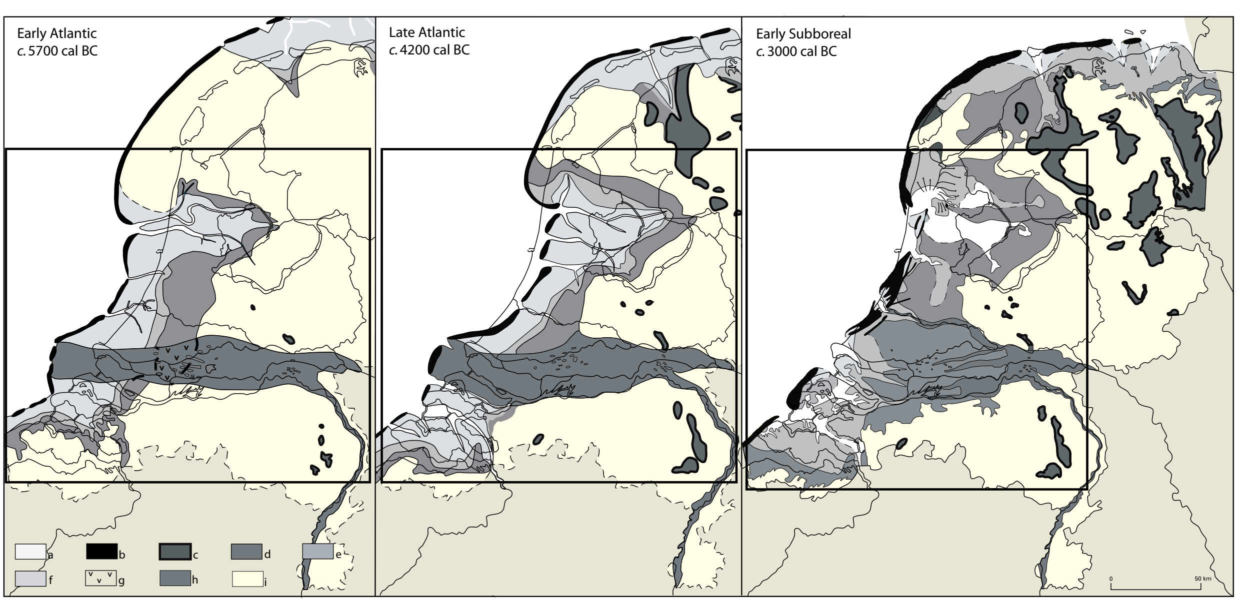


Fig. 7.1 Palaeogeography of the LRA wetlands and study area in the period 5700-3000 cal BC. Legend: a: open water; b: coastal dunes and beaches; c: blanket bog; d: raised bog; e: tidal marsh and clay-covered areas; f: tidal flats; g: local peat formation; h: fluvial deposits and peat marsh; i: Pleistocene uplands (adapted from plates 2-4 in: Van Gijssel/Van der Valk 2005).

a lateral and outward extension of the beach barriers. Sites such as Ypenburg and Schipluiden document the initial occupation of this new land (*e.g.* Louwe Kooijmans 2006[a]). The influence of the sea further declined with the formation of the Voorschoten-Rijswijk coastal barrier during the 4th millennium at a distance of 3 km from the aforementioned sites. Over time, however, cycles of regression and transgression led to recurrent fluctuations in the importance of marine influence. Wetlands silted up and became dry land, after which rising sea level and associated groundwater levels may have turned them into marshland again, only to be eroded later and be replaced by freshwater sediments in transgressive phases (Louwe Kooijmans 1974; 1993[a]). Similar processes took place in the IJsselmeer basin. A system of creeks connected the area around Swifterbant to the coast. During the occupation period there was a certain amount of tidal influence and the lower-lying levees flooded during high water. Around 4000 cal BC the entire area flooded and became uninhabitable (Hacquebord 1976; De Roever 2004). Similarly, the landscape around the site of Doel-Deurganckdok in the Scheldt valley became increasingly wet as a result of the rise in sea level around 4700 cal BC. Regular marine incursions led to the deposition of clay. The entire area became uninhabitable around 3700 cal BC (see Crombé 2005[a], 140; 2005[b,c]).

7.2.2 Landscape change and its impact

The rich faunal and botanical resources of the wetlands and wetland margins formed attractive settings for hunting, fishing, fowling and gathering, partially contradicting our ethnocentric unfavourable and negative impression of wetlands in general (Louwe Kooijmans 1997; Nicholas 2007[b], 247). The type, diversity, reliability, productivity and seasonal availability of many wetland resources are unsurpassed in comparison to upland environments (Nicholas 2007[a], 51). Nevertheless, the inhabitants also had to deal with the dynamics of wetland environments. There are general types of wetland settings, ranging from coastal environments and estuaries through fresh water tidal and peat zones to the river sedimentation area (Louwe Kooijmans 1993[a]). On a local level there is further diversification governed by local relief, sedimentation regimes and the composition and nature of wet and dry elements such as lakes, rivers, creeks, dunes, donken, boulderclay outcrops, levees and their specific ecological qualities. Furthermore, this constellation of divergent ecozones changed over time in tandem with the gradually diminishing rise in sea level and the various transgression and regression cycles. There is thus no such thing as a wetland environment, but rather an often rich and varied canvas within broader wetland ecozones (see for example Van de Noort/O'Sullivan 2006; Sturt 2006).

To the inhabitants of these lands this meant a confrontation with a continuous shifting in balance between dry inhabitable elements and water in its many forms. In some places and at some moments land was lost to water, at other times new land was created. Furthermore, it entailed shifts in ecozones, the disappearance and (re)appearance of flora and fauna and influxes of salt and freshwater. This must have put a considerable strain on the reliability of resources and on patterns of anticipation. These changes, and of the wetland landscape as a medium therein, were likely a factor of perceived importance (see Cooney 2004, 325).

Of course it should be questioned to what extent the rates of change were perceptible to the inhabitants of these 'wetlandscapes'. On the one hand change was slow, gradual, and perhaps imperceptible within a human life span (Louwe Kooijmans 1985). Change also may have been more rapid, unanticipated and dramatic (*e.g.* Mol/Van Zijverden 2007, 99; Peeters 2007; Raemaekers/Hogestijn 2008, 413; Sturt 2006). Slow sedimentation rates may eventually lead to the sudden avulsion of channels. Rising water levels may long be contained within banks of rivers and lakes and suddenly flood large adjacent stretches of low-lying land. Settlement locations, hunting stands, fishing spots and transport routes, which were perhaps known for generations, could vanish within a year, while new ones sprang up unexpectedly. The dynamics of the various wetlands are at any rate invariably greater than those of the loess and coversand areas during the Holocene.

7.2.2.1 Dealing with a dynamic environment

It is plausible that change was recognisable at an intergenerational level and was incorporated in stories and oral tradition (*e.g.* Cooney 2004; Leary 2009, 229-234; Warren 2005, 58; see also Fokkens 1998, 136, 147). This suggests that while natural phenomena are often classed within the Braudelian cycle of the *longue durée* (see Braudel 1966), they articulate directly with the level of *événements* and experienced time (see Chapter 6). From a geological perspective change may be slow, but its impact should be understood locally from an historical point of view. In this sense wetlands are inherently unstable and unpredictable, liable at any time to cause change in medium and short time scales. It should be stressed that while change in a wetland environment may be dynamic, it is the impact of change that counts. In this respect it should be realised that although environmental change and its consequences are abundant, they usually are not large-scale. Thus, the composition of the mosaic may change, but the overall picture far less so. This implies that the consequences of change were buffered by the opportunities the wider region offered and the disposition of the communities involved. In this sense we should refrain from focusing too much on issues of calamity, disaster and community vulnerability when discussing these dynamics (but see Leary 2009).

Nevertheless, the changing pattern of the mosaic most likely required a certain degree of flexibility in the way communities used the landscape. The routines and practices of these small-scale groups were engraved in the slower pace of natural processes. They had to be constantly redefined and attuned to the shifting dynamics of constraints and possibilities over time and in space. Patterns of anticipation had to be adapted continually. This had its effects on issues such as mobility, territoriality and resource availability. The nature of these dealings with time and repetition and the way they are materially constituted provide insights into the character of social memory and the way society perceives itself, the surrounding landscape and its interaction with it. This means we are dealing both with the strategies of adaptation of these communities as well as their perception of the environment. Both are perceived as the result of a long-term interaction between communities, landscape and environment.

Beyond theory

The interwovenness between these natural and cultural rhythms would develop through the inhabitation of these wetland areas, through practical use and symbolic activity. In the eyes of hunter-gatherers living in this area, land and water would have become familiar and structured through the act of symbolic and practical appropriation, through living and working with and in it (see Zvelebil 2003[a], 65). This enculturation of the landscape (*ibid.*) and its specific wetland character will have been handed down through practical knowledge, myth and oral tradition from generation to generation. The attested cultural continuity and absence of major breaks in occupation of the area suggests that important elements remained active in the conceptual framework of these communities, also during the later stages of Neolithisation. In this sense there are likely some general traits characterising the social identity of these wetland groups. There are a number of appropriate ethnographic and historical parallels that may substantiate such a theoretical perspective and which distinctly identify the existence of a wetland identity as opposed to uplanders or drylanders. Pliny the Elder, stationed in this area between 47 and 57 AD, commented upon the supposed inhospitable character of these wetlands in his Naturalis Historia. Pliny writes [my translation]: '*There the ocean is pushed inland twice a day by a tremendous tide. She boundlessly flows onwards, covering a perpetual area of natural dissension: a landscape of which it is not clear whether it pertains to the land or the sea. The destitute population lives on self-made hills or plateaus raised above the maximum tide. On these hills they constructed their huts. They are like passengers of a ship, but when the water recedes, they rather look like castaways*'. This etic perspective is more informative on his own upbringing, values and beliefs than on the nature of life in the wetlands and wet margins of the LRA, either in Roman times or several millennia earlier. Well-known is of course Thesiger's account of the Marsh Arabs (2007 (1964)). These tribal communities, such as the Madan, living in Southern Iraq were perceived by their upland neighbours as 'living like their buffaloes', with houses half under water, while they themselves chose and identified with a water-dominated life, not willing or wanting change. Another example is provided by Harrison (2004). He describes riverine village communities among the Sepik of Papua New Guinea, who contrast themselves with the Numbundu, or 'dry land men'. McNiven (2004, 344) mentions a further case involving the Saltwater Peoples of northern Australia. Certain people among these specialised maritime hunter-gatherers have deep spiritual connections with the sea and manage and orchestrate seascapes, practical and ideological frameworks combining perception, engagement and use of the sea and coastal environment.

7.2.2.2 Cultural choices: several case-studies

Since the choices made in relation to the dynamics of the environment and wetland landscape are also essentially cultural, they are informative upon community perception of their surroundings and the structuring principles governing behaviour and *habitus* (see Chapter 6). In the following, several case-studies will be presented in order to discover general traits or patterns.

Submergence at Hardinxveld (5500-4500 cal BC)

A first example concerns the gradual drowning of the Hardinxveld sites of Polderweg and De Bruin. Both were taken into use around the same time at *c.* 5500 cal BC. The choice of location seems to have been specific since two small dunes were targeted while more (extensive) options were available nearby (Mol/Van Zijverden 2007, 93; Verbruggen 1992[b]). Perhaps issues of physical protection from the elements, safety, proximity to the southern sandy soils and access over water were of importance (see Louwe Kooijmans 2001[a]). During their lifespan, both dunes gradually 'submerged' in the surrounding peat swamp. This means that the inhabitable surface of the dune declined over time. Submergence took place at a rate of *c.* 10 cm per human lifespan, but in relation to the dune relief processes were much more dynamic. During the third and last occupation phase of De Bruin, the donk edge shifted from -5.20 m to -4.50 m below sea level. In relation to the flat relief on the top it is likely that the habitation area decreased visibly within generations and even lifespans. The remaining large trees on top will have fallen over (Mol/Louwe Kooijmans 2001, 73; Louwe Kooijmans/Nokkert 2001, 109). Apart from this, the wider landscape changed. Around 5500 cal BC both sites were convenient stepping stones in a river plain of 25-30 km wide (see fig. 7.2). A millennium later the width of this plain almost doubled, with distance to the southern upland increasing from 5 to 11 km. The southern upland margin shifted 150 m in only 25 years (Louwe Kooijmans 2001[b], 504).[7] Ecologically the surroundings changed from an open environment with lakes, crevasse creeks and river activity in phase 1, to a landscape dominated by marshes, peat growth and continuous alder carr forest in phase 2 and back to a fluvial landscape in phase 3. Apart from several hiatuses in occupation (see also Mol/Van Zijverden 2007, 95), the sites remained in use within a seasonal mobility cycle. Of importance is that the emphasis of occupation shifted (Louwe Kooijmans 2001[b], 513; 2003, 612). During phase 1 Polderweg functioned as a winter base camp, while contemporary activities at De Bruin were less intense and probably of an auxiliary character. During phase 2, however, the main activities shifted to De Bruin when Polderweg became increasingly uninhabitable (Louwe Kooijmans 2003, 612). The actual use of Polderweg continued up until *c.* 5000 cal BC, although the character was no longer that of a base camp, but probably more extractive (*ibid.*; Louwe Kooijmans 2001[b], 511, 513). Use of De Bruin also continued until just a small and low remnant of dune was available. Most large trees had by that time fallen down. A small cluster of pits of a ritual nature was found at the edge of the surrounding swamp (see Louwe Kooijmans 2003). It may have been a structural deposition related to the disappearance of the dune (Louwe Kooijmans 2001[b], 505; see also Koch 1999).

Dry feet at Swifterbant-S3 and Bergschenhoek (4300-4000 cal BC)

The Swifterbant site S3, located in the northern part of what is currently the province of Flevoland, was used for about a century between 4300 and 4000 cal BC. The site is situated on a levee bordered by creeks. In case of high water the levees flooded, evidenced by regular clayey bands in the lower part of the find layer. This probably took place in autumn or winter (Ente 1976; De Roever 2004, 9). Since occupation might have taken place in several seasons (Raemaekers 1999; Zeiler 1997), it is not unlikely that the occupants of S3 were confronted regularly with the flooding of their site, or at least its results. Nevertheless, instead of abandoning the location in favour of, for example, the nearby larger, more elevated site of S2, or one of the river dunes, people chose to remain at S3.[8] This is evidenced by the fact that the wet conditions at S3 were probably countered by applying layers of woodchips, twigs and bundles of reed, raising the surface and creating a dry living space (Deckers *et al.* 1981, 133). Similarly several hearths were made on clay bases in order to protect the inflammable bundles of reed or because of the wet subsoil (De Roever 2004, 21, 41; see however Lage 2004 for alternative explanations). These features are absent at S2 which indicates the existence of drier conditions there (De Roever 2004, 22). A similar repetition in use in order to be able to continue occupation or use of a certain location has also been documented at the small fowling camp of Bergschenhoek, dating to *c.* 4300-4200 cal BC (see Louwe Kooijmans 1987). There too a sequence of superimposed hearths was discovered consisting of layers of reeds and peat with hearths on top of them. Again wet conditions seem to have been countered in order to continue using of a certain location. The site of Hüde I in Niedersachsen yields another example, where the floors of huts situated next to a channel were regularly reinforced with a layer of wood and a cover of bark, reed and branches of willow (*Salix*) and alder (*Alnus*; Stapel 1991, fig. 228).

Continuity at the Hazendonk (c. 4000-2500 cal BC) and Hoge Vaart (c. 6600-4100 cal BC)

Developments comparable to those at the Hardinxveld dunes took place at sites such as the Hazendonk and Brandwijk (see fig. 7.2). At the Hazendonk the changing wetland landscape and long-term marsh conditions affected the use of the location, although occupation phases and landscape change do not always show correlation (pers. comm. L.P. Louwe Kooijmans 2009). The evidence for occupation, however, stretches over almost two millennia and over time several changes may be perceived. During the SWB occupation the Hazendonk may have functioned as a base camp mainly occupied between spring and autumn, or at different times during the year (Louwe Kooijmans 1993[a]; Raemaekers 1999, 120-123; Zeiler 1997, 86, 99). Cereals were most likely imported from elsewhere (Out 2009, 423) and domestic animals, especially cattle, formed a substantial contribution to the diet (Zeiler 1997). During the Hazendonk-3 phase the contribution of the latter sharply drops, according to Zeiler (1997, 35) in relation to wetter conditions and decreasing pasture area, to remain low in all later phases. Despite this the occupation did not become less intensive but shows several fluctuations. The presence of artefacts such as a bow, a paddle blade and a fragment of a canoe and features such as a simple trackway and a palisade indicate the continued structural use of the location in Vlaardingen phase 1b. Despite these shifts in site use over time, much of the archaeological evidence also points to continuity in the face of change, such as the continued importance of trapping otter and beaver (see Zeiler 1997). Continuity is further expressed by the find of a cluster of Late Neolithic Beaker sherds suggesting limited short-term activity at the location (see Louwe Kooijmans 1974, 146-147) some 500 years after the previous occupation. At this point in time only an increasingly small part of the dune rose above the wet area.

Similar long-term behaviour with respect to site-use has been documented at the Hoge Vaart. Located on a coversand ridge next to an old channel of the Eem river the site boasts an occupation span of 2500 years, including two Mesolithic occupations. Separated by an intensive phase of erosion the character of the subsequent SWB occupation differs from the previous phase in the absence of hearthpits, the presence of pottery, antler tools, postholes, a clay-mixing pit, a possible water pit and indications for heavy trampling. The site was probably in use continually from 4850 to 4500 cal BC (Peeters 2004), after which occupation ended and the site was covered up by peat around 4400 cal BC. About 150-200 years after the last SWB occupation the site was used again, but now for an extractive purpose, with the installation of three fishweirs and traps. A large sherd, a fragment of a paddle blade and a charred half of an acorn form the little evidence there is for a renewed use of the Hoge Vaart ridge, which by then would barely have surfaced above the surrounding marshland (Peeters 2007).[9] This indicates that, despite drastic changes in the environment, locations remained in use over time.

From brackish to fresh at Schipluiden (3700-3400 cal BC)

The Middle Neolithic site of Schipluiden is located on a low dune in a beach plain, bordered to the south by the Meuse-Rhine estuary in the Delfland region. The site was situated on a former beach flat at at the convergence of three ecozones (coast, reed swamp and alder carr and estuary) and was occupied in several phases between 3700 and 3400 cal BC (see Louwe Kooijmans 2006[a]; Mol *et al.* 2006). The site yielded evidence for permanent occupation and intensive structuring of the settlement area. Subsistence was based to a significant degree on domestic resources, including stock farming and (presumably small-scale) cereal cultivation on the surrounding high salt marsh. Next to this 'Mesolithic' practices prevail with respect to the importance of fish and the collection of, for example, roots and tubers (see Appendix I). Important changes in the landscape and its ecology took place during occupation. During the first phase of occupation the site was located in a salt marsh landscape with brackish conditions and regular marine ingressions. This was, for example, evidenced in the entrapment of smelt and herring in several of the early wells, after the sea had retreated. Gradually flooding and sedimentation became less frequent. During occupation phase 2a, the higher parts of the landscape became covered with pioneer vegetation, while the now inactive high salt marsh became arable. In occupation phase 2b the landscape must have changed drastically, as freshwater conditions now became prevalent. At the end of the second phase a freshwater environment was established, groundwater level rose and the development of a peat marsh started. During phase 3 only a small strip of the dune, measuring 30 x 100 m, remained exposed (Mol 2006, 280). The growing layer of reed and sedge peat made the site unattractive for occupation around 3400 cal BC (Louwe Kooijmans 2006[a]).

It is evident that the dune and its surroundings underwent significant ecological and landscape changes, which must have placed certain constraints on what was possible and available in the landscape. Despite this there seems to have been very little influence on the occupants' way of life in the time span of occupation. Both the range of exploited resources and the ratio of hunting and stock farming remained the same from phase 1 through 3 (Louwe Kooijmans 2006[a], 497).

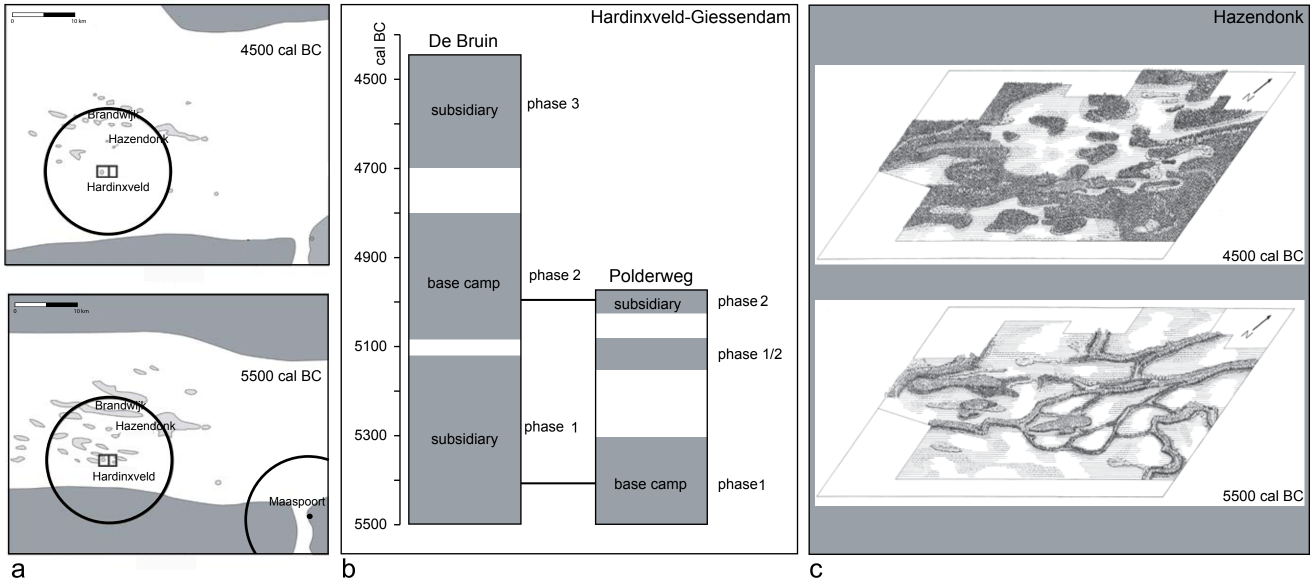


Fig. 7.2a-c. Fig. 7.2a Palaeogeography around some of the river dunes between 5500 and 4500 cal BC. The surface of the dunes becomes smaller over time, while the distance to the mainland increases (adapted from Louwe Kooijmans 2003, fig. 77.1). Fig. 7.2b Shifts in function in relation to the changing environment at the twin site of Hardinxveld (adapted from Louwe Kooijmans 2001[b], fig. 14.4). Fig. 7.2c Impression of the changes in the landscape between 5500 and 4500 cal BC around the Hazendonk site (adapted from Van der Woude 1983).

This means that in order to maintain this continuity, the inhabitants were able to adjust to changes in their surroundings and sought out new opportunities in the landscape to continue their old way of life. Some time after the beginning of phase 3, and again in the Bell Beaker period, the site may have been in use as an extractive location (see Hamburg/Louwe Kooijmans 2006, 64).

7.2.2.3 Common traits

The examples above indicate a number of reactions in community-landcape (and environment) interaction, dealing with different effects of change at different time scales. In themselves the examples above may seem anecdotal, but they do not form isolated occurrences. Many of the sites show evidence of continued or intermittent occupation over extensive periods of time (see Appendix I). Depending on the location of the site, changes in the environment will have been more or less intensive, but evidence for continuity in use of locations and flexibility with respect to changing circumstances abound (see for example the description and dating of the following sites in Appendix I: Brandwijk-Het Kerkhof; Doel-Deurganckdok; Ewijk-Ewijkse velden; Hekelingen III; Leidschendam; Linden-Kraaienberg; Melsele-Hof ten Damme; Oudenaarde-Donk; Schokland-P14; Swifterbant-S2; Swifterbant-S21; Urk-E4; Vlaardingen; Ypenburg).[10]

In Chapter 6, it was argued that the existing time frames and temporalities are not mutually exclusive. The character of short or medium-term activities at sites, which provide us with the most direct access to past perception and *habitus*, essentially may be informative on longer-term traits (Foxhall 2000, 484-485, 496), especially within settings where there is cultural continuity. The case-studies presented above highlight two characteristics that cut across time and inform us on the way the landscape and its dynamics were dealt with by communities in the wetlands and wetland margins of the LRA.

Continuity

The first aspect is continuity with respect to place and practice. Regarding place, certain locations in the landscape functioned as persistent places (see also Chapters 5 and 6). This may have related to economic motivations pertaining to qualities in the surrounding landscape, or elements of investment such as built structures and availability of raw materials (Schlanger 1992), but it also involved motivations related to the socio-cultural perception of place (*e.g.* Barton *et al.* 1995). This last aspect is substantiated by the fact that as at Hardinxveld, the Hoge Vaart, or the last phase of use at Schipluiden, the landscape had changed markedly so that previous economic or functional motivations could no longer have played the same role of importance. The choice for continued or renewed activity at these places may have sprung from new opportunities in the landscape, but is equally suggestive of a distinct attachment to certain locations in the landscape. These places could form reference points, a means of communication, or distinct boundaries, but the continuity in use could also point to the importance of forebears or deities, spirits and myths that may have been associated with certain sites in the landscape and for which there are rich ethnographic references (*e.g.* Descola 1994; Feld/Basso 1996; see also Peeters 2007, 232). This emphasizes the importance of past human activity at these locations (see Bradley 2000, 158) and the role of (long-term) memory in the conceptualization of the landscape (*e.g.* De Coppet 1985). Despite the sometimes extensive intervals between periods of use or occupation of sites, places seem to have remained part of mental maps and communal mnemonic heritage (see also Amkreutz 2013[b]).

Continuity also reflects upon practices and upon the way in which these places and the wider landscape were inhabited over time. This finds expression in the consistent manner in which these groups used and adjusted their extended broad-spectrum economy over time. By incorporating a broad spectrum of resources a system was created that provided a buffer for change. This touches upon the second point.

Flexibility

In their dealings with the dynamic environment, a great degree of flexibility seems to have been required of the inhabitants of these areas to deal with changing circumstances (see also Bird-David 1992[b], 39). The shifts in function at the Hardinxveld sites, or the decrease in importance of domesticates at the Hazendonk form apt examples, but also the regular (later) reuse of locations for entirely different purposes form expressions of flexibility, at least with respect to site use and settlement system. On the other hand the same flexibility may also have led to lack of change. The artificial raising of the living surface at S3 formed an adequate solution for dealing with increasingly wet circumstances. Similarly, the way-of-life of the inhabitants of Schipluiden was continued in the face of a changing environment, which must have involved flexibility in the use of the environment. These examples again stress that flexibility and adaptation to local circumstances does not mean that people were dominated by the whims of the natural environment (see also Van de Noort/O'Sullivan 2006, 25). It does mean that communities were able to adjust the technical, economic and social aspects of their way-of-life to new circumstances without far-reaching consequences. Hence, by flexibly interacting with the changing environmental and landscape mosaic in space as well as time, they managed to consolidate their livelihood. Leary (2009, 232-235) in this sense speaks of adaptability and resilience. Adaptability involves the process of learning and adjusting to both diachronic and synchronic events, while resilience signifies the quality that allows people to cope with and recover from changed conditions. The flexibility noted above, but also issues such as a close monitoring of the environment and its resources as well as mobility or the temporary intensification of food or raw material production, may form part of it. From an economic perspective this seems to be in line with the (extended) broad spectrum base of subsistence as proposed by Louwe Kooijmans (1993[a]).

7.2.3 Land and identity

It is evident that the way in which people dealt with the changes in these wetland environments varied from place to place and over time. Different interacting scales of rhythm may be postulated. Daily, such as tidal fluctuation, yearly, such as floodings, storms, high water, the seasonal migration of birds and (anadromous) fish, the cyclical growth and decay of plants, the iced over lakes, the mosquito plagues in summer, the ripening of nuts and berries in late summer and autumn etc. Rhythms with a time span of decennia, gradually or more abruptly changing the composition of the landscape and even longer and more intensive changes in landscape zones over centuries and millennia. It is plausible that the interlocking internal dynamics of the wetlands in general over time may have brought about the specific combination between continuity and flexibility discussed above. This leads up to the question to what extent these traits shaped social identity in the wetlands and wetland margins of the LRA.

Van de Noort and O'Sullivan (2006) argue that we need to rethink wetlands and specifically focus on the way people inhabited, understood and imagined their landscape as being constitutive of the society in which they lived (*ibid.* 29). Strategies to deal with a dynamic environment need not be merely physical adaptations, but may equally be reflected in ideologies and thus form a way of passing on knowledge and expertise over time. Cooney (2004, 323) points to the same arguments in a discussion of coastal communities. These considerations raise the question of whether there is such a thing as social identity of wetland communities, a 'people of the wetlands' as referred to by Coles and Coles (1989; see also Tilley 1991 and Van de Noort/O'Sullivan 2006, 66). It should be noted, as has been argued elsewhere (*e.g.* Louwe Kooijmans 1997; Bradley 2000), that the diversity in wetland landscapes and the specific, toponymic way in which places were defined by people in the past, stands in no comparison to our current geological distinction between upland and wetland. Furthermore, we should realise that many of the communities studied were mobile for at least part of the year as late as the Vlaardingen culture and that upland landscapes may also have been part of their mobility cycle. Despite these considerations, wetlands formed an important part of most of the daily experience of the communities in transition studied here. Following the notion of relationality accentuated in Chapter 6 it is likely that dwelling in wetlands would bring about a certain characteristic interwovenness of people, places and environment. Wetlands may in this sense be perceived as active agents in creating these local identities (see Tilley 2004). As people went about and saw to their routines and tasks they were attuned to the rhythms of the environment (Ingold 2000). Time and temporality were defined by these rhythms and by the seasonal and annual tasks that accompanied them. At times these rhythms and the tasks that had to be performed may also have been dangerous, especially in relation to resource procurement and navigation (*e.g.* Leary 2009; Sturt 2006). This underlines the fact that these wetlands were not only landscapes of domestic tasks, but simultaneously natural places that were revered, feared and respected (see Bradley 2000), and at times may have been liminal (Van de Noort/O'Sullivan 2006, 55-56) and have formed the scene of various forms of ritual activity (*e.g.* Nicholas 2007[b], 251; Peeters 2007, 232) alongside daily routines (Zvelebil 2003[b], 7).

Wetland people?

It is likely that living in the wetlands over the centuries led to the creation of something that may be termed a wetland identity, something that lay at the core of the *mentalité* of the communities living there. This rootedness of wetland identity must have come into existence not because of some abstract notion of landscape, but because of everyday (material) engagement of people with their surroundings. Local knowledge and lived experience lie at the heart of the manner in which people socialize their surroundings (Cooney 2004, 324). This will therefore result in patterns of similarity in the lifestyles and beliefs of people (*ibid.*) inhabiting these wetland landscapes, which are as much part of the social as well as the economic and technological aspects of society, stressing their interwoveness. Because of habitual practices, which remained in use for many centuries, similar experiences were created, situated at the same places, but in a changing environment. In this manner a sense of awareness of the past was handed down through time and an idea of being rooted in this wetland environment may have been created. Such a relationship between landscape, memory and identity is well-attested ethnographically (*e.g.* De Coppet 1985; Küchler 1993; Thesiger 2007), as well as historically (Kolen 1999, 284; Schama 1995). In acknowledging this it becomes important for us to try and assess what the formative characteristics of the landscape that shaped that particular identity were. Ultimately the development of such a landscape-bound *mentalité* may relate functionally and economically to important issues such as territoriality, the demarcation of boundaries and the conservative character of many small-scale societies (*e.g.* Cohen 2004). As argued above different motivations may operate alongside each other. This, however, does not make it less relevant to incorporate the relationship between people and their environment in an analysis of the long-term characteristics of these groups, as they contributed to and shaped them.

Water as a metaphor

Thomas (1996[d], 5) argues that environmental determinism preserves the notion of the environment as an externality, something 'out there', producing stimuli to which human communities respond. According to this perspective societies and social relationships somehow exist outside of the material world and are impacted upon by natural phenomena. Instead of such a nature-culture division it is suggested that social relationships are thoroughly bound up with the natural world. Humans dwell in a material world, and in the course of this dwelling an accommodation is made between the rhythms of social reproduction and the rhythms by which the organic world renews itself (Ingold 2000). Environment and landscape set the margins, but also actively contribute to the formation and character of social identity and society in general. If we acknowledge that this is a recursive relationship (Zvelebil 2003[a]), then the combination of traits (such as flexibility and long-term continuity in place and practice) characterising these communities sprang from being and surviving in these lands. However, this involves more than simply dwelling in the mere physical reality of a wetland environment. It also has to take into account the notion that such an environment was appropriated and encultured over a long period of time (for an elegant example see Meredith 1999).

These considerations make it worthwhile to try and identify the central element(s) of such a reality. Obviously an important element encountered when inhabiting a wetland is water, or the relationship between water and land. Water created and constrained opportunities, for living, subsistence, travel. It took life and land, but also shaped it and it was present and pervasive in many forms. The pervasiveness of this physical reality of water in the landscape formed a potentially strong element in the metaphysical and conceptual reality of people living in and near it. In their dealings with this multi-faceted water people had to adopt a flexible, 'fluid' attitude in order to engage with this physical reality, its rhythms and its unexpected aspects (see also Leary 2009). The boundaries between people, land and water may have become blurred (see Sturt 2006, 119, 136). This suggests that the temporal and spatial relationship between communities and their environment is not secondary to either a cultural or economic interpretation, but should be interpreted as an intrinsic, important element. Water and its fluid nature in this respect form more than a metaphor.

7.3 Dimensions of land-use, subsistence and procurement

It has been pointed out above that the relationship between people and the land was intensive, encompassed many aspects of society and was of a recursive nature. Continuity and stability in these landscapes, necessary for a reliable and structured transition to agriculture and the adoption of new techniques, were often of a relative nature, yet people had a range of options to choose from, within limitations set by the environment (see Louwe Kooijmans 1997; Mol/Van Zijverden 2007). Choice was not dictated by the environment but mainly governed by social convention and tradition, previously described as regulated improvisations, or *habitus* (Bourdieu 1977), although at times more personal, idiosyncratic motivations may have underlain action. While the land thus influences people and partially shapes local identity, this takes place in relation to the choices made by these people. These determine to what extent the dynamics of the environment were dealt with, what values, traditions and places were to be retained or continued, and what could be substituted or altered. Choices with respect to land-use, subsistence and resource procurement and especially the stability and changes therein are therefore informative on societal developments in these small-scale communities. This should take into account the different landscape and environment dynamics discussed above. Therefore, while changing strategies may reflect actual changes in society, abandoning the old for the new within given margins, they may also be aimed at consolidating an existing way-of-life and substituting certain practices for others in order to do so. This is in line with the adaptive attitude discussed above.

Visualising dimensions of wetland land-use

The model in fig. 7.3a schematically represents this relationship between the dynamic environment and the range of options available. The ecological limitations are determined by the balance between 'wet' and 'dry'. These represent available space and conditions as a result of the balance between land and water, but also related issues such as humidity, waterlogging, seasonal flooding and groundwater levels. While these environmental conditions are depicted vertically, they evolve over time, which is depicted horizontally. It should be stressed here that time is of a relative character in this model and may pertain to annual (or seasonal) fluctuations, but also to longer term processes such as increased waterlogging. In this respect it should be noted that while short term *événements* as well as longer term time scales (Braudel 1966) seem accounted for, the difficulty in reality lies with identifying and linking up environmental changes and cultural responses and distinguishing causality between the two (pers. comm. Louwe Kooijmans 2009). A further distinction is made between accretionary sedimentary phenomena (as for instance coastal dunes, levees etc.) and 'fixed' features such as Pleistocene river dunes, boulderclay outcrops and the wetland margin. Conditions there are usually ideal from the start and may deteriorate over time. This, however, does not include short-term annual fluctuations.

The model indicates that the potential for specific site use is related to the dynamics of environmental and landscape conditions. It is assumed that there is a larger range of situations suitable for an auxiliary function and a more optimal range for a residential function. The intermediate situation pertains to those situations where domestic conditions are sub-optimal (from our perspective) yet not impossible. This predominantly applies to sites in (dynamic) Holocene sedentary conditions, or locations that are gradually submerging beyond a certain point. In fig. 7.3b the hypothetical development of a site has been depicted over time according to this model. The two horizontal bars express site function and the possibilities offered by the potential subsistence range. The range of options is depicted vertically by the arrows (1 to 5). It should be noted that the specific sequence depicted is meant as an example.

The site becomes available for use shortly after conditions have become drier. The first arrow (1) indicates that the range of options available at the sites at that time is still limited. Arrows 2 and 3 indicate an amelioration of conditions and hence an increase in habitational and economic opportunities. This could result in a shift in site function from auxiliary to residential. Such a shift may coincide with a diversification of the environment or a decrease in environmental dynamics and flooding. In this model, the situation at arrow 3 may be conceived as the ideal balance between wet and dry, offering the best opportunity for intensive exploitation. From the later Swifterbant period onwards, this also may involve small-scale crop cultivation or animal husbandry. After this the balance reverses. The environmental conditions deteriorate and the range of feasible subsistence activities decreases, eventually forcing the location into an auxiliary function again (arrow 4), in this case preceded by a hiatus in site-use. Communities may have required some time to re-adjust their exloitation and settlement system. Arrow 5 indicates that the options have become very limited shortly after the site is abandoned.

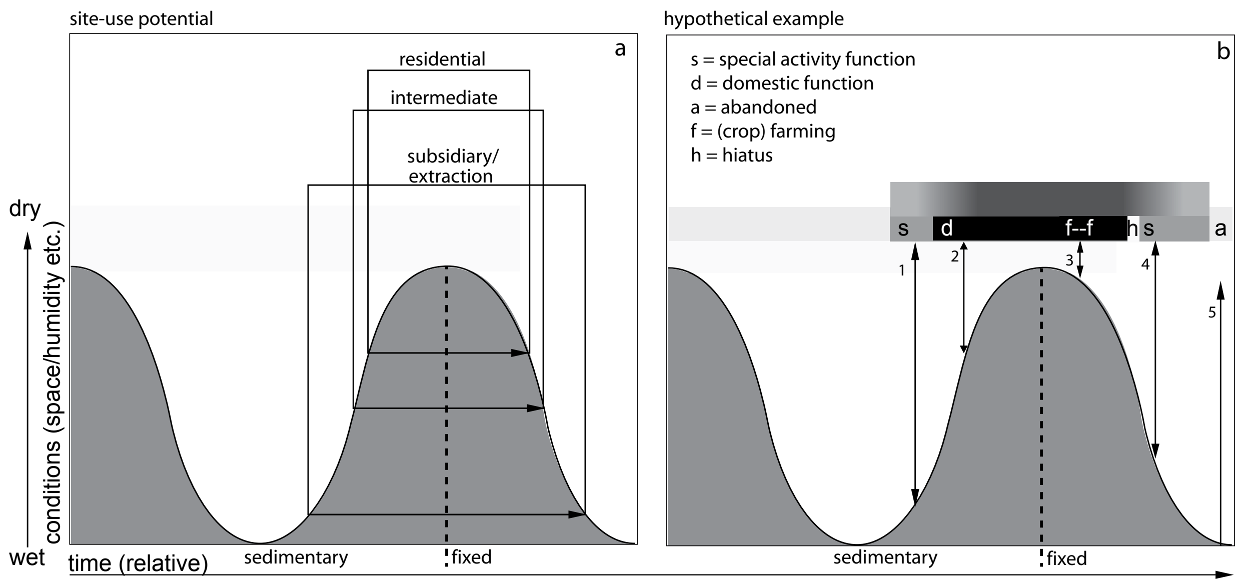


Fig. 7.3a and b. Model for the potential site use under changing Holocene sedimentary conditions with shifting functions; (a) model; (b) hypothetical development; 1-5 shifting stages of site use; dotted line: situation for fixed conditions such as outcrops or river dunes.

Margins and motivations

Rather than a theoretical framework for the interaction between man and environment, this model serves to stress the interplay existing between the margins set by the latter and the leeway given to the former. The range of options available to the inhabitants enables them to choose a certain subsistence strategy and make additional choices with respect to site use and habitation. This happens within the margins offered by the environment. In most cases conditions will change gradually, often enabling a continuation of previous lifestyles or a limited enhancement or alteration of these. In other cases, changes may be more drastic, requiring a revision of strategy. People had to be flexible and opportunistic to deal with these risks (see Leary 2009). The model thus shows the dynamic nature of the interaction between the environment and its human inhabitants, while accentuating the fact that societal choice aimed at continuation or alteration of previous strategies will often, yet not always, fall within the economically most viable range of options available. Moreover, it emphasises that conditions in these wetlands and in the wetland margins were not stable and demanded a flexible attitude of its inhabitants. This flexibility formed a central element in the character of these communities that enabled them to engage with their environment. At the same time it forms an important basis to understand the choices they made.

Below, several dimensions of land-use, subsistence and procurement will be discussed from a long-term perspective, ranging from the Late Mesolithic until the Vlaardingen culture. Although the geographical and chronological scope prevents being exhaustive, the most important developments will be mapped, especially with respect to continuity or change in practice.

7.3.1 Foraging, farming and procurement

Earlier (Chapter 6) it was argued that the shift to agro-pastoral farming should not be regarded as the single most important process signaling Neolithisation (see also Hodder 1990; Rowley-Conwy 2004; Thomas 1999; Tringham 2000[a]; Whittle 1999; Zvelebil/Lillie 2000). This is why the emphasis here primarily lies with changes in practice, rhythm and routine (*cf. supra*). Unquestionnably, however, within the potential array of changes, the introduction of agriculture (*i.e.* animal husbandry and crop cultivation) may have had important repercussions on everyday life. Perhaps more than the actual domesticates and cultigens themselves, the introduction, acceptance and practice of farming knowledge and techniques had an important impact on existing routines and rhythms. Nevertheless, caution is required when searching for the idea of a 'transported landscape' (Gosden 1994, 25). A qualitative perspective is required when interpreting, for example, the earliest finds of cereals and domesticates, or phenomena such as impressions of grains (*e.g.* Jennbert 1988) and ambiguous palynological signals. Their presence does not imply an integrated agricultural system (*e.g.* Louwe Kooijmans 2003). The co-existence and combination of both 'Mesolithic' and 'Neolithic' subsistence strategies instead requires prudence with regard to labeling them.

Procurement

It may be more correct to speak of 'procurement', rather than of hunting, gathering or farming, since procurement has none of the specific connotations of the other terms. It distinguishes itself from 'producing' in a classically Neolithic perspective, since it does not imply an intervention of society in nature. Similarly 'foraging' is not seen as a mere interaction between the human organism and its environment (see Ingold 2000, 58-59). Instead (according to the Shorter Oxford Dictionary) procurement is '*to bring about, to obtain by care or effort, to prevail upon, induce etc.*'. Procurement is therefore management, contrivance, acquisition, getting, gaining (Bird-David 1992[b], 40; Hind 2004, 44). In line with Ingold (2000) this notion better describes the nature of the multitude of options and strategies available to these communities during the transition to agriculture. From a behavioural perspective hunting, gathering, but also small-scale agriculture are all forms of skilled, attentive 'coping' in the world, '*intentionally carried out by persons in an environment replete with other* [perceived, my addition] *agentive powers…*' (Ingold 2000, 59). This perspective stresses that these activities are part of inhabiting a specific landscape and its environment and as such form variations on a similar theme (*e.g.* Chapter 6). It accentuates an engendered environment that is alive, instead of a physical substrate that may be altered (*e.g.* Bradley 2000). In short the relationality between people, places and objects as well as plants and animals is brought to the fore.

Below I focus on the various strategies of procurement and the way they changed over time, remained stable or were combined per site and period. The emphasis will be on the procurement of different food resources as these activities exhibit important developments over time. Procurement of non-food resources will be dealt with briefly subsequently. Following this, the long-term character of food procurement in the LRA will be interpreted in light of the existing explanatory models for the transition to agriculture as well as with respect to the perspective they offer on settlement systems and habitation. The reader is referred to Out (2009) for more detail on both botanical food and non-food vegetable resources.[11]

7.3.2 The wild and the tame

The earliest presence of bones of domesticated animals (excluding dog) is at the Early Swifterbant site of Hardinxveld-Giessendam-De Bruin phase 3, with a date between *c.* 4700-4450 cal BC (Louwe Kooijmans 2007[a], 297). From that period onwards livestock form a recurrent element on most wetland and wetland margin sites. Nevertheless, hunting, fishing, and trapping remained important (*e.g.* Louwe Kooijmans 1993[a]). To interpret the impact and implications livestock may have had on fixed rhythms and routines, it is important to provide a qualitative perspective of their importance versus that of wild resources. Below, the faunal aspect of the subsistence spectrum is presented for sites chronologically ranging from the Late Mesolithic to the Vlaardingen culture. This overview combines new data from recent, commercially excavated sites in combination with their wild-domestic ratios and counts of fish and fowl (for previous overviews see Lauwerier *et al.* 2005; Louwe Kooijmans 1987; 1993[a]; 1998[a]; 2007[a]; Zeiler 1997). The composition of the faunal assemblages is presented in fig. 7.4.

Since we are dealing with subsistence it is germane that background fauna and irrelevant fur animals are excluded from the counts as well as dogs. In light of the well-known difficulties in morphological identification (*e.g.* Albarella *et al.* 2007; Bollongino/Burger 2007; Louwe Kooijmans 2006[a]; Rowley-Conwy 2003), indeterminate bones of pig/wild boar, and cattle/aurochs, when possible, have been attributed on the basis of the ratio of positive identifications (*e.g. contra* Gehasse 1995; Raemaekers 2003). This has not been done when positive identification was insufficient (none, or only one of either species).[12] Furthermore, antler is excluded if published data allowed selection. Due to differential depositional, preservational and taphonomical circumstances it is not sensible to calculate fish and bird remains as part of the overall faunal spectrum. Their numbers therefore are presented separately. Furhermore, it should be mentioned that the informative resolution of faunal assemblages greatly depends on the sample size, the methodology of excavation and, except for large mammals, whether or not sieving took place.

The most distinct characteristic of fig. 7.4 is the variability in faunal composition between sites, as well as over time. This is a feature of environmental variability, but also represents the differential choices made by the inhabitants of the wetlands and wetland margins. Underneath this variability a general trend may be observed which is further accentuated in the wild-domestic ratio and shows a gradual decrease over time in the importance of game in favour of domesticated animals. Within this trend four phases may be distinguished, although the variety in landscapes and the small number of sites with substantial specific faunal data influence the importance of this distinction. The boundaries of these phases are necessarily fuzzy, both because developments extend across them, as well as due to the limited number of sites.

7.3.2.1 Phase 1: *c.* 4700-4400 cal BC, a tentative start

The first phase starts with the appearance of domesticates at De Bruin phase 3 between 4700 and 4500 cal BC (Louwe Kooijmans 2007[a]; Mol/Van Zijverden 2007). While there is also evidence for simultaneous introductions elsewhere on the North European Plain, (*e.g.* Hartz *et al.* 2007), it is important to note that there are contemporaneous Swifterbant sites such as Hoge Vaart-A27 (see Lauwerier *et al.* 2005, 47; Peeters 2007, 183) where no evidence of domesticated animals

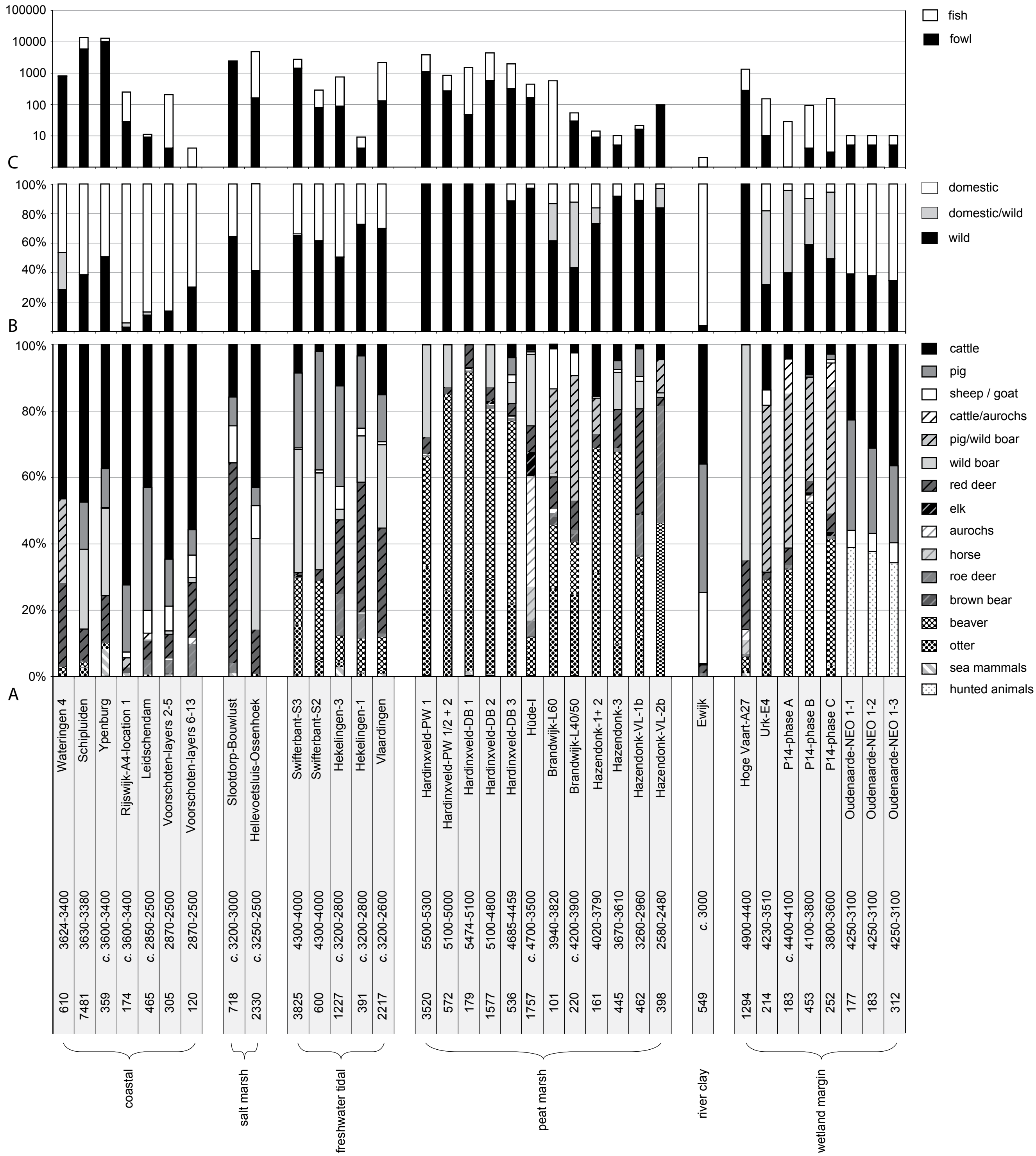


Fig. 7.4a Composition of the mammal faunal assemblage (A) per site according to geographical region and in general chronological order. Sections B: wild-domestic ratio and unspecified identifications of pig/wild boar and cattle/aurochs. Section C: fish and bird remains.

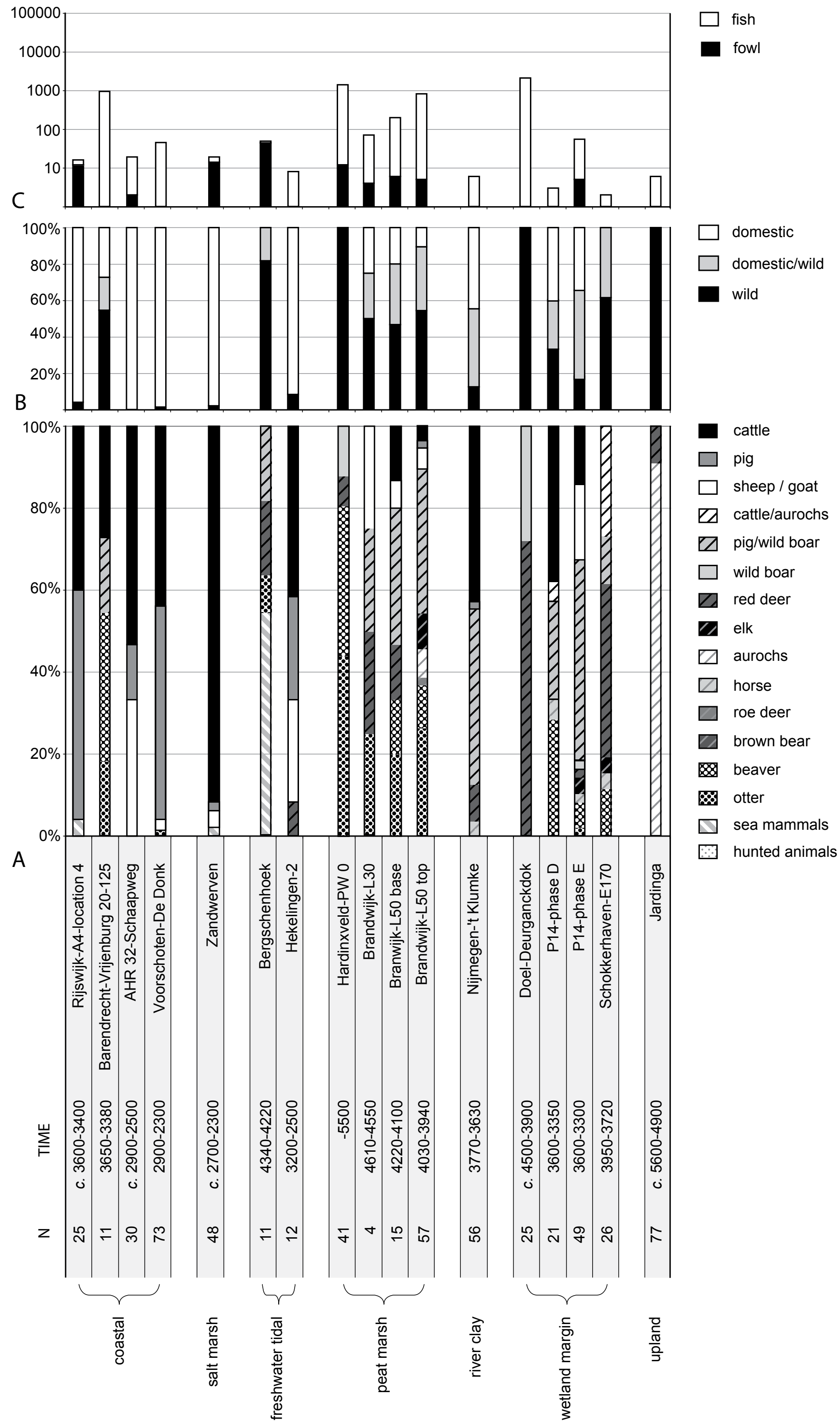


Figure 7.4b Sites with low counts (N≤100).

has been documented among the substantial faunal remains of phase 3 (*c.* 4850-4500 cal BC). Similarly the lake margin site of Hüde I, despite its rather large chronological range (4700-3500 cal BC), only yielded a very limited contribution of domesticated animals (2-3%), including cattle, sheep/goat and pig. Based on the spectrum of dates available, the first domesticates should be situated in the

Rössen-Bischheim period, phase 1, most likely somewhere between 4400 and 4000 cal BC (see Appendix I; Hübner *et al.* 1988; pers. comm. Louwe Kooijmans 2011). Situated considerably further north-east (*c.* 500 km), the evidence from Grube-Rosenhof (Schleswig-Holstein, 4750-4450 cal BC), only represented by 9 cattle bones (1-2%), already dates to 4600 cal BC (Hartz *et al.* 2002, 327; Hartz *et al.* 2007, 579), yet stable isotope analyses on aurochs and early cattle bones from southern Scandinavia have raised doubts regarding these attributions (Noe-Nygaard *et al.* 2005). Additional evidence from De Bruin indicates that, apart from the pig bones, the faunal remains found at this site represent transported quarters instead of live animals (Louwe Kooijmans 2007[a]). The bones were located in small concentrations, hinting at a deposition practice. A juvenile pig was buried in a small pit, possibly along with fragments of ochre (Louwe Kooijmans 2003; Louwe Kooijmans/Nokkert 2001).

These few sites indicate that the economic importance of the first domesticates in the LRA wetlands and wetland margins must have been limited.[13] This first phase, which roughly dates between 4700 and 4400 cal BC, therefore can be characterized as *tentative*. Since the contribution of domesticates to the overall faunal spectrum is small, it is questionable whether livestock was actually kept at these sites, especially taking into account the small size of the donk of De Bruin. Pigs principally would be best suited to be kept in this type of environment, while extensive grazing areas for cattle may have been limited. The environment may have been largely unfit for keeping sheep/goat, while cattle and sheep/goat may furthermore have suffered from liver fluke (*Fasciola hepatica*) (see Zeiler 1997; De Roever-Bonnet *et al.* 1979), typical for freshwater environments. In practice the domestic animals may have been kept by these communities elsewhere in their territory, or exchanged with other groups. For Hüde I the swampy terrain surrounding the lake margin site is contrasted by upland landscape in the direct vicinity (<5 km). This may explain their presence and imply a more economical use, probably of a later date.

Despite their limited economic importance it should be realized that all four domestic species were available around 4600 cal BC. This provides a *terminus ante quem* for the development of familiarity with the concept of livestock and contacts with groups using this range of domesticated animals. Currently, the archaeological evidence available does not allow any conclusions on whether some form of animal husbandry was practised by Swifterbant groups in the adjacent coversand area, or whether the presence of domesticates in the wetland area should be attributed more directly to imports from fully Neolithic Rössen and Bischheim groups further south and east, or perhaps even the older *Groupe de Blicquy* in the south.[14]

7.3.2.2 Phase 2: *c.* 4400-3800 cal BC, limited importance

The second phase is characterised by several Swifterbant sites where domesticated animals form a limited yet consistent contribution to the faunal spectrum. The most important sites in this phase are located both in the Rhine-Meuse delta (Brandwijk-L50-L60 and Hazendonk phase 1 and 2) as well as the IJsselmeer basin (Schokland-P14 A-C, Urk and Swifterbant), potentially indicating a more widespread practice. As can be seen in fig. 7.4a and b, determining the exact contribution of domesticates is hampered by the indeterminate groups of pig/

wild boar and cattle/aurochs, but the number and character of the positive identifications point to an increased role for animal husbandry at these locations. At the Hazendonk domesticates are dominated by cattle which represents *c.* 15% of the total Number of Identified Species (NISP). At Brandwijk the evidence from layers 50 and 60 is quantitatively more limited than at the Hazendonk or Hardinxveld-De Bruin, but points to a consistent contribution of some cattle and pig and remarkably mostly sheep/goat. Overall the composition of the faunal spectrum is consistent over time, a trend similar to for example P14 layer A-C, although there cattle was more important.[15] With regard to cattle, this was also the case at Urk-E4, but faunal evidence from the levee sites S2 and S3 at Swifterbant shows a clear preponderance of domesticated pig. In this respect it is important to note that while the wetter conditions at Swifterbant favoured the rearing of pigs over cattle, compared to for example the boulderclay outcrop of P14 or the river dune at Urk, similar conditions existed at the Hazendonk, where cattle clearly is the dominant species (see also Zeiler 1997, 42). Evidence in the form of skeletal element distribution, age structure and cut marks from several assemblages indicates that animals probably were slaughtered locally and were part of herds that were at least partially managed and maintained at these locations (*e.g.* Gehasse 1995; Zeiler 1997).

Several points emerge from these assemblages. First, the attested consistency at some locations points to a certain cultural continuity in economic choice (*e.g.* Gehasse 1995, 59). Despite changes in the environment, people adhered to the composition of their livestock and its balance to wild resources. This shows that similar conditions do not necessarily lead to similar choices. Again cultural choices determine the composition of the faunal assemblage within the limits set by the environment (see Louwe Kooijmans 2009). This indicates the existence of a certain flexibility, with respect to the initial composition and with respect to maintaining familiar practice in the light of a changing environment. This also means that differences between sites may be meaningful from a socio-cultural perspective. Unfortunately many pertinent factors such as site size and surrounding ecological conditions are difficult to quantify. While Raemaekers (1999, 113) argues that similarities in the wild/domestic ratio between P14 and S3 are meaningful because of differences in the environment and suggests that this faunal composition may therefore be representative for the Swifterbant occupation of Pleistocene areas, this does not do justice to the internal differentiation present within the faunal composition of Swifterbant sites (compare for example the importance of domestic pigs at both sites and the Hazendonk), nor the dynamics of the environment in medium time spans. There is notable differentiation and it is related both to the existing balance between socio-cultural flexibility and environmental constraints.

7.3.2.3 Phase 3: *c.* 3800-3200 cal BC, substantial contribution

This phase is represented by sites from the late phase of the Swifterbant culture in the north and contemporary sites of the Hazendonk group in the south. The later phases of P14 and the sites of Nijmegen-Klumke, Schipluiden, Wateringen, Ypenburg and Rijswijk all show a considerable contribution (around 50%) of domestic animals to the faunal spectrum. At Rijswijk-A4 domestic species are dominant (see also Laarman in De Vries 2004). Unfortunately the contextual information from Oudenaarde and its chronological range do not allow a more precise attribution of this data. It should be noted that sites with a considerable contribution of domesticates are all situated in locations with extensive 'dry' areas. P14, for example, is located on an extensive boulderclay outcrop, while the Delfland sites of the Hazendonk group are all situated on dunes in the former beachs plains, with ideal grazing grounds situated nearby (*e.g.* Louwe Kooijmans 2006[a]; Zeiler 2006[a]). At least for the Delfland sites this may explain the predominance of cattle in this phase, as the area was less well suited for pigs (Zeiler 2006[a]). The river clay area site of Nijmegen-Klumke shows an even greater contribution of cattle, yet this is based upon lower numbers. A rather remarkable development is the increase in domesticates in phases D and E at P14 (from *c.* 3600 cal BC), in comparison to the earlier phases. Cattle and sheep/goat distinctly increase in importance.[16] Although hampered by low numbers and taphonomical problems, there are some clues indicating that changing local conditions influenced the shifts in the faunal spectrum, (see Gehasse 1995, 59). This would mean that the inhabitants of P14 were able enough to adjust their subsistence spectrum when environmental developments made this profitable, even if this included tending larger herds of cattle and ovicaprids.

In this timeframe there are, however, also sites where the contribution of domesticates was less than substantial, particularly phase 3 at the Hazendonk and to a lesser extent and with lower numbers Barendrecht-Vrijenburg. Not surprisingly, these sites also are located in considerably wetter settings than the others, which may explain the limited presence of cattle, pig and sheep/goat and the evident importance of otter and beaver. According to Zeiler (1997, 35) the wetter circumstances during Hazendonk phase 3 may have decreased the pasture area available, and in combination with the decreasing dune surface explain changes in the faunal spectrum. In comparison to phase 1 and 2 for example, cattle becomes increasingly less important, while red deer takes on a more important economic role in phase 3 and during the VL-1b ocupation.[17] The importance of pig and wild boar remains stable, while roe deer becomes more important from the Vlaardingen occupation onward (Zeiler 1997, 45). Overall it also should be noted that cattle (except during phase 1; 14%), sheep/goat and pig continued to form a constant, yet very minor part of the diet (see Zeiler 1997, 50-52). In all phases the emphasis in activity of the occupants was aimed at trapping otter and beaver, and hunting of red deer, roe deer, and wild boar (Louwe Kooijmans 2007[a], 298). This underlines on the one hand that environmental circumstances over time may encourage shifts in subsistence choice; communities were pragmatic and adaptive. On the other hand it stresses the continuity characterizing the use of a certain location and therewith the long-term consistency in practices and strategies employed by the communities exploiting it [18] Complementary to the domestic spectra of the Delfland area, this stresses the ongoing importance of hunting and gathering and the knowledge and expertise involved well into the Late Neolithic. The implications this has for the interpretation of the Hazendonk within a settlement system will be discussed later on.

7.3.2.4 Phase 4: *c.* 3200-2500 cal BC, partial consolidation

Most evidence for this phase is derived from sites of the Vlaardingen culture located in the southern part of the Delta. One TRB location may serve as a northern counterpart. Although the number of remains sometimes is limited, it is evident that coastal sites of the Vlaardingen culture yield a faunal spectrum mainly characterised by domesticates. Although the location is different this may be interpreted as a continuation of the domestic faunal signature of some of the Delfland sites mentioned above, most notably Rijswijk-A4. Sites situated in the river clay area, such as Ewijk, also yield a spectrum dominated by domesticates. This spectrum potentially may be extrapolated to the nearby Vlaardingen sites located on the wetland margin, such as the Wijchen cluster (see Teubner/Tuyn 2010), which unfortunately suffers from unfavourable conditions of organic preservation. These sites indicate that by this time farming had become the most important contributor to subsistence in certain areas and cattle the most important domesticate (fig. 7.4). At the same time several other sites of the Vlaardingen culture yield a different spectrum with a dominance of wild fauna. Apart from the already mentioned Vlaardingen occupation of the Hazendonk, this concerns Hekelingen (I and III) and Vlaardingen, located on levees in the freshwater tidal area. There, red deer, roe deer, beaver, otter, fowl and fish are well represented. While these sites lack the supposedly sedentary character of upland and coastal sites there is substantial evidence to suggest a residential function at least on a seasonal basis. Whether or not these locations should be perceived independently or in a satellite relation to permanently occupied sites in the coastal or upland areas is still a subject of discussion (*e.g.* Amkreutz 2010; Van Beek 1990; Van Gijn 1989; Louwe Kooijmans 2007[a]; Raemaekers 2005[a]; *cf. infra*), but they do point out the existence of a broad range of (subsistence) strategies within the Vlaardingen culture. This has recently been confirmed by the discovery of the Vlaardingen site of Hellevoetsluis, located in a salt-marsh and mudflat landscape (Goossens 2009; 2010). There, convincing evidence for substantial structures, including a palisade, and arable farming, including ard marks, is contrasted by a faunal spectrum characterized by a considerable contribution of wild animals of up to 40%.[19] Moreover the overwhelming number of fish and fowl remains confirm the importance of wild resources.

The TRB site of Slootdorp-Bouwlust, located within a former salt marsh in current West-Frisia, furthermore demonstrates that also within the cultural context of an archetypical Neolithic culture, a seasonally occupied residential site may yield a faunal spectrum that is largely oriented on hunting and fowling (see also Appendix I). Again occupation of the wetlands only leaves a certain margin for the exploitation of domesticates.

7.3.2.5 Methodological considerations

The four phases above demonstrate the general outline in faunal composition in terms of NISP, but do not account for the often important nuances that exist.

Dietary importance

By including bone weight (BW) and eventually caloric value one could arrive at a better interpretation of the dietary contribution of different faunal categories (see for example Jochim 1976; Zeiler 1997). Although the relative importance of different species mostly will remain roughly similar, in some cases this leads to shifts in importance (see for example Zeiler 1997, fig. 12). A limited number of bones of cattle, for example, still represents a substantial caloric contribution, something that should be accounted for especially when interpreting the balance between domesticates and wild animals in phases 2 and 3. Although this may shift the balance in favour of domesticates, the often important indeterminate wild/domestic category (fig. 7.4 section B) suggests that shifts in importance must not be overinterpreted. This is important since tending domesticated animals involves different investments of energy and time than hunting.[20] The often substantial contributions of red deer, roe deer and wild boar, therefore point to the importance of active hunting strategies. With respect to time investment and activities, a further distinction that may be made relates to selective and aselective hunting, trapping and fishing as was demonstrated for example at the Hardinxveld sites, Swifterbant, the Hazendonk and to some extent Schipluiden (Van Wijngaarden-Bakker *et al.* 2001; Zeiler 1997; 2006[a]). A final factor which has received little attention is the relative underrepresentation of wild fauna, especially ungulates, in relation to domesticated animals, based on principles of procurement. While domestic animals may be held at or driven to a site for slaughtering, wild animals usually are hunted at some distance from the site. This often may lead to selection of parts that are transported and subsequently to a nominal underrepresentation.

Otters and beavers

What also should be noted is the importance of otters and beavers at some locations.[21] As is demonstrated in fig. 7.4a, both form a substantial contribution to the faunal assemblages at several sites as late as phase 4. Of course their importance is related to the degree to which wet aspects dominated the landscape. This explains their continued importance over time at the Hazendonk (with the exception of VL-1b) and Brandwijk, although fluctuations in composition at sites such as P14 and, to a lesser extent, Hardinxveld demonstrate that alternative motivations may have been important as well. From an ecological perspective one also might have expected a more important contribution of these animals at for example Hüde I, Hekelingen or Vlaardingen. It is likely that otters and beavers were trapped especially for their fur (*e.g.* Prummel 1987; see also Charles 1997; Coles/Orme 1983) in which case they would point to autumn and winter activity (see Jochim 1976, fig. 2; Louwe Kooijmans 2003) as furs are at their best around that time.[22] At some sites cutmarks and the age distribution confirm this (*e.g.* Prummel 1987, 205; Zeiler 1997, 66; 2006[a]; 399). There is also evidence for beaver hunting in different seasons and for the absence of age selection (*e.g.* Oversteegen *et al.* 2001; Van Wijngaarden-Bakker *et al.* 2001). Zeiler (1997, 63, 66-67; 2006[a], 399-400) interpreted cutmarks on bones at the Hazendonk, Swifterbant and Schipluiden, and showed that otters and beavers (as well as fox) were hunted for both their meat and fur. The caloric importance of beaver furthermore is documented extensively in ethnography. Adult beavers usually weigh up to 20 kg (see Jochim 1976, 20, 100) and have a high fat content, which is highly valued in hunter-gatherer societies (Kelly 1995, 105; Layton *et al.* 1991; Nicholas 1998[a]; Walthall 1998). In combination with their non-food yields, density and degree of aggregation they make a very profitable prey. Some of the sites in fig. 7.4a suggest that beaver and to a lesser extent otter were a staple food in communities exploiting the wetlands and wetland margins. However, the extremely high proportion of beavers as late as the VL-2b occupation at the Hazendonk is probably also indicative of a special activity function and may imply culling that exceeds self-sufficient purposes (see for example Zvelebil 1998[a]; 2000).

Fish and fowl

This brings us to a further issue concerning the faunal composition at the studied sites. Fish and fowl are present at almost every site (fig. 7.4, section C). Although most counts do not exceed 100, it is safe to assume that this is a rather direct result of taphonomy and excavation methodology, especially the absence of sieving (see also Chapter 4; Louwe Kooijmans 1993[a]). Sites with extensive sampling programs, such as Hardinxveld, Schipluiden or Ypenburg therefore automatically rank highly.[23] Zeiler (1997, 14, drawing on Jones 1986) mentions that up to 80% of the bones of fish may be lost or damaged beyond recognition at sites where fish is consumed. This, in combination with sampling methodology influences both the size and composition of the assemblages. The fatty skeletal parts of salmon, for example, will be underrepresented in comparison to the hard bony plates of sturgeon. As for birds, their small bones also are prone to fragmentation, for example by trampling (*e.g.* Van Wijngaarden-Bakker *et al.* 2001). It, therefore, can be concluded that the primary information (quantitative bone counts) for both fish and birds cannot be used to assess their overall importance to the diet and that the counts in fig. 7.4c do not represent the effective contribution of these food resources. In contrast, secondary sources rather unambiguously stress their importance. A number of sites yielded evidence for fishing in the form of (parts of) fish weirs and fish traps, most notably Bergschenhoek and Hoge Vaart-A27, but also at Jardinga, Hardinxveld-De Bruin, Vlaardingen, Swifterbant-S3 and, indirectly, at Hekelingen-III (see Appendix I). Spectacular was the find of a large number of fish traps at Emmeloord-J97. Although most (*c.* 41) date to the Late Neolithic, at least three fish traps are of Swifterbant date (Bulten *et al.* 2002). Pieces of rope and roping techniques, as demonstrated at Polderweg (Louwe Kooijmans *et al.* 2001[a]), Rotterdam-Randstadrail (Guiran/Brinkkemper 2007) and Vlaardingen (*e.g.* Van Beek 1990) point to the existence of nets. Furthermore, leister prongs were found (Bergschenhoek) as well as spears and pointed sticks. Importantly, no hooks have been found, which may be related to the absence of evidence for deep sea fishing, demonstrated in the fish spectra. Most of the marine species present, such as mullets (*Mugilidae*) and the roker, may under certain circumstances, also venture into areas with brackish or freshwater conditions (*e.g.* Brinkhuizen 2006).[24] In any case, based on the evidence in the form of artefacts and features from the study area, as well as elsewhere (*e.g.* McQuade/O'Donnell 2007; Out 2008[b]), fishing seems to have been an activity broadly practised and it is likely that fish formed an important part of the diet. This is substantiated by the bone isotope composition of the buried individuals at Schipluiden (Smits/Louwe Kooijmans 2006, 101-104; Smits/Van der Plicht 2009; Smits *et al.* 2010). Both high values of ^{15}N and a considerable amount of calculus formed on the individuals' teeth demonstrate the importance of aquatic resources in the diet, in contrast with the archaeozoological contribution of domestic animals.

Concerning birds, the secondary evidence is more limited. Lithic arrowheads, fragment of bows (*e.g.* Hardinxveld and Hekelingen) and nets form indications for their exploitation. At some sites, such as Vlaardingen and Hekelingen III, birds exceed 10% of the overall faunal composition (*e.g.* Louwe Kooijmans 1993[a]; Prummel 1987). Emblematical is the special activity site of Bergschenhoek (see Appendix I; Clason/Brinkhuizen 1993) that was repeatedly used for fowling. In comparison to the subsequent Bronze Age, where birds form a minor element in the faunal spectrum, the importance of fowling should not be underestimated for the Late Mesolithic and Neolithic wetland communities studied here, especially those situated in, or exploiting the coastal area and the intra-coastal plain (see Lauwerier *et al.* 2005, 62). The caloric contribution of birds is difficult to establish, however, they yield twice as many calories per 100 g meat than mammals or fish (Hockett/Haws 2003, 212).

Other species

There are several other species that were hunted occasionally. Some of these, specifically fur animals and probable background fauna, such as the (pine) marten, weasel, wild cat, pole cate, badger, fox, wolf and lynx have been excluded from the counts above. This does not mean that they were never consumed as has been attested for fox and badger (Zeiler 1987; 1997; 2006[c]). Others, such as elk, aurochs, horse and brown bear occur regularly, but were never hunted in great numbers. This may relate to specific habitat circumstances, the environment may have been too wet or too densely forested (*e.g.* Zeiler 1997, 33; 2006[b], 28), or reflect their special status. For horses it has been suggested that they were domesticated, especially since wild horses seem unfit for inhabiting wetlands and dense forests (*e.g.* Clason 1967). It should be questioned, however, to what extent the horses at S3 and even for example at Hekelingen I were domesticated, since this is a process mainly taking place in the 4th millennium in current southern Russia and the Ukraine (Zeiler 1997, drawing on Benecke 1994). The high count for horse at Hüde I probably reflects wild individuals related to nearby uplands and the Dutch wetland counterparts may be interpreted as stray animals (pers. comm. Louwe Kooijmans 2011). Similarly, the natural habitat of bears consists mainly of dry land and mountainous regions, which, apart from their living a largely solitary existence, could explain their limited contribution. Remarkably, for bear remains, there is a preponderance of cranial elements and sometimes lower limb ones. This may indicate the existence of hides and furs with head and feet still attached (Zeiler 2006[b], 29; 2010, 54). This emphasises the potential non-food role of this species and perhaps its ritual significance, especially during the Vlaardingen culture where indications exist for such practices (Zeiler 2010, 54). At the same time bears should not be underestimated as an extremely rich, fat and valuable food source (*e.g.* Charles 1997; Ikeya 2006; Jochim 1976, 20). Finally marine mammals should be mentioned. While present at some sites this does not imply active marine fishing or hunting as seals may swim up rivers and whales might have been stranded on the beach (*e.g.* Zeiler 2006[a])

7.3.2.6 The meat of the matter

Several concluding remarks have to be made regarding food procurement. It is evident that by and large the composition of faunal assemblages is consistent with the limitations posed by the ecological context. For example beavers and otters dominate the spectra in the peat marsh area. Moreover, in time, the coastal and wetland margin faunal compositions become largely comparable, with respect to the importance of cattle. People operate within given margins and will attune their strategies to these. Interesting, however, is the evidence we have for the choices they made within these margins. Several sites provide an interesting perspective. At the Hoge Vaart the continuous evidence of occupation between 4850 and 4400 cal BC (phase 3) has yielded no evidence for domesticated fauna (*e.g.* Peeters 2004; 2007). This may indicate the absence of domesticates in some early Swifterbant communities, but cannot be linked directly to the environment, because although the Hoge Vaart sand ridge was slowly covered by peat during the SWB-occupation, its overall size and its vicinity to dry uplands further east (see Peeters 2007, fig. 3.12 and Appendix I) provided the opportunity for animal husbandry. In contrast, the first domesticates are found in a location far less suitable, namely the isolated river dune of Hardinxveld-De Bruin, at that time emerging only a mere 80 cm above the surrounding peat and measuring *c.* 950 m^2 (see Mol 2001[b], 53). While it is questionable, with the exception of the pigs, to what extent this concerns live animals and not quarters of meat, all four species are present and taken together contribute more than 11% to the overall spectrum of that phase, despite the possibilities for hunting, fishing and gathering offered by the environment. They may reflect animal husbandry taking place elsewhere, probably on the southern coversand landscape or in the Meuse valley and as such represent a farming component within or related to these communities. In the latter case this may represent intensive contacts, including exchange of domesticates with, for instance, Bischheim communities to the south. In any case the early presence of domesticates in the small-scale wetland setting of De Bruin points to the incipient extension of the broad spectrum economy (*cf.* Louwe Kooijmans 1993[a]) and to the versatility and pragmatism involved on behalf of the communities.

Cultural choice

These considerations indicate the existence of cultural choice. Two aspects may be stressed in this respect. First, communities appear to not always have adopted the most suitable practices if we take into account the specific ecological and physical site circumstances. Secondly, and at the same time, communities belonging to the same cultural group (*e.g.* Swifterbant culture or Hazendonk group) demonstrate significantly different emphases in their subsistence practices. Moreover, these do not always relate to the reigning ecological and physical conditions. In effect similar ecological contexts may nevertheless yield different emphases (*cf.* Louwe Kooijmans 2009).

With respect to the first point several sites yield indications. One example is the Hazendonk river dune, where domesticates form a limited yet consistent contribution to the food spectrum up to the last phase (VL-2b), while the inhabitable area of the dune over time decreased from 12500 m^2 to 4000 m^2 (Louwe Kooijmans 1985, 124). Conditions for habitation and grazing areas ameliorated slightly (became drier) during the VL-1b occupation, yet this did not result in an increase of cattle (Zeiler 1997, 35). Cattle *did* increase slightly in the last phase (VL-2b) of occupation (from approx. 1% during VL-1b to *c.* 4% during VL-2b), perhaps in reaction to the decrease of red deer most likely related to the innundation of the environment (Zeiler 1997, 35; see also the increase in beavers during phase 2b). While the actual contribution remains small and therefore should be interpreted with caution, it does point out the persistent presence of domesticates at the site in spite of environmental change. People thus were able to choose from the spectrum of resources available. This also enabled them to make more or less ecologically irrational choices, for example to prolong the use of a favoured location. This unpredictable singularity can be witnessed also at P14, although one has to take into account the stratigraphical problems associated with this site (see Appendix I). Although located in a freshwater tidal environment, the site itself is situated on an extensive boulderclay outcrop, which would have formed an ideal upland pasture area (Raemaekers 2003, 742). Despite this the contribution of cattle remains limited over time (the deviating phase D assemblage consists of only 21 bones). While Gehasse (1995, 59) argues that some of the fluctuations in the importance of certain species correlate to changes in the environment of the site, the overall image is consistent. This means that if domesticates were generally available to these communities, as is suggested by their continuous presence, there was no internal social necessity to maximize their exploitation. Instead the P14 spectrum, especially in light of its residential function (*e.g.* Raemaekers 1999, 117), hints at a community that is rather conservative with respect to change, something also witnessed at other locations (see fig. 7.4).

With respect to the second point, examples may also be given. At the time of the Middle Neolithic Hazendonk group, coastal sites such as Schipluiden, Rijswijk and Ypenburg and wetland margin locations such as Nijmegen (*e.g.* Koot/Van der Have 2001; Louwe Kooijmans 2006[a]) indicate the existence of sedentary communities with an important role for domesticated animals and crop plants. However, the Schipluiden isotope signal shows that the largely domestic spectrum indicated by the faunal remains should be nuanced (*cf. supra*; Smits/Louwe Kooijmans 2006, 101-104; Smits *et al.* 2010; Smits/Van der Plicht 2009). While isotopic correlation of the contribution of plants versus animals in the diet remains difficult, the high ^{15}N values for fish actually reflect a high contribution of this resource in the diet over a period of approximately 7 years (Fischer *et al.* 2007; see also Richards *et al.* 2003[a,b]; 2006[a,b]).[25] This actually means that at Schipluiden (see Smits/Van der Plicht 2009; Smits *et al.* 2010) there was a very important aquatic component in the diet. Another perspective is offered by the Vlaardingen culture, as is demonstrated by the Hazendonk, Hekelingen-III and Vlaardingen. It is evident that the environmental circumstances in the peat marshes and freshwater tidal wetlands favoured a large contribution of hunting, although domesticates, especially pigs, remain present. The coastal and intracoastal locations demonstrate a more important role for domesticates, while some sites, such as Hellevoetsluis occupy an intermediate position. What these locations indicate is that underneath the cultural umbrella of the Hazendonk group and Vlaardingen culture, a number of different subsistence strategies existed side by side at the same time. These differences in faunal spectra and the associated strategies cannot be studied separately from the landscape and ecological contexts of the sites involved. However, they do imply flexible ways of dealing with and combining resources across various geographical and ecological zones. How this reflects on settlement systems will be discussed later on. Furthermore, while most of the noted differences with respect to the faunal spectra relate to specific conditions per ecozone, a recent study indicates that cultural choices may play a role as well. In a comparative analysis of several sedentary sites in the coastal Delfland area, situated in a similar environment in each other's vicinity, Louwe Kooijmans (2009) pointed out that differences in practice choices occur, amongst others with respect to subsistence. As argued earlier, this implies that even within a homogenous ecological context, cultural choice and group agency are factors to be taken into account.

7.3.3 *Cultivating crops*[26]

Currently the earliest indications for crop cultivation and the consumption of cereals in the wetlands and wetland margins of the LRA have been found at Swifterbant-S3 and roughly date between 4300 and 4000 cal BC. Both charred kernels and chaff of emmer and naked barley were found (Raemaekers 1999; Van Zeist/Palfenier-Vegter 1981). A concentration of charred kernels, chaff and internodes of the same species at the Hazendonk (Louwe Kooijmans 1987) and a single grain of breadwheat at Doel (Bastiaens/Meersschaert 2005) also fall within this time range. Additionally, palynological evidence for arable weeds and disturbance of the natural vegetation from the Gietsenveentje in Drenthe indicates crop cultivation possibly was practiced there around 4050 cal BC (Bakker 2003[a,b]). This indicates that towards the end of the 5[th] millennium cal BC, roughly 1200 years after their introduction by *Bandkeramik* farmers, and from that time onwards, cereals formed a recurring contribution to the food spectrum. An overview of the available evidence is presented in table 7.1.

A cautionary note

In view of the implications of the Neolithisation process and the often emphasised difference between living off the land and producing food (*e.g.* Zvelebil/Lillie 2000, 59-60), much discussion has evolved around the evidence and possibilities for crop cultivation in the wetlands and their margins (*e.g.* Louwe Kooijmans 1976[b]; 1993[a]; Bakels 1981; 1986; Van Zeist/Palfenier Vegter 1981; Cappers/Raemaekers 2008; Out 2009). It should be noted that the evidence in table 7.1 is primarily of a documentary nature. The actual evidence for crop cultivation and consumption is strongly dependent upon taphonomical factors and excavation methodology (see Chapters 4 and 5) and should be based on a qualitative analysis of a combination of indications. Furthermore, the presence of fields in spite of convincing ard marks can be only hypothetical. While these considerations apply to the archaeological evidence available, there are also a number of behavioural connotations that operate in conjunction with these. These have been depicted schematically in fig. 7.5. This scheme may be used alongside the following paragraphs (see also Out 2009, ch.11, for an elaborate discussion of the evidence for crop cultivation).

7.3.3.1 *Macroremains of cereals*

From the initial discovery of charred remains of cultivated cereals at Swifterbant-S3 and the Hazendonk, it was questioned whether the size of and the conditions on the river dunes and levees allowed crop cultivation, or whether crops were imported. Initially the recovery of remains of chaff of emmer and naked barley were interpreted as an indication of local cultivation (Bakels 1981, 145; Van Zeist/Palfenier-Vegter 1981, 143; see also Kubiak-Martens 2006, 325-329), especially since free-treshing cereals such as naked barley are assumed not to have been transported on the ear over long distances, because of the additional bulk. Bakels (1986, 5; 2000, 105), however, argued that in view of the small space available on the dunes and levees, import of both emmer and naked barley in semi-treshed state is more likely. Final treshing and consumption then would take place locally. In this perspective chaff thus is considered a product of food processing. While ethnographic evidence supports this hypothesis (Bakels 1986),

Table 7.1 Pollen, macroremains and other indications for crop cultivation and consumption per site, ecological zone and period (see Appendix I and Out 2009 for references and further information).

				Cerealia				*Triticum*			*Hordeum*	*other (cultigens)*								*other indications*		
site	date cal BC	context	location	arable area	pollen	impr.	macro	*monococcum*	*dicoccum*	*aestivum*	*vulgare*	*Cerealia indet*	*Hordeum/Triticum*	*Triticum spec.*	*Avena*	*Papaver somniferum*	*Bromus secalinus*	*Pisum sativum*	*Linum usitatissimum*	quern	sickle bl.	fields
SWB																						
Bergschenhoek	4340-4220	4	8	+	+																	
Swifterbant-S3	c. 4300-4000	4	4	+			2039		72(k)	1(k?)	1967(k,i,gf,r)						?			+	?	
Swifterbant-S2	c. 4300-4000	4	4	+			109		8(k),1(s)		49(k)	51										
Swifterbant-S4	c. 4300-4000	4	4	0.02-0.1 ha			+++				+++(k)											+?
Winterswijk	4240-3700	1	2	+++		2			1(r)		1(k)											
Brandwijk L50	4220-3940	3	3	+	+		+		+(k,c?)		+ (k,c)					+				1		
Brandwijk L60	3940-3820	3	3	+	+		+	?	+(k,c?)		+ (k,c)					+						
Hazendonk 1	4020-3969	3	3	1.25 ha (+)	+		1400		1000+(k,c,i,r)		400+(k,c,i,r)						150+					
Hazendonk 2	3910-3790	3	3	c. 1 ha (+)	+		+		+(k)								+					
Schokkerhaven-E170	3950-3720	4	3				+		+(k)		+(k)											
Urk-E4	4230-3960	4	3	++	+?		12	1? (k)			8 (k,c)											+?
Barendrecht-(20-126)	4200-3800	6	4	+?			c. 32	1?	1(k),4(g),4(s)		6(k),20(r)											
Gietsenveentje-NOP 1	4050-3450	1	1	+++	+																	
Linderbeek(-1944)	c. 3700	1	5	+++	+																	
Melsele	4710-2930	4	3	+	2																	
Hüde-I	c. 4700-3500	3	6	+		3		+			+									+	+	
Doel-Deurganckdok	c. 4550-3960	4	3				1			1(k)												
Schokland-P14 ABC	c. 4400-3600	4	1	25 ha (+++)	+	6 (k,i,s)	3		1 (i)		5 (k),1(c)											
Oudenaarde-Donk	3800-2195	2	2	+	+																	
Haz-3																						
Nijmegen-'t Klumke	3770-3630	2	2	+++			5		1(k),4(g)			2										
Dodewaard-Peyenk.	3700-3400	2	4	+++			10+		10+(k,s)			+										
Hazendonk 3	3670-3610	3	3	c. 0.9 ha (+)	+		+		+ (k,r?)		+(k,r?)									+		
AHR-42-Sion	3640-3380	7	7	+++			c. 61		2(k),c.10(g)		14(k)	c. 35								1		
Wateringen 4	3624-3400	7	7	+++			53		3(k),12(g)		18(k),10(i)		10							5	-	
Barendrecht-(20-125)	3650-3380	6	4	+?			33		14(k),5(g)		18(k)							5		1		
Schipluiden	3630-3380	7	7	+++	+		+		+(k,s,g,r,i)		+(k,r)	+								37	c.3	+
Ypenburg	3600-3400	7	7	+++			+		+(k,s)		+(k)				?					+	+	
Rijswijk-A4	3600-3400	7	7	+++	+?																	
TRB																						
Slootdorp-Bouwlust	3200-3000	5	6?			+			+		+											
VL																						
Vlaardingen	3200-2600	4	4	+			+		+	+	+				+							
Westbroek-Velzerbr	3340-2870	7	7	+++	+				+		+											+
Hazendonk VL-1a	3270-3090	3	3	c. 0.7 ha (+)	+																	
Hazendonk VL-1b	3260-2960	3	3	c. 0.6 ha (+)	+		+		+ (k,r?)		+ (k,r?)									+		
Hekelingen-I	3200-2800	4	4	+																+		
Hekelingen-III	3200-2800	4	4	+			45		3+(k),4+(s)		32+(k),6(r)		?						+		-	
Vlaardingen	3200-2600	4	4	+	+		291(k)		21(k)	199(k)	4(k)			65(k)	1?(k)					+		
Hellevoetsluis-OH	3250-2750	5	7	+++			+		+(k,c,g)		+(k,c,r?)									+		+
AHR-32-Schaapweg	2900-2500	7	7	+++			3	1(g)?	2(g)													
Leidschendam	2850-2500	7	7	+++	+															+	2	
Voorschoten-Bgeest	2870-2500	7	7	+++	+															4		
Zandwerven	2700-2300	5	7	+++			272		95(k)		177(k)											+
Hazerswoude-Spookv.	2800-2500	6	7	++			+				+									+		
Hazendonk-VL-2b	2580-2480	3	3	0.4 ha	+		+				+ (k,r?)									+		

macroremains		context	location
k=kernels	+=present	1=upland	1=boulderclay (outcrop)
c=chaff	++=dozens	2=riverine	2=coversand dune or ridge
i=internodia	+++=many; concentrations	3=peatmarsh	3=riverdune or donk
g=glume base	?=inconclusive evidence	4=freshwater tidal	4=levee (or crevasse)
gf=glume fragments	arable area	5=(former) saltmarsh	5=streamvalley location
r=rachis	+=small	6=intracoastal	6=elevation
s=spikelet fork	++=limited (1.3-2.8 ha)	7=coastal	7=coastal ridge or dune
	+++=sufficient (2.8+ ha)		8=lake margin

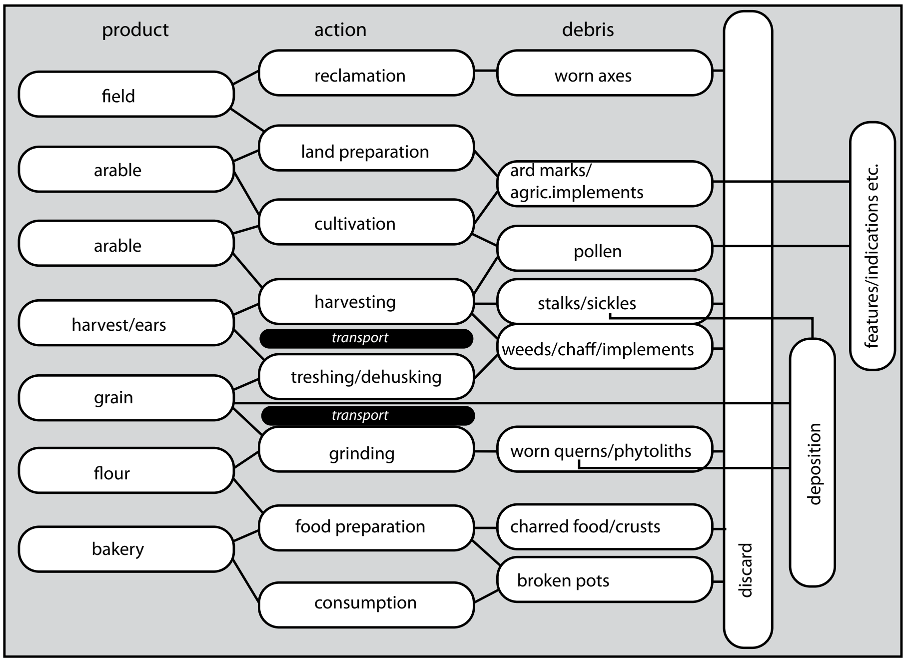


Fig. 7.5 Factors influencing the interpretation of evidence for crop cultivation and consumption of cereals, and related archaeological evidence.

it should be noted that this would involve harvesting naked barley in milk-ripe state, because otherwise too much of the yield would be lost (see Kubiak-Martens 2006, 325). Both scenarios therefore remain plausible. As can be seen in table 7.1, chaff and cereal remains of emmer and naked barley are represented well from the earliest finds onwards (see also Out 2008[c]). However, based on the arguments above they cannot be used to distinguish between import or local cultivation and only their positively attested absence (if not affected by research methodology or preservation) may indicate an absence of local cultivation (Out 2009, 421).[27] Most macroremains are charred, which does suggest human interference, being most characteristic for processing activities.

7.3.3.2 (Making) space

Another point of discussion is the extent of potentially available arable land required, estimated between 0.5 ha (Louwe Kooijmans 1983[b]) and 2.8 ha (Bakels 1986; 1988), depending on the assumed importance of cereals in the overall food spectrum and the number of inhabitants. According to Bakels (2000, 105), the 1.2 ha of the Hazendonk provided insufficient space to grow enough grains for one family, especially when also providing space for other activities and because of the potentially dry conditions of the sand body (pers. comm. Louwe Kooijmans 2011; see also Out 2009, 417). If cereals were grown at these locations, one also would expect some evidence of deforestation, although these signals are often hard to detect (Bakels 2000). Until now only Brandwijk and the Hazendonk have yielded palynological evidence for small-scale deforestation in the wetlands (Out 2008[a,c]; 2009, 417). In contrast, P14, located on a spacious boulderclay outcrop, yielded pollen diagrams that indicate a largely intact vegetation (Gehasse 1995; Raemaekers 2003). In combination with the sparse finds of cereals, crop cultivation there was of limited importance. Another argument has involved the ecological restrictions, such as wet conditions and occasional flooding. This may have inhibited crop cultivation potential at locations such as Swifterbant, Hekelingen and Vlaardingen (*e.g.* Louwe Kooijmans 1993[a]; Out 2009, 411). It should be taken into account that other, nearby dry locations may have functioned as arable plots. Verbruggen, for example (1992[b], 117) argues that more than one hundred river dunes were located east of the coastal barriers. There is also evidence for dunes located in the vicinity of the Hazendonk and Brandwijk (*e.g.* Van Gijn/Verbruggen 1992, 349; Louwe Kooijmans 2005[a], 261; Zeiler 1997, 111). However, some locations may have been too high and dry and no distinct palynological signals pointing to such 'external arables plots' have been documented yet. In table 7.1 an estimation of the available arable area is given. Most space is available on the upland and in the coastal area (however, see Out 2009, 418).

7.3.3.3 Other evidence

Other evidence is provided by cereal pollen, artefacts and features. Cereal pollen may indicate crop cultivation, but is more likely to relate to threshing (Bakels 1986; Kalis/Meurers-Balke 1997; Out 2009, 418; see also fig. 7.5). The frequent occurrence of cereal pollen on sites therefore cannot be used as a direct correlate for crop cultivation. This also relates to additional information and aspects such as ecological context.[28] For the wetlands the pollen diagrams of Brandwijk and the Hazendonk show small-scale deforestation, possibly indicative of garden-like cultivation (Out 2008[c]; 2009, 423).

Concerning artefacts, (fragments of) querns have been found, sometimes yielding phytolith evidence of processing domestic cereals (*e.g.* Van Gijn/Houkes 2006, 180). Sickle blades do not occur regularly and should be interpreted with caution, since the gloss characteristic of harvesting cereals is not easily distinguishable from cutting reed or grasses (*e.g.* Van Gijn 1989; 1992; Zvelebil 1994). According to Out (2009, 417) no sickle blades haven been found at sites in the northern or southern wetlands, except for possible finds at the Hazendonk (see Bienenfeld 1986, 239). The coastal area did yield some sickle blades at the Hazendonk sites of Schipluiden and Ypenburg (Van Gijn *et al.* 2006, 154), but none were found at Wateringen-4 (Raemaekers *et al.* 1997). While the presence of sickle blades may substantiate a claim for local cultivation, their absence does not argue against it, since crops may have been harvested in another way (Out 2009, 417).[29] Furthermore, Van Gijn (2008, 198; 2010[a,b]) points out that this contrast in presence may relate to different harvesting techniques practised as well as differential practices surrounding the deposition of these tools.

Fields

Other evidence is provided by the presence of fields. Analysis of field weeds on wetland sites, yielded a number of species, but these are only proof of open terrain or ruderal habitats and not necessarily of agricultural fields. Furthermore, they also may indicate transport instead of local production (Out 2009, 419). Their continuous presence and small quantity may favour the interpretation of open terrain (Bakels 2000, 145). The find of a large quantity of chess (*Bromus secalinus*) in concentrations of cereals for Hazendonk-1 may be interpreted as evidence for winter cropping of emmer or naked barley (Bakels 1981, 143). This species also can be interpreted as a cultivated plant (*ibid.*). Its unique occurrence at the Hazendonk, in combination with its preference for poor soil conditions form at least a minor indication for transport from elsewhere (see Out 2009, 419; 2009 (2010) Appendix III, pp. 164). Other finds of domesticated plants are mostly less informative on whether cereals were grown locally or imported (see table 7.1). Features such as ard- or hoe marks would provide more solid evidence. Indications for this have been found at a number of sites (*e.g.* Bornwird, Groningen-Oostersingel, Hellevoetsluis, Swifterbant-S4; see Bakels/Zeiler 2005; Fokkens 1982; Goossens 2010; Out 2009, 417 and Appendix I for more details and references). The oldest ard marks have been found in Groningen and can be attributed to the TRB culture. Zandwerven in the coastal area also yielded ard marks dating to the late Vlaardingen occupation and similar features were documented at the Vlaardingen site Hellevoetsluis-Ossenhoek, confirming the presence of fields and crop cultivation in the intracoastal areas around that time. Claims for older ard marks dating to the Swifterbant occupation have been brought forward for the site of Urk-E4 (Peters/Peeters 2001; Peeters 2007, 218), but have to be refuted on morphological grounds and because of difficulties in chronological attribution (see Appendix I; see Out 2009, 417). Recently (2007) excavations at Swifterbant-S4 (*c.* 4300-4000 cal BC) yielded features that could be interpreted as hoe marks. Immediate sedimentation following exploitation preserved this potential field. Additional micromorphological data from thin-sections, charred remains and pollen of barley and the presence of diatoms typical for arable fields substantiate this early evidence for some form of crop cultivation (Huisman/Raemaekers 2008). The field is estimated to between 180 m^2 and 1000 m^2, which indicates it was of limited size.[30] Other evidence for the presence of fields was provided at Schipluiden (*c.* 3700-3400). Among the charred remains of cereals, field weeds and charred weed species characteristic of the nearby high salt marsh were found, indicating that in all probability the fields were located in the direct vicinity of the site (see Kubiak-Martens 2006).

Further evidence is less convincing. It involves a find of *Trichuris* parasite, possibly indicative of manure, at Urk-E4 (Van Smeerdijk 2001), a potential digging stick at P14 (Gehasse 1995) and structures tentatively interpreted as granaries at Haamstede, Leidschendam, and Ypenburg (*e.g.* Hamburg 2005; Louwe Kooijmans 1985; Verhart 1992).

7.3.3.4 A local tradition?

A problem with respect to the interpretation of the evidence for crop cultivation, are the many taphonomical issues that should be taken into consideration. As demonstrated above and in fig. 7.5, interpretation of the available evidence with respect to cultivation or consumption often is problematic. Pollen, macroremains and grinding stones, for example, are not directly indicative of local cultivation. This means we should not over-interpret the evidence for crop cultivation in these communities, but the reverse holds true as well (*e.g.* Hartz *et al.* 2002, 327). The absence of evidence for crop cultivation does not mean it was not practised. The scarcity of sickle blades or evidence for fields therefore does not form a strong argument against crop cultivation.

While it is difficult to substantiate claims for local cultivation, it is equally difficult to come to terms with the mechanisms and actors involved in transport from elsewhere. In the past, import of cereals has often been suggested as a plausible explanation for their presence in the wetlands and wetland margins (*e.g.* Bakels 1986, 5). However, the exporting party is unknown (*e.g.* Bakels 2000, 105).[31]

This could involve intercultural contacts or exchange with culturally associated communities. Another possibility is formed by the same group inhabiting both upland and wetland environments and transporting cereals within their seasonal or logistical round.

From elsewhere

If 'other' communities were involved it is possible to see the initial introduction of cereals in SWB-communities in a non-economic perspective, perhaps as 'fertile gifts' (*cf.* Jennbert 1988) or in another symbolic role of exchange as has been assumed for southern Scandinavia and the British Isles (*e.g.* Edmonds 1999; Thomas 1999; Whittle 2003). Similarly, crop products may have functioned in a socio-economic system of exchange as modeled by Zvelebil (1998, 18) for the Baltic, or Verhart (2000) for the Southern Netherlands. In this type of system cereals may have been an actual food item, but also a prestige product. Crop cultivation may have been introduced early on, for example during the Rössen culture, as suggested by Gehasse (1995, 195-198) and Brinkkemper *et al.* (1999, 82). However, the most probable upland candidate for this type of exchange is the Michelsberg culture (Out 2009, 435-436) based on the age of macrofinds, which supposes an introduction between 4300 and 4100 cal BC. The nature of this supposed interaction remains ambiguous. While Van Gijn (2008, 200) argues for a switch from a symbolic to a more functional exchange of lithic tools (from the Swifterbant culture to the Hazendonk group), there is little evidence for a symbolic function with respect to cereals. Impressions of cereals have been found on pottery at Winterswijk (Schut 1984) and Hüde I (Kampffmeyer 1991), but there are no contextual indications for a specific role. Most evidence such as the charred state of most kernels, the presence of chaff remains and pollen, grinding stones, and the presence of both concentrations and more dispersed occurrences of cereals and chaff amongst layers of refuse, points to an economic function for cereals on Swifterbant sites. If not cultivated, it is most likely that cereals were at least regularly consumed at these locations and not treated with the respect and veneration one would expect in case of a scarce or highly esteemed symbolic commodity. On the other hand we should be cautious of making any rigid distinction between ritual and functional aspects of practices (*e.g.* Bradley 2005).

Home-grown

An alternative possibility is cultivation by culturally similar communities on the uplands, and subsequent exchange or seasonal transport of cereals, instead of wetland cultivation. Ambiguous evidence such as the Winterswijk sherd and the pollen of the Gietsenveentje indicate that cereals were probably present in Swifterbant upland communities and that small-scale agriculture was practised towards the end of the 5^{th} millennium. Nevertheless, convincing evidence for distinctly residential Swifterbant upland occupation is still lacking (see also Chapter 8; Niekus 2009). However, the evidence for crop cultivation at later Hazendonk sites in the coastal area such as Ypenburg and Schipluiden (see Kubiak-Martens 2006) suggests a rooting in an earlier local agricultural system. Recent investigations have started to alter the perspective on wetland crop cultivation. Cappers and Raemaekers (2008), for instance, have discussed the possibilities of floodplain agriculture (*sensu* Bogaard 2004) at Swifterbant and have demonstrated the potentially fertilizing role of seasonal flooding. This was supported by diatom analyses and the supposition that combining barley and emmer was used as a risk-reducing strategy, especially when grown in separate fields (strip intercropping). Recently Out (2008[c]; 2009, 421-422) argued that the ratio between more resilient naked barley and emmer is related to ecological conditions. Barley is better suited to environments with occasional marine influx. The difference in cereal composition between the freshwater river dunes and the Swifterbant levees with occasional marine influx, as well as the shifting cereal ratios accompanying the change from brackish to freshwater conditions at Schipluiden (Kubiak-Martens 2006) support this. The existence of this variation thus argues in favour of local cultivation, perhaps with occasional early imports (Out 2009, 444). These indications, and the discovery of potential hoe marks and an agricultural field at Swifterbant-S4 (Huisman/Raemaekers 2008) combined with macroremains, pollen and artefacts argue in favour of small-scale local cultivation practices.

7.3.3.5 Core business or convenience?

In contrast to, for example, the Ertebølle culture in Scandinavia and Northern Germany, (Raemaekers 1997; 1999), cereals and incipient crop cultivation eventually were adopted by Swifterbant communities without evidence of radical socio-cultural change (see Hartz *et al.* 2007, 585-586). The interpretation with respect to the wetlands and wetland margins of the LRA, however, has long revolved around the idea that there was 'no or limited evidence for crop cultivation' or 'some evidence for limited crop cultivation'. This has obscured the message this interpretation conveys. Although difficult to assess (Out 2009, 445) due to the limited available arable area (*e.g.* Bakels/Zeiler 2005, 327) and physical and ecological conditions, crop cultivation in large parts of this area, necessarily will have taken place on a limited scale and was therefore most likely of minor economic importance. This restricted economic role of cultigens in the Swifterbant culture is supported indirectly by the attested importance of hunting, fishing, fowling and gathering and the prevalence of mobility. Although it is not possible to qualitatively compare the importance of crop plants versus gathered plants, the stable composition of the spectrum of the latter over time, suggests that crop plants simply were added to the already existing plant food (Out 2008[d]), comprising a wide variety of species of fruits, tubers and nuts, ranging from hazelnut and water chestnut, to hawthorn, sloe and crab apple to dewberry and yellow water-lily (*ibid.*; Louwe Kooijmans 1993[a]; Zvelebil 1994). The trophic richness of the wetlands (*e.g.* Nicholas 1998[a,b]; 2007[a,b]) did not urge Swifterbant people to switch the mainstay of their subsistence procurement to crop cultivation or stockfarming. Instead these Neolithic novelties were incorporated into what had been common practice since the Mesolithic (see also Zvelebil 1994, 64). As such they formed an extension of the existing broad spectrum economy (*sensu* Louwe Kooijmans 1993[a], 103; 1998[a]; Raemaekers 1999). Cappers and Raemaekers (2008) argue for 'small-scale fields, being not crucial but simply an extra aspect of the subsistence strategy.' The absence of evidence for any large-scale clearances on the Pleistocene upland (see Bakker 2003[a,b]) or suitable locations on the wetland margin suggests that the limited role of crop cultivation was characteristic for most of the Swifterbant culture.

In time, the limited role of crop cultivation may have become more substantive, especially in the coastal region and on the Pleistocene wetland margin (some evidence is provided by coastal and salt marsh sites dating to the Hazendonk and Vlaardingen periods, see Out 2009, 432). The site of Schipluiden provides the first solid evidence for year-round sedentism, in combination with nearby fields (Louwe Kooijmans 2006[a]; Kubiak-Martens 2006). The stable character of occupation also is reflected in the later Vlaardingen culture where domestic faunal spectra, rectangular houses and eventually ard marks characterize part of the occupation.[32] However, the continued importance of hunting and gathering show that the situation was more nuanced. This especially relates to the distinct and continuous wetland setting of the peat marshes and freshwater tidal areas. There the opportunity for increased reliance on domesticates and cultigens remained limited. The combined evidence from fauna, artefacts, seasonality and limited human impact seems to confirm the continuous importance of hunting and gathering and the likelihood of a mobile existence for groups in this area (Louwe Kooijmans 1987; Prummel 1987; Raemaekers 2003). For many communities in the wetlands and wet margins of the LRA, crop cultivation was not 'core business' for a long time.

7.3.4 Evidence for seasonality and permanence in occupation

The way the communities of the wetlands and wet margins of the LRA inhabited their land and the impact this had on their lives and its associated rhythms is illustrated by the available evidence on seasonality. It provides an indication of the character of the rhythms of the land, and the way inhabitants, within their taskscape, were attuned to them (see Edmonds 1997; Ingold 2000).

With respect to the process of Neolithisation (see also Brinch Petersen/ Meiklejohn 2007) one would expect an increasing degree of sedentism, or permanency in occupation (Louwe Kooijmans 1993[a]) over time, and therefore a seasonality signal that over time would become less specific.[33] In other words as the reliance on crops and livestock increased, there should be a decrease in the occurrence of seasonally clustered wild resources.

Cautionary notes

The interpretation of the available evidence on seasonality, unfortunately, is hampered by various difficulties (*e.g.* Dark 2004, 39-40; Milner 2005, 33-35). The most important factor is that many resources are not seasonally specific, or have long and overlapping season-bound biological ranges (Louwe Kooijmans 1993[a], 92-93). Their occurrence in combination with those that are specific cannot substantiate these and leaves other options open. Moreover, absence of seasonal indicators does not equal absence of people. Of crucial importance also is that in most cases seasonal evidence results from waste disposal activities of several years up to several centuries of occupation. Moreover, unless site use was seasonally specific and the activity spectrum constant, the seasonal signal always will form a time-averaged representation of the overall spectrum (Binford 1980; Kelly 1992). The faunal and botanical evidence presented above already indicates that site use may have changed over time and site-function could even vary within one year (*e.g.* a seasonal base camp function during part of the year and an extractive function during another as for instance hypothesized for Hardinxveld-Giessendam-De

Bruin). These cumulative, spatial and temporal palimpsests (*cf.* Bailey 2007) distinctly limit our interpretations, especially when extensive time ranges are involved (*e.g.* Hüde I; Schokland-P14; Hoge Vaart). Furthermore, one has to deal with the effects of background fauna, natural vegetation, and changes in the current seasonal characteristics of certain species compared to the past and aspects such as storage and spatial divergence between procurement and consumption. Finally it should be realized that the biological indicators of seasonal information on site-use often make up only a small percentage of the overall assemblages. They should be combined with other evidence for permanency, such as quantity and character of waste, presence of solid structures such as houses and for example indications for the presence of livestock and arable fields (*e.g.* Rafferty 1985).

It is difficult to arrive at conclusions concerning seasonal mobility in the absence of contemporaneous short-lived locations (Milner 2005). Much of the information presented below is therefore based on extrapolation, rather than fact, since only few sites yield unambiguous data on seasonality. Because of these problems, previous attempts dealing with settlement systems in the LRA have done so from the perspective of models characterized by several options (Louwe Kooijmans 1993[a], 96-100; Raemaekers 1999, 121-122). The available information on seasonality is presented in fig. 7.6. The figure should be used as an overview and in concordance with Appendix I and the analysis below. Interpretations regarding seasonality cannot be based only on this overview, but are in need of a contextualization and combination with other factors. This will be dealt with further in a discussion on settlement systems below.

7.3.4.1 Late Mesolithic and Swifterbant culture: flexible strategies

The evidence for seasonally specific occupation of sites is strongest for the Late Mesolithic and the Swifterbant culture (see fig. 7.6). The detailed studies at Polderweg convincingly indicate a presence from autumn until the end of winter for phase 1 (Louwe Kooijmans 2003, 619; 2007[c], fig. 3). Summer indicators are absent. The later phases of Polderweg and De Bruin yield modest summer indicators (sturgeon and purple heron), reflecting at least incidental summer use, next to winter occupation (*ibid.*). The river dune site of Rotterdam-CS shows a similar spectrum indicating that some of the wetland locations were predominantly used in winter. Both Brandwijk and the Hazendonk show that there are also distinct indications for occupation in the summer, although for both it is difficult to establish the nature of occupation for the different seasons. Emblematic in this respect is the fishing and fowling camp of Bergschenhoek, occupied in winter. This isolated special activity site demonstrates that its specific character may very well have been lost if the location also was used during other seasons for other (residential) purposes (Sommer 1991). Faunal indicators for all phases of the Hazendonk indicate a presence between spring and late autumn, perhaps combined with more incidental visits in winter (Zeiler 1997, 86, 99).

Seasonal emphasis thus differed per site. Other Swifterbant wetland locations did not provide additional insights (see fig. 7.6 and Appendix I for details). At Brandwijk, for example, sturgeon and sea trout argue for a presence in summer, while long-tailed duck and whooper swan point to winter (*e.g.* Raemaekers 1999, 61). Presence in other seasons cannot be excluded. At the Hoge Vaart there is some evidence for a presence in autumn and winter yet this was accompanied

site	season				evidence					references
Late Mesolithic	**spring**	**summer**	**autumn**	**winter**	**f**	**b**	**m**	**a**	**bo**	
Hdx-Polderweg 1			e	m	-/+	-/+	+	+	+	*Louwe Kooijmans 2001[a]*
Swifterbant Culture										
Hdx-Polderweg 2			e	m	-/+	+	+		+	*Louwe Kooijmans 2001[a]*
Hdx-De Bruin 2	F-A	e,l	O-Ja	F-A	+	+	+	+		*Louwe Kooijmans 2001[b]*
Hdx-De Bruin 3	e			l	+				+	*Louwe Kooijmans 2001[b]*
Rotterdam-CS					+				+	*Guiran/Brinkkemper 2007*
Hoge Vaart-A27 (wl)										*Laarman 2001*
Urk-E4 (wl)					+					*Oversteegen in: Peter/Peeters 2001*
Brandwijk					+	+	+			*Raemaekers 1999;Robeerst 1995*
Doel-Deurganckdok		l		e	+				+	*Bastiaens et al. 2005; Van Neer et al. 2005*
Swifterbant-S-3					+	+	+			*Zeiler 1997*
Bergschenhoek					+	+				*Louwe Kooijmans 1987*
Hazendonk-1-2		l	l		+		+			*Zeiler 1997*
P14-ABC (wl)					+	+	+	+		*Gehasse 1995*
P14-DE (wl)					+	+	+	+		*Gehasse 1995*
Hüde-I		l	e							*Kampffmeyer 1992; Raemaekers 1999*
Oudenaarde-Donk (wl)					+	+		+		*Blanquaert 1987; Vanmontfort 2004*
Hazendonk group										
Nijmegen-Klumke (wl)	F-A			F-A			+			*Zeiler in: Ball/Van den Broeke 2007*
Hazendonk-3					+	+	+			*Zeiler 1997*
Wateringen-4 (c)					+	+	+	+		*Raemaekers et al. 1997; Louwe Kooijmans 2006*
Schipluiden (c)					+	+	+	+	+	*Louwe Kooijmans 2006[a]*
Ypenburg (c)					+	+	+			*De Vries 2004; 2008*
Rijswijk-A4 (c)					+	+				*Laarman in: De Vries 2004*
TRB										
Slootdorp-Bouwlust					+	+	+	+		*Hogestijn/Drenth 2000/2001*
Vlaardingen Culture										
Hazendonk-VL1-2		l	l		+	+	+			*Zeiler 1997*
Hekelingen-III	My-J	My-J			+	+	+	+		*Prummel 1987*
Hekelingen-I						+				*Clason 1967*
Hellevoetsluis-OH (c)					+	+	+	+	+	*Goossens 2009; 2010*
Vlaardingen					+	+	+			*Van Beek 1990*
Leidschendam (c)										*Glasbergen et al. 1967*
Voorschoten-Boschgeest (c)										*Glasbergen et al. 1967*
Voorschoten-De Donk (c)	M-N	M-N	N-M	N-M			+			*Deckers 1991*
Zandwerven (c)										*Van Regteren Altena et al. 1962/1963*
Ewijk (wl)										*Clason 1990*

Season

- inferred period of occupation
- positive seasonal absence
- non-specific or conflicting seasonal indicators
- seasonal evidence

e=early
m=mid
l=late

Evidence

+=positive evidence
-=negative evidence

Fig. 7.6 Seasonality and seasonal indicators. If possible the main period of occupation has been indicated, as based on all archaeological evidence. Wetland margin is indicated by (wl), coastal zone is indicated by (c).

by species that could have been present year-round (Laarman 2001, 19-20). Material evidence points to both short-term specialist occupations as well as more substantial domestic activities (see Peeters 2007; Hogestijn/Peeters 2001, 149 and Appendix I).[34] The question of seasonality could be resolved better at the levee site of Swifterbant-S3. Slaughtering of pigs and cattle, in combination with the presence of grey mullet indicate a presence between spring and early summer. The remains of swans and one of the beaver remains also confirm a presence in winter. Given the location and seasonal floodings and in view of the seasonal evidence available, it is likely that the site saw a residential use in spring and summer and that winter visits were rather of a short-term extractive nature (Zeiler 1997, 86-87; see also Louwe Kooijmans 1987). For the SWB-occupation of the wetlands and wet margins seasonal indicators thus point to mobility and perhaps a versatile use of locations. It is evident that the wetlands were far from inhospitable and also were inhabited during the winters (see Louwe Kooijmans 1997; 2003). Although we lack unambiguous indications, the evidence points to a combination of domestic and auxiliary or extractive tasks. These comprise different seasons and in some cases sites are used differently over time or perhaps within the year. The places seem to have remained fixed nodes in the settlement systems (see Amkreutz 2013[b]; Schlanger 1992).

7.3.4.2 Hazendonk group: first year-round occupation

In the subsequent Hazendonk group, the most important change is formed by evidence pointing to year-round occupation of some sites. The site of Schipluiden yields convincing evidence for sedentism. Apart from the presence of repeated housing, the existence of fields and fixed yards and the use of local resources, this is supplemented by a variety of biological indicators. Fish and cereals indicate summer activities, the gathering of wild fruits pointing to autumn, while hunted swan and geese, in combination with shed antler, attest a substantial presence in winter (Louwe Kooijmans 2006[a], 486). Although less rich in seasonal indicators, the elaborate Ypenburg settlement seems also to have been predominantly inhabited in a sedentary manner (see De Vries 2008, 390; Koot *et al.* 2008, 480-481). The domestic spectrum at Rijswijk-A4 could be viewed in a similar perspective. These sites were located in the coastal area where the salt marshes and low dunes of the intracoastal plain provided ample opportunity for cattle herding, while the rich hinterland of peatmarshes and estuarine environments provided a safe back-up to buffer for the increasing reliance on domesticated resources. Year-round sedentism is less evident at Wateringen-4. The faunal spectrum at this site suggests a presence in the summer in the form of a young calf and fish such as sturgeon and thin-lipped mullet, while widgeon bones and grown antlers indicate winter activity. Additional evidence in the form of available arable area and the presence of a houseplan, some argue that the site probably was occupied year-round (Raemaekers *et al.* 1997, 187). Others (Louwe Kooijmans 2006[b], 170-171) argue that the summer indicators largely overrule a presence in winter, especially since the wigeon may have also been caught in autumn or spring. For phase 3 at the Hazendonk there are no convincing indicators for a specific seasonal presence or absence. Mandibles of beaver point to presence in May and November, as well as in between. A fragment of aged cattle furthermore points to a presence between June and September. Swans once more indicate a presence in winter, while sturgeon argues in favour of a date between spring and early autumn (Zeiler 1997, 81-84). Hence, there is no unambiguous seasonal presence and in the light of the previous period and the available material evidence a non-permanent use in multiple seasons may be expected (*e.g.* Louwe Kooijmans 2006[b]; 2007[a]; Zeiler 1997, 87). At Nijmegen, collected antler points to a presence between February and March (Zeiler, in Ball/Van den Broeke 2007, 126), but the domestic character of the faunal spectrum (*cf. supra*) in combination with its wetland margin location, argues in favour of a year-round occupation.

So, current evidence for seasonality within the Hazendonk group is limited. There are strong arguments for the existence of year-round occupation in the coastal area and, perhaps analogous, on the wetland margins, such as the southern Pleistocene coversand landscape, however, convincing evidence for the latter region is lacking. On the other hand, the character of sites such as the Hazendonk, but also locations such as Barendrecht-Vrijenburg and Wateringse Veld (see Appendix I; Louwe Kooijmans 2009) point to an ongoing non-permanent use of certain parts of the wetland landscape and, likely, in relation to the permanent sites mentioned here. Within this timeframe other sites confirm a flexible non-permanent use of sites in the wetland and wetland margin. At the TRB site of Slootdorp most seasonal evidence points to occupation in the winter half of the year, although remains of sturgeon may indicate occasional visits in summer (Hogestijn/Drenth 2000/2001, 51-53; Lauwerier *et al.* 2005). At Schokland-P14 phase D-E a continued seasonal use of the site may be expected as well.

7.3.4.3 Vlaardingen culture: interaction and continued mobility

The coastal sites of the Vlaardingen culture, Haamstede, Voorschoten, Leidschendam, Zandwerven and Hellevoetsluis, did not yield clear zoological evidence for sedentism, apart from indications for year-round butchering of pigs at Voorschoten-De Donk (Deckers 1991). Other types of archaeological evidence, however, may form a convincing argument. Due to the presence of indicators such as houseplans, cultigens, ard marks, and, to a lesser extent, a domestic faunal spectrum it may be assumed that these locations were occupied year-round.[35] This will be further discussed in Chapter 8. This residential function also may be assumed for the river clay site of Ewijk. There is also convincing evidence for at least a partial continuity of seasonal wetland use, provided by other sites of the Vlaardingen culture. At Hekelingen I the red-throated diver is a typical winter guest. In Hekelingen III the mammal remains, in combination with the fish remains point to a presence in spring and early summer (May-July). Some fowl points at occasional winter visits (see Prummel 1987). At Vlaardingen most evidence points to both summer (young red deer, sturgeon and Dalmatian pelican) and winter presence (*e.g.* goosander and brent) (Clason *et al.* 1979; Clason, in Van Regteren-Altena *et al.* 1962/1963; Louwe Kooijmans 1987, 250). At the Hazendonk, phases 1b and 2b yield evidence that may be placed between late autumn and early spring (swan) and spring and early autumn (sturgeon). This is substantiated by data on age distribution and an occasional roe deer killed in midwinter (VL-2b; Zeiler 1997, 86). Again a single season of use could not be determined indicating that the site may have been in use at several moments in the year.

Is unlikely that sites such as the Hazendonk, Hekelingen, Vlaardingen and perhaps Hazerswoude (however see Diependaele/Drenth 2010) were inhabited year-round since the natural environment was not well-suited for this (*e.g.* Raemaekers 2003, 744). This is substantiated further by a number of other archaeological indicators such as housing, site structure, faunal spectrum etc., which will be discussed later on (see also Van Gijn 1989, 130-131; Louwe Kooijmans 1987). Both the Hazendonk and Hekelingen-III lack evidence for permanent living structures. The clusters of posts at the latter site should rather be interpreted as temporary huts or shelters (Louwe Kooijmans 1987).

The contrasting faunal spectrum and the different character of habitation, in combination with supposed seasonally specific activities such as fishing for sturgeon (Hekelingen), or trapping beaver and otter (Hazendonk), argues for a non-permanent occupation of several Vlaardingen sites located in the peat marshes and freshwater tidal area. The evidence does not deny these sites a certain residential function and does not automatically mean that they should be interpreted as subordinate to other settlements (see discussion at the end of Chapter 8). It does indicate that in addition to a permanent component in the settlement system, other sites may have been used differently in more or less direct relationship with these. Especially for the freshwater tidal and peat marsh areas this indicates a continuation of a seasonal type of wetland use.

7.3.4.4 Seasoned solutions

The evidence on seasonality in the various periods is limited. Figure 7.6 demonstrates this. Only at Hardinxveld-Polderweg phase 1 could seasonal absence, and therewith a certain season of occupation (late autumn-winter), reasonably be established (Louwe Kooijmans 2001[a]). All of the other sites lack such a clear signal. There, biological species indicators for seasonal presence (dark grey) are combined with indicators that have a non-distinct seasonal signal (light grey). This means that although quantitatively or qualitatively use in certain seasons may be most plausible, there is no absolute evidence of absence for the entire (grey) range, which, in fact, comprises all of the year. In those cases where archaeological arguments indicate that seasonal use is most likely, qualitative differences regarding the strength of the argument emerge. For instance, the arguments for a winter use of the Bergschenhoek fishing and fowling camp are more convincing than those available for deciding on the season of use at Hüde I. The suggested yearly occupation spans presented in figure 7.6 (black rectangles) therefore are presented only for sites where convincing archaeological indicators may be combined with evidence on seasonality or if these indicate a year-round use. Even then the evidence may not be regarded as absolute, especially in view of the many types of palimpsests (*cf.* Bailey 2007) that blur our resolution on annual site use. The coupling between seasonality information and other archaeological indicators will be further discussed below and in Chapter 8.

If, by means of conclusion, we focus on the seasonal evidence that is available, then some general trends may be noticed despite the many pitfalls. During the Late Mesolithic and Swifterbant period most evidence points to a seasonal use of sites. Hardinxveld-Giessendam-Polderweg phase 1, Swifterbant-S3, Bergschenhoek and, to a lesser extent, the Hazendonk are the informative sites. Convincing evidence exists for a residential use of the wetlands in both the summer and winter half of the year. From the Hazendonk period onwards, a new trend emerges where coastal locations, including the salt marsh area, demonstrate convincing evidence for year-round permanency (see Koot *et al.* 2008; Louwe Kooijmans 2006[a]; 2009). This may be based on a number of archaeological arguments as well as seasonal evidence (see Chapter 8). Based on similarities in geographical and ecological setting, a similar permanent site function may be extrapolated to the wetland margin, although distinct site-based evidence for this is lacking. At the same time evidence for a seasonal type of exploitation remains characteristic for the freshwater tidal and peat marsh areas. In these types of landscapes, sites probably were not occupied permanently. It is not possible to establish functional links from a seasonal perspective between the coastal or upland locations and the sites located in the peatmarshes and freshwater tidal areas. The data on seasonality in this respect are not distinct and allow a number of scenarios (Amkreutz 2010[b]). The different character of habitation makes it at least a plausible option that logistical or residential mobility and some form of exchange and interaction (mutualism) linked-up connected sites in the various ecozones. The way this may have taken place and the characteristics of the settlement systems involved will be discussed in Chapter 8.

7.3.5 A note on non-food raw material procurement

Next to the evidence for seasonality and the composition of the faunal and botanical datasets, non-food raw material procurement forms a point of importance to understand the character of the communities involved and the nature and development of interaction and exchange between these groups as well as across larger areas. Elsewhere, the character of resource procurement and networks of interaction in the LRA have received much attention (*e.g.* Amkreutz *et al.* 2009; Devriendt 2013; De Grooth 2008; Louwe Kooijmans 1998[a]; 2001[a,b]; Raemaekers 1999; Robinson 2010; Vanmontfort 2008[b]; Verhart 2000; 2009; 2012). I will highlight several categories of materials and focus on their information regarding interaction sphere, contact networks and change over time. Many of the resources discussed are presented in fig. 7.7. The reader is referred to Appendix I for further details and references.

Important interactions

The systems of interaction and exchange underlying raw material procurement shaped the development of the LRA wetland communities and indirectly formed a factor in their behaviour with respect to social and economic change. Expeditions outside of the home range (*sensu* Bakels 1978) and seasonal mobility cycle (Kelly 1992) brought indigenous groups into direct or indirect contact with Danubian and subsequent farming communities. While many of the sought-after resources (especially flint, stone, amber and perhaps jet) were rooted in fixed and ancient (Mesolithic) patterns and remained relatively unchanged, other products (adzes, *Breitkeile*, axes, pottery, mined flint) were added to the spectrum.

Despite efforts to classify various scales of interaction and exchange (*e.g.* Zvelebil 2006), it remains difficult to distinguish between the movement of people, goods or ideas on the basis of 'exotic' artefacts at sites (see fig. 7.8). It is difficult to distinguish between expeditions, interpersonal exchange, down-the-line exchange, marriage-exchange and for example travelers or traders (*e.g.* Helms 1988; Kimball 2006; Zvelebil 1998[a]).[36] Some trends can be determined for the LRA wetlands and their margins that inform us on the networks that the studied communities were part of and how novelties and innovations may have travelled across these. The most informative categories are pottery, flint and other stone materials.

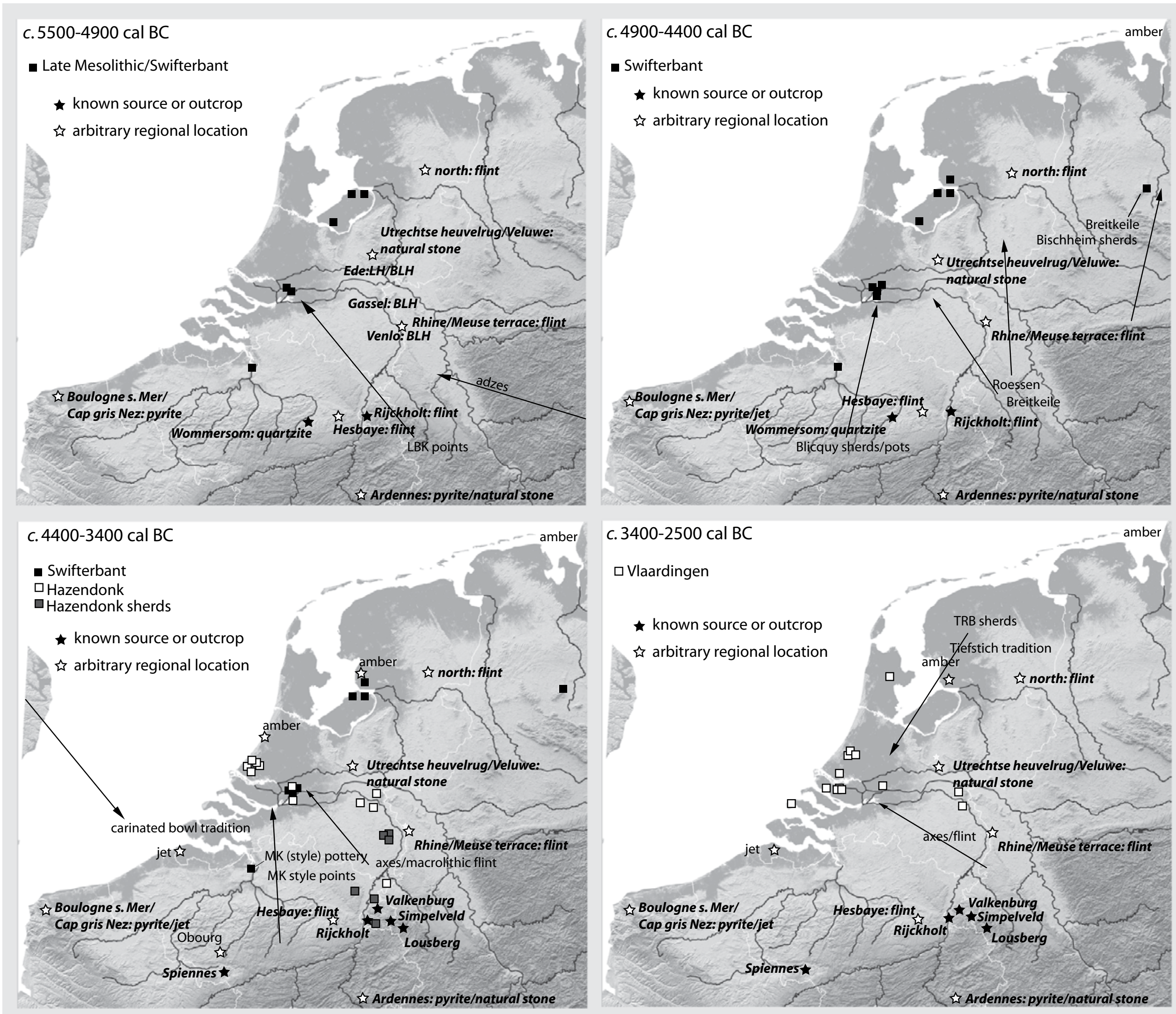


Fig. 7.7 Maps showing the most important raw material sources and routes of interaction of objects and ideas within a span of c. three millenia.

7.3.5.1 Pottery

It has been argued that the earliest pottery may be associated with (boreal) hunter-gatherers on the margins of the North European plain (*e.g.* Crombé *et al.* 2011; Timofeev 1998; Ilkiewicz 1989; Van Hoof 2005; Raemaekers/De Roever 2010; De Roever 2009). This would substantiate the existence of E-W contact networks between the various communities of hunter-gatherer-farmers inhabiting this zone (see Louwe Kooijmans 1998[a]). On the basis of chronological arguments and contact evidence, a southern origin of inspiration is most likely.[37] This points to southern contacts, although Swifterbant pottery was made in a local fashion with a coiling technique, which differs from Bandkeramik and later Danubian traditions (*e.g.* Louwe Kooijmans 2010[a]; Raemaekers/De Roever 2010). The southern influence on local pottery production is substantiated by finds of possible Linearbandkeramik (LBK) and Blicquy sherds at sites in the wetlands and wet margins such as Hardinxveld-De Bruin (*cf. supra*; *e.g.* Louwe Kooijmans 2005[c]; Raemaekers 1999; 2001[b]; Vanmontfort 2008[b]). At Bazel a possible Limburg sherd has been identified (Perdaen *et al.* 2011). These vessels or sherds may have been imported

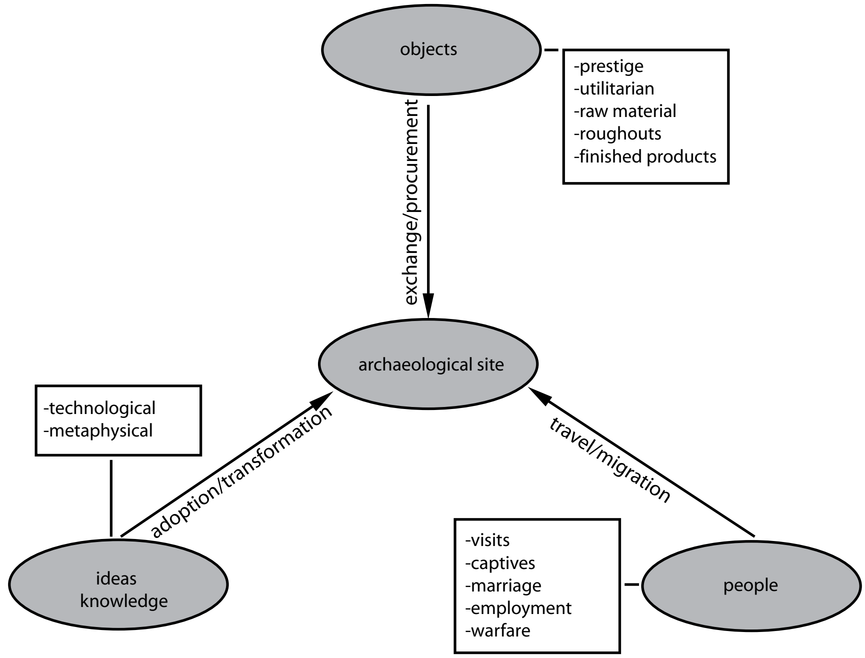


Fig. 7.8 Scheme of hypothetical correlates for interaction and exchange in combination with several specifications (after Amkreutz et al. 2009).

or exchanged (Amkreutz *et al.* 2010). There is in fact a distinct distribution of LBK pottery outside of the loess area (*e.g.* Oudenaarde; see Crombé/Vanmontfort 2007; Van der Graaf 1987). Furthermore, there are several sites with La Hoguette pottery and *Begleitkeramik* (*e.g.* Gassel-Over de Voort, Venlo-Ossenberg and Ede-Frankeneng) that are situated relatively far to the north, verging on the wetland margins (see Brounen/Hauzeur 2010). They currently provide an ill-understood and potentially early influence of pottery producing communities with a largely southern distribution, that may have influenced developments taking place in the wetlands. Much later, a site such as Hüde I may demonstrate the ongoing importance of these southern contacts as rather complete Bischheim vessels were found there dating to *c.* 4400 cal BC (Kampffmeyer 1991).

Further evidence for the existence of these contacts is provided by the continuous southern influence on the ceramic assemblages of sites in this area. This is demonstrated by the Michelsberg (MK) characteristics of some vessels at the Hazendonk during phase 2/3 and the presence of MK vessel shapes and technological elements (tulip beakers, *Lochbückel* and *Tupfenleiste*; *cf.* Raemaekers 1999, 111) in southern SWB context in general and perhaps also at Hüde I (Kampffmeyer 1991; Louwe Kooijmans 1974; 1976[a]; Raemaekers 1999, fig. 3.20; Verhart/Louwe Kooijmans 1989). Sites in the Scheldt basin also yielded evidence of Michelsberg influence. At Doel-Deurganckdok sector C a mixed complex containing MK sherds as well as several SWB tradition sherds was found (Vanmontfort 2004). In the light of these developments it should be mentioned that the distribution of MK-sites is more wide-ranging then that of the previous Danubian phase. A number of sites such as Linden-Kraaienberg and Grave-Pater Berthierstraat are indicative of the northern distribution of MK-elements in pottery assemblages and therewith of the existing contact networks. Sites such as Coesfeld-Harle, Nottuln and Osterwick in Nordrhein-Westphalen further demonstrate the northern extension of the MK distribution (see Appendix I).

The pottery tradition of the subsequent Hazendonk group appears to have combined elements of a SWB and MK background ino a newly constructed material expression (Raemaekers 1999, 160-161). Several finds of Hazendonk sherds as far south as Southern Limburg and adjacent Belgium again argue in favour of these north-south links (Amkreutz/Verhart 2006). Late Neolithic Vlaardingen pottery also shows an affiliation with its southern counterpart the Stein-group (*e.g.* Louwe Kooijmans 1983[a]; Louwe Kooijmans/Verhart 1990; Schreurs 2005).

It should be mentioned that the southern influence on pottery assemblages remains restricted to SWB and subsequent sites located in the southern part of the wetlands and wet margins. This is in line with the general distinction between a northern and a southern group as proposed by Raemaekers (1999, 111). This does not mean that there was no interaction in other directions. At the Hazendonk, two sherds in *Tiefstich*-tradition (Bakker 1979; 1982; Raemaekers 1999) have been documented, while Hazerswoude and Hellevoetsluis in the intracoastal plain yielded several TRB-sherds (see Appendix I). Clay discs (baking plates) and collared flasks also belong to a shared ceramic repertoire (*e.g.* Louwe Kooijmans 1983[a]). An indication for E-W contacts and cross-channel interaction during the Middle-Neolithic is the spread of the carinated bowl tradition (*e.g.* Sheridan 2007). This group provides a link between the continental MK pottery and the British Grimston ware, yet sherds of similar vessels have also been found at the Hazendonk (phase 2/3) (*e.g.* Louwe Kooijmans 1974; 1976[b]; see also Louwe Kooijmans 1980; Vanmontfort 2004). It is currently not clear what meaning may be attributed to these and other sparse indicators (*e.g.* Peeters 2007; Vanmontfort 2008[b]), yet they do point to several spheres of interaction. Finally it should be mentioned that the evidence available from clay resources points to local fabrication of most pottery (*e.g.* Ten Anscher 2012; Gehasse 1995, 58; De Roever 2004), while the many indications for repair witnessed at Hüde I (Kampffmeyer 1991), indicate that both production as well as import may at times have been scarce.

7.3.5.2 Flint and Wommersom quartzite

In a recent study by Vanmontfort (2008[b]), the contribution of imported flint to the lithic assemblages of sites in the southern part of the LRA wetlands has been discussed for Late Mesolithic and SWB sites (see also Chapter 5; Amkreutz 2010). There is a regular and continuous incorporation of southern flint, predominantly Rijckholt type flint and grey Hesbaye (Lightgrey Belgian) type flint. The presence of a heavy Rijkcholt pre-core at Polderweg (see Louwe Kooijmans 2003) indicates the importance of this southern network and suggests that (riverine) expeditions to procure flint took place (see Louwe Kooijmans/Verhart 2007). A point of LBK affinity in Polderweg phase 1 (Louwe Kooijmans 2003) and several other LBK-like points of southern flint at both Polderweg and De Bruin, provide further evidence for contacts with the southern Danubian Neolithic from a very early stage onward (Van Gijn *et al.* 2001[a]; Vanmontfort 2008[b], 90). These contacts may have been direct, or indirect via down-the-line exchange (De Grooth 2008).[38] The flint of southern type only sporadically occurs in the northern half of the LRA and may originate from secondary terrace positions in the middle of the Netherlands (see also Devriendt 2013). At Hüde-I, however, next to the Baltic component, flint from Hesbaye type was found also (Stapel 1991).

Apart from flint, several sites, including Hardinxveld-Polderweg and de Bruin and Hoge Vaart-A27, participated indirectly in the outer margins of the distribution network of Wommersom quartzite (Van Gijn *et al.* 2001[a,c]; Peeters 2007). The prolonged use of this typical Mesolithic resource, over time, may have involved contacts with the Danubian Neolithic as it also became part of their raw material spectrum (see Vanmontfort 2008[b], 90; Lodewijckx/Bakels 2000). The arrival of farmers perhaps positively influenced the importance of local and northern flint, especially at Hardinxveld-Giessendam-De Bruin (Van Gijn *et al.* 2001[c]), but over time the southern contacts clearly remained in function, although the emphases may have shifted (see Vanmontfort 2008[b]). For the Rössen culture the general absence of Rullen flint and the continued use of existing raw materials such as Wommersom quartzite (Doel-Deurganckdok, Hoge Vaart-A27 phase 3; Vanmontfort 2008[b], 90), question its involvement (*ibid.*).

During the middle phase of the Swifterbant culture, the similarities in point type (leaf and drop shape) between the MK and the southern SWB groups indicate a prolonged affiliation and intensive southern contacts (*e.g.* Raemaekers 1999, 124). Furthermore, while Wommersom exchange ceases, there is a continuation of the use of southern (mined) flint (Vanmontfort 2008[b], 91), for instance at Brandwijk and the Hazendonk. This import of southern flint continues in the Hazendonk group. A gradual distinction may be perceived between sites located nearer to the Rijckholt source, which perhaps had direct access, for example at the Kraaienberg (Louwe Kooijmans/Verhart 1990), and sites located at a greater distance such as Wateringen (Louwe Kooijmans 2006[b]; 2009). While this signals the existence of down-the-line exchange, the occurrence of, for example, Hesbaye-type flint as well as flint originating from Spiennes, Obourg and possibly Cap-Blanc-Nez (Van Gijn *et al.* 2006) also indicates the existence of certain *Hinterlands* of raw material procurement that were not the same for the entire Hazendonk sphere. Overall there is an increase in contact and exchange, especially with regard to macrolithic tools. Van Gijn (2008, 200) interprets this increase in exchange in relation to a shift in meaning attributed to these objects from venerated tokens of affiliation or allegiance, to objects implemented in their own technological system.

This pattern of more intensive exchange continues in the Late Neolithic. The often mentioned differences in the flint procurement of the Vlaardingen culture are typical in this respect (see table 7.2). The coastal sites have a large regional component (Meuse eggs or rolled flint) which differs from locations such as the Hazendonk (mainly regional terrace flint) and Hellevoetsluis or Hekelingen III where southern types of ('exotic') flint (Rijckholt, Spiennes, Hesbaye and Northern France) provided an important contribution. The expedient use of imported flint at the site of Hekelingen (*e.g.* Van Gijn 1989) may be seen as an indicator of the success of these networks. While there is a distinct need for new research in determining the origin of the lithic material (Amkreutz 2010[b], 22), the large scale trends are represented in table 7.2. These point to a general and ongoing north-south distinction that characterizes the overall network as well as heterogeneous choices on a settlement level, especially regarding the contribution of 'exotic' lithic raw material. The latter category involves those types of flint that could only be obtained through down-the-line-exchange and mobility, versus regional resources that were more likely exploited through expeditions within the annual site territory. The way this difference reflects upon settlement systems and interaction between sites will be dicussed in Chapter 8.

	rolled/ (Meuse-egg)	terrace	Limburg/ Rijckholt	Hesbaye	Spiennes	Belgium	N. France/ Boulogne	northern	regional	'exotic'	references
Haamstede-Brabers	+					+			90.6%	9.4%	Verhart 1992
Leidschendam	+							+?			Van Gijn 1989
Voorschoten-De Donk	+					+					Van Veen 1989
Voorschoten-Boschgeest	+							+?			Verhart 1992
Zandwerven								+			Van Regteren-Altena/Bakker 1961
Hekelingen-3	+				+?	+?	+?		0%	100%	Van Gijn 1989; Verhart 1983
Hekelingen-1				+?		+?			0%	100?%	Modderman 1953
Hellevoetsluis	+	+	+?	+	+?	+	+?			74,1%	Goossens 2009; 2010
Vlaardingen	+					+			70-80%	20-30%	Raemaekers 1999
Hazendonk		+	+	+					70-80%	20-30%	Raemaekers 1999
Ewijk				+					20.3%	79.7%	Asmussen/Moree 1987

Table 7.2 Vlaardingen culture flint sources (adapted from Amkreutz 2010). Insecure attributions are marked with '?'. 'Meuse-eggs' are rolled flint nodules, mostly of regional origin.

7.3.5.3 Other stone resources, amber and jet

Other stone resources confirm the southern orientation in raw material procurement of Late Mesolithic and SWB communities in the southern part of the wetlands and wet margins. Pyrite and certain pieces of quartzitic rock found at both Hardinxveld sites probably derived from the Ardennes region (Louwe Kooijmans 2003). Pyrite also was found in the subsequent SWB period and remained in use during the Hazendonk occupation of the area, for instance at Schipluiden (Van Gijn 2006; Van Gijn/Houkes 2006) and Wateringen-4 (Raemaekers *et al.* 1997). Jet and amber also are found in SWB, Hazendonk and Vlaardingen context. Amber probably was collected from secondary sources on the coast, in the northern and northeastern part of the Netherlands (for example near current Urk), where it eroded from the glacial till (see Piena/Drenth 2001). Richer sources of amber can be found on the Baltic coasts (*e.g.* Zvelebil 1998[a]), although import cannot be attested. Jet may also have been collected on the Dutch coast, although there are some indications for the presence of jet from sources on the coast in Northern France. These materials were used to make beads and pendants from the SWB culture onwards (they are absent in Late Mesolithic and Early Swifterbant sites). Amber has been found in Swifterbant, Hüde-I, Urk-E4, Schipluiden, Ypenburg, Leidschendam, Vlaardingen, Voorschoten, Hazerswoude and Hellevoetsluis (*e.g.* Van Gijn 1989; Van Gijn 2006; Koot 2005; Peters/Peeters 2001; Van der Waals 1977) and jet at Swifterbant-S22, Schipluiden, Wateringen-4, Ypenburg, Ewijk, Leidschendam, Voorschoten and Hellevoetsluis (*e.g.* Asmussen/Moree 1987; Van Gijn/Houkes 2006; Goossens 2010; Glasbergen *et al.* 1967[a,b]; Groenman-Van Waateringe *et al.* 1969; Price 1981; Koot 2005; Raemaekers *et al.* 1997). Both the Limburg and Ardennian raw materials confirm the southern orientation for the sites located in the Rhine delta. Amber and jet seem to have been regularly used in the entire wetland area of the LRA. The continuous use of the same resources over time and the (predominant) southern orientation indicate a considerable degree of continuity from the middle Swifterbant period onwards.

7.3.5.4 Adzes, *Breitkeile* and axes

A further group of objects informative on interaction and exchange is formed by adzes, *Breitkeile* and axes. While the former two are derived from the (evolved) Danubian Neolithic in the south and form somewhat alien elements in the wetlands and wet margins of the LRA, the latter are found regularly, sometimes as complete objects, but more often in the form of axe flakes (*e.g.* Van Gijn *et al.* 2006).

Adzes occurring far north of the loess extension usually are interpreted as items that were exchanged and possibly were treasured objects in Late Mesolithic society (*e.g.* Amkreutz *et al.* 2009). Most of the adzes are found in the eastern part of the LRA, which can be seen as indicative of southern links (Verhart 2000; 2003; 2009; 2012). An amphibolite adze was dredged from the river dune site of Gassel-Over de Voort in the river district in open association with flint of Late Mesolithic affinity and pottery that may be attributed to *Begleitkeramik* of La Hoguette (Brounen/De Jong 1988; Brounen 1999).[39] Rare examples have been documented as far north as the western part of the Baltic Sea area (Klassen 2004, 346). Until now no adzes have been found in closed association within Late Mesolithic or SWB sites of the LRA (*e.g.* Vanmontfort 2008[b]). The subsequent phase, between roughly 4900-4400 cal BC, is characterized by the spread of perforated wedges or *Breitkeile* (Raemaekers *et al.* 2011; Verhart 2009; Van der Waals 1972). This type of object, characteristic for the Rössen culture, was spread in far greater numbers and over a much larger area (as far north as southern Scandinavia) (Hartz *et al.* 2007; Klassen 2004; Raemaekers *et al.* 2011 Verhart 2000; 2009; 2012). Although the distribution of *Breitkeile* is confined mainly to the Pleistocene upland area, two *Breitkeil* fragments were found at Swifterbant-S3 (*e.g.* Louwe Kooijmans 1976, note 110; Devriendt 2013; Raemaekers 1999). Contact between the Rössen communities and the Swifterbant groups indeed comprised the Pleistocene area and extended far north (*e.g.* Vanmontfort 2008[b], 91). Whether this indicates a residential Swifterbant occupation of this area (*cf.* Raemaekers 1999, 106) is questionable as the evidence is mainly confined to relatively sparse finds of isolated objects. For the west the Swifterbant find suggests that the pattern may be a taphonomic distortion (deeply buried surface) or that the intensified contacts between Swifterbant and Rössen communities were confined mainly to the east, western groups perhaps being more oriented on the southern Blicquy and, later, MK cultural sphere (*e.g.* Verhart 2009; 2012). Other sites also show evidence of interaction. At Hüde-I broad wedges were imported (Stapel 1991), as well as further afield at Rosenhof (Hartz *et al.* 2007). These northern groups may have been orientated more on nearby Germany for acquiring these items. Hüde, for instance, was situated at only a short distance of Rössen territory. Apart from this east-west gradient there is also a temporal development. Raemaekers *et al.* (2011, 26), in this respect distinguish between an initial phase (5200-4900 cal BC) comprising perforated adzes, most likely obtained from Lower Saxony, and a second phase (5000-4000 cal BC) involving the Swifterbant culture and perforated broad wedges, most probably from the Rhineland. Even with this temporal distinction in mind, the Swifterbant fragments are surprisingly late as the occurrence of perforated wedges in contemporary MK sites is confined to one settlement (Hahn 1997; Raemaekers *et al.* 2011)

Intensification

Whereas adzes and perforated wedges were irregular imports, perhaps even imitated in some of the locally fabricated picks (Spitzhaue; Verhart 2009; 2012), the period from 4400 cal BC onwards is characterized by a spread of stone axes with oval cross-section. This points to intensive contacts between the Neolithic MK in the south and east and the communities in the wetlands and wet margins of the LRA (see Raemaekers 1999, fig. 3.36; Raemaekers 2005[a], 268; Vanmontfort 2008[b]). During the subsequent Hazendonk group, axes became a common element of site inventories, instead of an irregular import, and are found both in the north and the south. At Schipluiden several grinding stones were used to shape and maintain axes (Van Gijn/Houkes 2006). At many sites flint axes were used intensively and served as sources of raw material (*e.g.* Glasbergen *et al.* 1967[a,b]; Van Gijn *et al.* 2006; Verhart 2000). Axes of southern flint that could be identified originated from different sources, including Rijckholt, Spiennes, Valkenburg, Hesbaye, Lousberg and Simpelveld (*e.g.* Asmussen/Moree 1987; Ball/Van den Broeke 2007; Van der Kroft 1997; Verhart 2000). The axes, in contrast to adzes and *Breitkeile*, indicate that from the Middle Swifterbant period onwards there was an increase of (in)direct southern contact, which was not confined to the sites in the southern part of the LRA. This also reflects upon the earlier mentioned macrolithic tools.

7.3.5.5 Fixed paths, familiar worlds

With respect to the character of non-food raw material procurement, several aspects draw attention. First of all, some of the (raw) materials procured elsewhere, already circulated in the existing Mesolithic networks of contact, exchange and expeditions. With respect to the advancing Neolithic, it is likely that knowledge of these new peoples and initial contacts existed several decades before we see actual evidence of contacts and exchange in the wetlands and wet margins. Southern expeditions and contacts for flint and stone raw material, such as the ones that brought the pre-core and LBK point to Polderweg, provided the first opportunities to learn about a Neolithic way-of-life. They probably formed the channels along which (knowledge of) pottery, as well as domesticated plants and animals may have travelled north. During the early stages, impact of these novelties on local communities was minimal. The increased contribution of southern lithic elements to the material spectrum in later periods can be seen as intensification. The fact that by the time of the Michelsberg culture much of the indigenous groups south of the wetlands of the LRA probably had adopted farming, or were in the process of doing so (*e.g.* Vanmontfort 2004, 344), may have acted as a stimulans for these processes (Dusseldorp/Amkreutz, in prep.). The intensity of exchange and interaction during the Hazendonk period, in this respect, indeed may point to a changed attitude (Van Gijn 2008). This is substantiated further by evidence for the presence of Hazendonk (affiliated) pottery far to the south of the wetland margin (Amkreutz/Verhart 2006). The existence of a Mesolithic 'infrastructure' upon which much exchange and interaction continued also is attested for other areas (*e.g.* Gronenborn 2003[b]).

An interesting question is who was physically involved in exchange and interaction. Based on both ethnographic and archaeological sources (*e.g.* basketry techniques in early pottery production), Louwe Kooijmans (2010[a], 35) argues that it is most likely that the (younger) men were the ones who performed procurement activities and expeditions away from the settlement and were most likely to engage in intercultural contact. This also is reflected in many of the items exchanged (adzes, axes, points etc.).

Changing approach

While the old networks, routes and paths remained in place, the character of the hinterland and its occupants changed and this will have had its effect on groups further north. During the middle phase of the Swifterbant culture, the southern elements in pottery style and point types similar to those of the MK attest to this increased intensity in interaction (Raemaekers 1999, 124). By the time of the Vlaardingen culture or perhaps earlier, one might hypothesise that certain networks of interdependence had come into existence and the increasing importance of axes forms an example. As argued earlier, Van Gijn (2008, 200) identifies a difference in the role and function of exotic stone tools in these communities. Between the Swifterbant and Hazendonk import products there is a shift from an affiliation with a southern Neolithic world, to an appropriation and identification with it. North of the river delta similar processes may have been at work during the development of the TRB West group. At the same time this does not mean that a homogenization of these communities took place. The differences in raw material use and thus supply between several of the well-known Vlaardingen sites such as Vlaardingen and Hekelingen, Leidschendam and Voorschoten and the Hazendonk, indicate rather characteristic differences with respect to the frequented *hinterland* or indirect contacts further south. This is illustrated, for instance, by the contrasts in imports at Leidschendam and Hekelingen (*e.g.* Van Gijn 1989; Hamburg 2005).

At the same time and next to the lithic interaction with the southern hinterland, we see a continuation of other old networks, for example for amber and jet. These resources remained valued throughout the process of Neolithisation and were of importance in a large part of the wetland area. This contrasts with imports of southern flint, axes and pottery, which were mainly characteristic for the southern sites. In general it thus might be stated that the north-south distinction identified by Raemaekers (1999; see also Vanmontfort 2008[b]) remained in place through time, although there was by no means a closed frontier between North and South.

Familiar procurement

Summarizing, we see that many of the Mesolithic tasks and routines related to the procurement of raw material remained in place. This shows the world 'out there' was familiar and the tracks, pathways and contacts that already existed provided the basic infrastructure for knowledge on and adoption of new elements. These should not be seen as disruptive (they were already known) and although their importance over time increases, they were obtained through and incorporated in a world that changed only gradually. So while it cannot be denied that the Neolithic novelties that started to appear in the indigenous world of hunter-gatherers in the second half of the 6th millennium BC, eventually brought important changes and developments, they seem not to have changed existing lifeways in an abrupt manner. From the perspective of the communities involved, one explanation for this may be sought in the pragmatic way the inhabitants of the LRA wetlands and wet margins dealt with these new elements (*cf. infra*), using them to their advantage at times and places where it was convenient, but refraining from culture-wide adoption of a new way of life, or dependence on production. This also will be touched upon later on.

In view of this stability, an important avenue for further research is formed by the way these networks of procurement, interaction and (gift)exchange shaped the identities of the LRA wetland communities. In doing so it should be realised that, as argued above, it is difficult to attest to what extent people, or ideas travelled with objects or even domestic animals or plants (*e.g.* Jennbert 1988). Moreover, as argued by Edmonds (1995, 57) it is important to acknowledge that there is no given distinction between the exchange of objects in the sense of (economic) commodities, or (symbolic) goods.[40] Assessing which roles these objects and goods, and the technology, power and stories related to them played in the social networks of the groups in the wetlands of the LRA, and how they were incorporated in daily life, will shed further light on the process of Neolithisation in the area.

7.4 Alternative options

The overview presented above focused on procurement, mobility and seasonality of hunter-gatherer and hunter-gatherer-farmers in the wetlands and their margins of the LRA. The study of these aspects of livelihood reflected upon the way in which these communities dealt with their surroundings and the choices they made within certain ecological and physical margins. It stressed the unique way in which these groups continued their use of places as persistent nodes (*sensu* Barton *et al.* 1995; Schlanger 1992) and made use of the wider landscape by adopting a flexible strategy based on different types of resources (extended broad spectrum, *cf.* Louwe Kooijmans 1998[a]). This enabled them to buffer for change and create a certain stability over time.

Living in and dealing with the dynamic wetland environment at different spatial scales and temporal scales, over time created a recursive relationship between these groups and the wetland landscape and environment (see also Ingold 2000). It shaped a *mentalité* or moral community (*cf.* Whittle 2003) from which we may understand certain characteristics of behaviour. Unfortunately much crucial information still is missing, especially with respect to the role of upland subsistence strategies and their cultural correlation to wetland occupation in terms of mobility, activity spectrum and intercultural interaction and exchange. While the archaeological data do not allow us to sketch a complete picture over time, the long-term nature and character of these aspects makes them an attribute of the inhabitation of this area (see Chapter 6). From the combined data, several general traits may be distilled that form the basic ingredients for a characterization of food procurement and the nature of wetland occupation in the LRA. Following this 'baseline', I will position these wetland 'strategies' in relation to prevailing models and ideas regarding the transition to agriculture. The main aim is to define further the unique position of the developments in the study area within the 'mosaic' of Neolithisation (*cf.* Louwe Kooijmans 2007[a], 306; Tringham 2000[a]).

7.4.1 Where in the mosaic?

In recent years students of the process of Neolithisation have become aware of the multitude of spatio-temporally divergent ways in which the transition to agriculture took shape (Whittle/Cummings 2007; see also Chapters 2 and 3). An important point emerging from this discussion is the necessity to 'zoom in' on culturally and historically coherent regions for which the process of Neolithisation may be studied. In this respect it is important to place the processes taking place in the wetlands and wetland margin in relation to the existing models for the area. This way their position in relation to regional and Northwest European developments can be determined.

7.4.1.1 Profiling the LRA wetlands

In the following a number of statements will be made regarding resource procurement and occupation of the LRA wetlands and their margins during the transition to agriculture. These serve both as a focus for discussion and to sketch a general 'profile' of these communities.

- With respect to the broadly established implications regarding crop cultivation, sedentism and 'the Neolithic' as such (*e.g.* Jones/Rowley-Conwy 2007; Rowley-Conwy 2004; Zvelebil/Lillie 2000), the LRA wetland communities are non-exemplary. The use of pottery as well as the use and possible production of crop plants and domestic animals is added to the spectrum during the 5th millennium, while sedentism is attested for the Hazendonk group (for instance at Schipluiden and Ypenburg) around 3700 cal BC. These developments occur very gradually, they do not involve all of the sites within a given time period and they are marked by an element of diversity that cannot be linked solely to the environmental or physical context (see also Louwe Kooijmans 2007[a]).
- In this respect the composition of the subsistence spectrum, as best evidenced by the faunal remains, can be seen as representative of the natural exploitation possibilities with respect to hunting (as well as fowling and fishing) and farming. However, diverging choices with respect to subsistence and habitation were made, even on adjacent, contemporaneous sites with a comparable ecological background (see Louwe Kooijmans 2009). This indicates a flexible choice in resources as well as a commitment to place. From this perspective differences in subsistence spectrum and habitation between sites in different geographical regions may and should be explained primarily by reigning differences in ecology and conditions relating to those regions, yet the aspect of group agency and intra-cultural diversity should be taken into consideration as well.
- Although availability and incorporation of domesticated animals and later on crops increase, the practices of hunting, gathering, fishing and fowling remain an important part of food procurement at many sites. Even at those locations where crop cultivation and animal husbandry are attested firmly, hunting, gathering and fishing remain important. This is related partially to the qualities of these areas with respect to wild resources, as well as the limits they pose on, for example, extensive crop agriculture. Nevertheless, this continuity should be appreciated for its implications. The tasks involved in 'living off the land' differ from the traditional routines of farmers. Both, however, seem to have merged without noticeable disruption indicative of a break or drastic change in lifeways.
- Based on the evidence available, the overall contribution of domestic animals to the diet increased over time. When evidence from multiple sites is compared, an increased reliance on domestic fauna is mainly a feature of coastal (and potentially wetland margin sites) from the Middle Neolithic Hazendonk group onwards. However, as late as the Vlaardingen culture, sites located in other areas demonstrate a more varied composition of the faunal spectrum with an important role for wild resources (Amkreutz 2010[b]). Regarding crop cultivation, some positive evidence for small-scale cultivation

exists for northern Swifterbant sites, as well as firmer evidence for coastal locations from the Hazendonk period onwards (*e.g.* Out 2009). However, for the wetland sites in the southern part of the delta, transport of crops remains an option (*ibid.*), while the scale and contribution of crop cultivation in the coastal areas remains difficult to establish (see also Cappers/Raemaekers 2008).

- It can be argued that while activities will have been seasonally specific, there is no season in which wetlands were not inhabited. This contradicts the often negative connotations wetlands have received in the past (see Louwe Kooijmans 1997). The site of Polderweg (Louwe Kooijmans 2003) indicates that residential occupation also may have taken place during winter. Other sites (*e.g.* Swifterbant-S3) point to summer occupation (*e.g.* Zeiler 1997).
- Domestic occupation of the wetlands occurred as late as the Vlaardingen culture. There is no archaeological evidence to suppose a shift in the use of the wetlands and wetland margins from a residential and extractive use to an exclusively extractive use (and therewith a focus on optimal farming locations) before the Early Bronze Age (see Louwe Kooijmans 1993[a], 101). Domestic sites such as Vlaardingen, Hekelingen, Hazerswoude and Hellevoetsluis provide evidence for a substantially 'wild' character in their economy and overall site composition, in combination with a distinct residential use.
- In conclusion these communities show an overall flexible attitude towards food procurement and in their way of inhabiting these wetlands. Sites as places in the landscape form stable and dry elements, but site use may shift and is subject to both shifting short-term seasonal use patterns (*cf.* Binford 1980) as well as long-term or more definitive shifts in function over time. From a long-term perspective this flexible way of inhabiting the LRA wetlands and their margins is suggested to be a characteristic feature of the inhabitation of this area.

7.4.1.2 Understanding the LRA profile

The profile indicates that the occupation of the LRA wetlands during the transition to agriculture is not determined by a straightforward Neolithic trend that develops from hunter-gatherer to farmer, exchanging traits and practices of one for the other, but rather by a unique long-term and diverse combination of features of both. Over time certain aspects were added, most evidently in the material culture or technology domains and in the foodspectrum, yet these did not lead to rapid changes. Instead, change seems to have been very gradual. This does not imply an absence of important differences between the Late Mesolithic LRA communities and the Vlaardingen culture 3000 years later, but there is no complete shift in subsistence base. Continuity in practice and general patterns of habitation indicate that there is no restructuring of the social subsystem, although permanent settlement becomes part of the settlement spectrum. Neither are there any indications for fundamental socio-symbolic changes in relation to alterations or additions to the economic basis (in the sense of Hodder's domestication of society (1990, 31 *et passim*). Instead the evidence points to a continuity in the use of natural resources and flexible wetland habitation, amongst others characterized by a continuing importance of (residential) mobility.

This raises the question *why* a complete change did not come about and *how* the inferred flexibility (and hence stability over time) in these communities may have worked out in practice.

7.4.1.3 An ethnographic frame of reference

It is important to establish insight into the various ways this system of habitation and the combination of wild and domestic resources in the wetlands and their margins may have functioned. Since the archaeological database and its resolution is limited, hindering our comparison of sites and interpretation in the sense of settlement systems, an ethnographic survey of subrecent and contemporary groups combining different economic strategies may lead to a better understanding of the past situation. Of course we have to accept that these groups in no way provide an ideal analogy for the groups that once inhabited the LRA wetlands (see Louwe Kooijmans 2001[c]; see also David/Kramer 2001, 50-61) both from an ecological as well as social perspective. Nevertheless, in the absence of any direct-historical analogy, the ethnographic case-studies are used as a structural analogy (*cf.* Van Gijn/Zvelebil 1997, 5) and as such provide a contextual background. The values of this analogy are centered on the idea that, despite obvious differences, small-scale, largely non-hierarchical communities of forager-farmers face a similar array of issues or decisions of management, scheduling and mobility that lead them to adopt a combination of procurement strategies, perhaps in combination with intra-group differentiation.

In Appendix III a selection of more than 30 groups is presented from ethnographic, (ethno)historical and archaeological sources. They form a selection of many more case-studies that provide an increasingly diverse picture of 'intermediate' subsistence (*e.g.* Ames 2003; Evans-Pritchard 1940; David/Kramer 2001; Gregg 1988; Kelly 1995; Layton *et al.* 1991; Piperno 1989; Terrell *et al.* 2003; Smith 2001; Spielmann 1986; Zent 1998). The case-studies exhibit a large variability in manners of combining forms of hunting, gathering and farming. These often are accompanied by diverse strategies in mobility and interaction. Furthermore within different time spans, ranging from years to centuries, adaptive and flexible shifts may be witnessed. A number of informative case-studies will be presented here.

The Siona: intra-group differentiation

The Ecuadorian Siona practice swidden agriculture, forage and hunt. Their gardens are located at various distances from the settlements and sometimes can be reached only by canoe. Gardens require low investments of time and labour, often concentrated in brief periods, and are replaced every three years (Vickers 1989, 50). At times they are left unattended for long intervals. Domesticated animals make no significant contribution to the diet, but hunting, fishing and collecting do. The ratios of hunting vs. fishing, although practised by all, significantly differ with respect season and local habitat conditions (*ibid.* 51), which means that contemporary groups of Siona have different emphases in their procurement strategies and diet. Siona settlement systems are complex and variable and next to their yearly mobility, demonstrate dynamics intermediate between those of hunter-gatherers and agriculturalists. This involves settlements that may endure for a number of years in relation to the importance of domesticated plant foods, while communities overall retain a high degree of flexibility and mobility in response to available wild and domestic resources. This also involves episodes of group aggregation, followed by dispersal. There is thus a certain multi-year 'waxing' and 'waning' of central sites when a certain investment in gardens has been made in combination with a high degree of mobility during other parts of the year in order to hunt and procure wild resources. This also relates to the fact that the cultivated gardens do not need constant attention and tending (Vickers 1989, 59).

The Agta: farmer contacts and limited horticulture

The Philippine Agta are foragers that employ various subsistence tactics, including horticulture activities, within a daily and yearly strategy of food procurement. They function within an intricate set of relations with dominant nearby farm-based societies, to which they adjust their own activities (Griffin 1989, 61). Due to this system, subsistence and settlement are intertwined and permanency and location of residence as well as group composition change depending on the environmental conditions. In general, in case of an increase in horticultural activities, hunting diminishes and semi-sedentary residences are found more often (*ibid.*). There is also a continuum of vegetal food procurement from gathering over 'tending' to actual planting and horticulture. However, horticulture, in contrast to hunting, is often of minor importance. Fields are small, usually no more than 50 m across (Griffin 1989, 61). Horticulture sometimes is used even as a crude emergency food tactic: '*The main thrust of the style is the planting of a 'swidden' ploy of as few as three or four cuttings…seemingly useless in nature…if it might not be a single meal tucked away for future use*' (Griffin 1989, 61). Small-scale horticulture is used here as a caching strategy and only increases in importance when hunting returns are inadequate. As with the Siona, Philippine foraging groups demonstrate that there are contemporary groups with different emphases in their routines of subsistence procurement and seasonal moves, depending on the ecological situation and relations to nearby farmers (Junker 2002, 351). Current Agta still experiment with different emphases in food procurement (Griffin 1989, 66).

The Mikea: the value of immediate return

In Madagascar, the Mikea also display a mixed foraging-horticulture strategy. They practice low-investment, extensive horticulture, which means they plant cultigens in patches of wilderness that largely remain untended until harvest time. On average pay-offs are low, since cultigens compete with wild plants. Returns are vulnerable to pests and predation and unexpected climatic conditions can ruin harvests. Hunting and gathering, sometimes forming the bulk of the diet, are used as a compensation mechanism. Despite these issues there is no intention among the Mikea to refrain from planting cultigens or to invest more to increase results (Tucker 2006). It appears that Mikea 'decision makers', apart from socio-symbolical motivations, do not value possible future outcomes over direct gratification for a number of reasons. In studies on the behavioural ecology of these groups it is argued that reasons for this discounting of possible future benefits most likely includes uncertainty over the outcome and the question who will benefit from the saved resources (will offspring or future generations benefit?). Furthermore, the pleasures of immediate gratification are valued highly (Tucker 2006, 28, 39).

The Fremont complex: contemporaneous diversity and long-term shifts

A final example is taken from archaeology. It involves the Fremont complex, groups of foragers and farmers inhabiting the Eastern Great Basin and Northern Colorado between *c.* 100 cal BC-1500 AD.These groups cultivated maize between 600 and 1300 AD, yet continued to rely on hunting and gathering throughout the Formative period. Archaeological evidence indicates large inter-assemblage diversity in the importance of agriculture and local food sources (Barlow 2006). It involves a mosaic of strategies, including full-time farmers, full-time foragers, part-time farmer-foragers who seasonally switched modes of production, and foragers who switched to full-time farming. There is a matrix of behavioural options open to people pursuing an array of adaptive strategies. A mix of symbiotic and competitive relationships among farmers and between farmers and foragers has been suggested (Madsen/Simms 1998, 255). Over the span of a millennium, the transition from foraging to farming is followed by a period of adaptive diversity and ends with the abandonment of farming (*ibid.*). Within the Fremont complex there is thus a differentiation ranging from densely populated farming communities with incipient stratification to small, widely dispersed egalitarian family groups, and from autarky to mutual interdependence. To an important extent this diversity can be linked to the variation in geography and the diversity in natural ecosystems, although this should not be seen as the only explanatory factor (*ibid.*, 259; Barlow 2006). Adding time, it should be realized that even during periods as brief as a human lifetime, the lives of some people were probably relatively constant, while others shifted between foraging and farming or a mixture of these. Ties between various groups were marked furthermore by demographic fluidity implying that the composition and size of groups could change in space and over time (Madsen/Simms 1998, 257). The Fremont complex is an elaborate, geographically widespread and temporally continuous complex. Concerning these aspects of scale it does not lend itself easily for a comparison with the LRA wetland communities. However, despite this it offers a tantalizing perspective on the diversity of adaptations existing within one cultural framework, both over space and in time, as well as the many ways in which they were combined, alternated and interrelated (see also Madsen/Simms 1998, 258). Similar practices have been documented for the !Cae !Cae in Botswana (see Wilmsen 1989).

7.4.1.4 Spatio-temporal flexibility

The case studies and ethnographic survey cannot provide *the* ideal parallel for the LRA situation, but do offer a broad perspective of the manifold adaptations that exist among small-scale societies in combining various subsistence and mobility strategies. The existing diversity makes it clear that rearing livestock and growing crops may regularly not fit our etic pattern of settled sedentary farming communities, fields with crops and sizeable herds. Switching to producing modes of food procurement therefore may not always have the impact we often assume it had. The image of the range of pursued strategies is more fleeting, haphazard, experimental and even careless. Certain groups are capable of adding domesticates and cultigens to their diet, or to abandon these without much consequence. For certain groups these food sources therefore are not crucial for survival and often are obtained also by specialization, trade or exchange, in combination with continuing mobility. As evidenced by a number of the communities above (see also Appendix

III), mutualism (*cf.* Gregg 1988) is not uncommon. It may occur in the form of exchange, but often leads to some form of interdependence or symbiosis. This may occur within one cultural framework, by communities providing complementary resources, or between culturally and economically different groups, such as of foragers and farmers.

Etnography is known to be able to provide appropriate case-studies for most archaeological scenarios, but often fails to do so on a comparable spatio-temporal scale and similar technological and ecological footing. The added value therefore mostly lies with the degree to which underlying structuring principles may be determined out of comparable case-studies. One can argue there is convincing evidence for the existence of a certain flexibility among communities using and combining wild and domesticated resources. This flexibility exists both in space, among contemporary, often (partially) mobile, interacting groups, often (though not exlusively) in different and complementary geographical areas, as well as in time. This latter aspect both incorporates short-term or yearly switches between benefical modes of production, as well as longer developments leading to more substantial changes in strategy. Both aspects are represented in the case-studies mentioned here (see for instance the Mikea for a temporal argument or the Fremont for a spatial case-study). While in all cases this concerns examples that are only partially comparable to the LRA situation, similar characteristics stand out. These mainly centre on the existence of a flexible and pragmatic attitude towards combining and switching between domestic and wild resources and the absence of a distinct drive or need to 'go over' (*cf.* Whittle/Cummings 2007), or adopt agriculture as the main economic system on culture-wide scale. It is with this broadened horizon on the character of agriculture in small-scale societies that we return to the LRA and reassess the character of land-use and food procurement between 5000 and 2500 cal BC.

7.4.2 From hunting to herding and harvesting? – changing scope

The diverse strategies that may have shaped subsistence, mobility and settlement systems, point out the need to incorporate these in our perspective on the process of Neolithisation in the LRA wetlands and their margins. This involves an open approach towards the possible strategies employed by the communities involved and the way they may have shaped their transition to agriculture. Below, this dynamic perspective is introduced against the context of the availability model.

7.4.2.1 The availability model – another look

Hunting, fowling, fishing, trapping and gathering are fundamental tasks of hunter-gatherer existence. During the process of Neolithisation these are believed to become increasingly less important in favour of a new core-business focusing on domesticates and cultigens (*e.g.* Price 2000[a]; Zvelebil/Lillie 2000). The availability model has been influential in our understanding of this process (Zvelebil/Rowley-Conwy 1984; see also Chapter 3). The model defines three stages for the transition from foraging to farming. In the initial 'availability phase' cultigens and domesticates make up 0-5% of the total subsistence spectrum, in the following 'substitution phase' 5-50% and in the final 'consolidation phase' farming takes over with more than 50% of domesticates and cultigens.[41] Although intended as a heuristic framework instead of a set scenario (Zvelebil 1986[a]; 2000), Zvelebil (*e.g.*

Zvelebil 1996, 326; 1998[a], 11; 2000, 391; Zvelebil/Rowley-Conwy 1984, 112) does stress the fact that the substitution phase, and therewith the combination of foraging and farming strategies, should be perceived as a state of conflicting interests (esp. with respect to time scheduling and man power resources). He argues that this phase is unlikely to last very long.

A critical assessment

For more then 20 years the interpretation of the transition to agriculture in the LRA, as in many other places, has drawn on the availability model (*e.g.* Gehasse 1995; Van Gijn/Louwe Kooijmans 2005[b]; Louwe Kooijmans 1986; 1993[a]; 1998[a]; 2007[a]; Out 2008[c]; 2009; Raemaekers 1999; 2003; Vanmontfort 2007). While this has greatly helped to understand the specific LRA development, several important comments should be taken into account against the background of the diversity sketched above. These nuances are not intended to deconstruct the model, but provide a cautionary tale with respect to its application in the LRA wetland development.

- In contrast to the original availability model, involving a short substitution phase, Louwe Kooijmans (1998[a], 422-425) and Raemaekers (1999, 187) have demonstrated convincingly that the region knew a rather long substitution phase. This means that communities incorporating agricultural practices were able to do so on a moderate scale and for a long time, without encountering man power or scheduling problems and without being forced into either a collective or producing mode of procurement. The length of this period indicates that it forms a crucial, longstanding and characteristic aspect of the communities involved, that should be studied in itself.
- The model is distinctly economic, focusing on the subsistence spectrum as mainly defined by faunal remains. Although faunal composition is one of the few comparable and reasonably quantifiable elements in the transition to agriculture, this 'primacy of subsistence' point-of-view (see Zvelebil/Lillie 2000) does not do justice to the broader and variable set of changes that potentially characterize the transition to agriculture (see also Louwe Kooijmans 1993[a], 102). Focusing only on the transition in subsistence could lead to a conceptually homogenous Neolithic, in the same way that hunter-gatherers often were characterized in ecological terms. Furthermore with a main focus on subsistence, change, or perhaps more importantly absence of change in other aspects is not incorporated in the interpretation of Neolithisation. Nor is the diversity in these aspects appreciated as characteristic (*e.g.* Pluciennik 2008, 27).
- As for spatio-temporal developments, the character of the process of Neolithisation can be described best as a mosaic (*sensu* Tringham 2000[a], 21; see also Whittle/Cummings 2007, 2 and Robb/Miracle 2007). The availability model lacks the necessary resolution to deal with this variability, both from a geographical and a chronological perspective. It only forms a descriptive framework for larger regions and periods of time that include both the beginning and end of Neolithisation, sometimes millennia apart. It should be questioned whether this is the appropriate level at which to study the transition to agriculture. Neolithisation took place on different scales. To capture the actual process, we need to zoom in on regional developments

(*e.g.* Tresset/Vigne 2007) and find a resolution that is culturally significant, meaningful and coherent, yet geographically and ecologically wide enough to understand the multitude of factors involved as well as the influence of interaction, contact and exchange. This also means that there is a need for the incorporation of *historicity* into our understanding of Neolithisation and accepting that it was far from similar everywhere. As such the availability model may serve well as a basis for developing more region-specific models (*cf.* Zvelebil 1998[a]) that attempt to incorporate these nuances.

- In relation to the previous point it is questionable to what extent the contribution of domesticates may be distinguished for a cultural unit instead of a single site (*contra* Zvelebil 1998, 11). Although sites such as hunting stations of course form a different category, variation in the food spectrum of residential sites demonstrates the difficulties of such an approach for the wetlands and wet margins of the LRA. It neither seems an option to base our interpretations on presence/absence data, rather than proportional data. Raemaekers (1999, 13) argues in favour of this '*because the main concern is the subsistence base, rather than the proportion of people's diet provided by domestic animals*'. He uses the faunal spectra of the Vlaardingen sites as an example: some Vlaardingen sites would fall in a 'consolidation phase', while others would fall in a 'substitution phase', although according to him these sites functioned within a single settlement system (*ibid.*). The recent information available regarding the diversity and flexibility of the wetland and wetland margin communities (*cf. supra*; Amkreutz 2010[a]), also against a comparable ecological background (Louwe Kooijmans 2009), questions this point of view. A qualitative and proportional approach is required when using economical indicators (see Chapter 8).
- Finally, the availability model is read from left to right, from availability, over substitution to consolidation. As with many other interpretations of Neolithisation it incorporates direction. Although scholarly debate has come a long way since its initial focus on the superiority of agriculture and has shifted to incorporate the hunter-gatherer perspective (*e.g.* Lee and DeVore 1968; Zvelebil 1986[a,b]), it is questionnable what perspective such a linear approach offers for understanding the communities involved (see Layton *et al.* 1991; Rowley-Conwy 2001; Smith 2001). Reasoning with the benefit of hindsight clearly defines farming as a logical step between hunting and gathering and the incipient states forming the foundations for current societies. From a western *etic* perspective, however, it is difficult not to imbue this with a neo-evolutionistic character. Yet, although we may be aware of this, it underlies much of our modelling and even the syntax and logic we use to discuss this period: process, frontier, transition, availability, and subsititution. This also was addressed by several scholars (*e.g.* Barrett 2005, 119; Bettinger 1999; Terrell *et al.* 2003; Whittle/Cummings 2007, 2).

While we cannot erase our longer-term knowledge of the process at hand, this does stress that we need to combine or confront this perspective of a trajectory and the choices made therein, eventually resulting in an agricultural society, with a perspective that focuses on communities and their choices without these 'benefits of hindsight'.

In conclusion, the availability model helps us to understand the broader implications and general development of the transition to agriculture. It was intended as a descriptive framework for understanding the transition from a spatio-temporal perspective and as a frontier situation. Its focus on tracking economic contribution limits its potential to inform us on the actual character and fabric of the process of Neolithisation at the small-scale level of regional communities. However, it is this scale that may yield information on the manner in which communities coped with change and the degree to which general livelihood as well as socio-cultural and symbolical aspects changed. The acquisition of this kind of understanding relies heavily on more bottom-up research at the site and intraregional level.

7.4.2.2 Adding strategies – characterizing 'substitution'

Taking the above considerations into account, the aim here is to arrive at a better understanding of the manner in which the communities involved dealt with the potential array of changes during the transition to agriculture from a bottom-up regional perspective. The focus is on the manner in which subsistence, interaction and mobility shaped and were shaped by these changes (this of course does preclude stability or change in other aspects of society; *e.g.* Amkreutz 2013[a]).

Hunting and gathering and agriculture are not '*mutually incompatible ways of life*' (*cf.* Zvelebil 1986[a], 12). Neither was the transition between the two necessarily rapid (Zvelebil 1996, 326-327; see also Raemaekers 2003). The polarization between different modes of subsistence has led to an either/or situation which tends to obfuscate the analysis of subsistence (Ellen 1988, 127). In fact this middle ground, the actual phase of 'substitution' for the LRA wetlands and their margins formed a sustainable subsistence strategy (see Terrell *et al.* 2003; *contra* Keeley 1995; Louwe Kooijmans 2007[a]). Therefore it is interesting to study the success of these strategies and their stability over time, without doing this from the perspective of an intermediate position (see Smith 2001, 3, 24).

Low-level food production: a grip on subsititution?

A key to a different perspective may be to avoid connotations of direction in studying the strategies that were employed between hunting and gathering and (full-time) farming. An example is given by an analysis of 'low-level food production'. Smith (2001) characterizes the livelihood in between hunting-fishing-gathering economies and agriculture. Arguing against the existence of a one-way boundary or frontier between foragers and farmers (compare Layton *et al.* 1991), Smith stresses that adjectives such as 'complex' and 'affluent' for hunter-gatherers and 'incipient' or 'semi' for agricultural modes of production obscure the variable social and economical 'landscape' between both. He (2001, 17, 22) identifies domestication (*s.l.*) as a defining characteristic between hunting and gathering and farming. It is used as a landmark to map the area between both modes of existence. This way these communities may be perceived as '*a separate general class of extremely variable, successful long-term socio-economic solutions, fine-tuned to a wide range of local cultural and environmental contexts*' (Smith 2001, 34). Smith (2001) coins the term 'low-level food production', which involves a continuum of food procurement strategies to characterize the 'area' between hunter-gatherers and groups using domesticates. As discussed above, this 'area' may be defined by practices such as cultivation, management, tending or manipulation. They involve the interference of man with populations of plants or animals in order to increase productivity, yields or reliability. The 'area' between domestication and farming is characterised by similar practices involving varying combinations of wild, managed and domesticated resources, without any complete reliance on domesticates or cultigens (see also Ellen 1988; Smith 2001). This distinction serves to show how the one may evolve out of the other (prolonged tending and management may lead to genetic modification and subsequently domestication), but for the LRA perhaps more importantly, stresses that there is a continuity in practices and strategies performed arguing against a sharp boundary between hunter-gatherers and farmers (see also Zvelebil 1994). A further perspective on these 'intermediate' strategies with respect to cultivation was offered by Freeman (2012, 3014-3016). He distinguishes between ancillary cultivation, where foragers adopt domesticated plants as a compliment to foraging and minimal surplus producing strategies where 75% or less of the diet is derived from foraging. The second model requires greater residential stability due to labour allocated to planting, tending and harvesting and investment in storage. The ancillary model allows for more mobility, but needs (intensive) contact with farmers to obtain seed. It also would imply higher intersite variability. Of course combinations cannot be ruled out (*ibid.*, 3016). For the LRA both options may have been in operation, however, the the intersite variability and ongoing evidence for mobility (see also Chapter 8) suggests that an important part of the communities involved would rather fit within the ancillary model. Increased residential stability from the Hazendonk group onwards would offer a plausible moment for the introduction of a minimal surplus producing strategy.

Evidence of Intensification?

There is no to limited evidence for activities of manipulation and tending involving non-domesticated resources in the LRA. The Early Mesolithic site of Zutphen-Ooijerhoek yielded a palynological signal pointing to possible anthropogenic burning of the reed swamp (Bos *et al.* 2005, 41). It, however, is questionable to what extent fire ecology (see Davies *et al.* 2005; Mellars 1976[b]; Zvelebil 1994) was practised. In contrast to the riverine contexts in southern Britain (see Bell *et al.* 2006), evidence in the LRA is limited or absent (see Louwe Kooijmans 2001[c]). The practicality of burning deciduous trees in a wetland environment is complicated (see Brown 1997, 136). Other palynological evidence (*e.g.* Out 2008[c]; 2009) also indicates human impact on the natural vegetation. However, the changes at most sites point to small-scale and inconsistent clearings, while management and cultivation of other plants than crop plants is difficult to demonstrate and highly questionable (Out 2009, 311-312). Another example, although hard to proof, is the occurrence of some 400 small features of *c.* 25 cm in diameter and 10 cm deep that were found in a peat filled fen, near Zutphen. These have been interpreted as pointing to the large-scale extraction of roots or tubers, perhaps of *Sagittaria sagittifolia* (see Peeters 2007, 224). Furthermore, woodland may have been managed to some extent, for instance for the manufacturing of Swifterbant fishtraps as those at Bergschenhoek (Out 2008[b]; 2009), and for the construction of fences at Schipluiden (Kooistra 2006, 369; Louwe Kooijmans/Kooistra 2006, 249).

With respect to animals, including fish, slightly more evidence is available that may be interpreted as indicative of management. Concerning pigs, ethnographic evidence exists, for example from Sardinia, for the intermixing of free ranging and wild pigs and the existence of semi-domesticated herds (Albarella *et al.* 2007). These practices have also been suggested for the wild and domesticated pig complexes in the LRA (*e.g.* Gehasse 1995; Zeiler 1997, 79), although this research is fraught with metrical difficulties. Fishtraps (*e.g.* Bulten *et al.* 2002; Louwe Kooijmans 1986) and the large-scale culling of beaver and otter, most likely with the aid of traps and snares (Zeiler 1997) form further indications for a very structured, intensive and systematic use of wildlife.

Zvelebil (1994, 40) identifies the management or husbandry of plant food as '*marked by deliberate and planned promotional strategies designed to increase the control over plant resources and the conditions of habitat favourable to the propagation of targeted plants*'. A similar perspective may be adopted for animals. In the LRA there is little evidence for these practices and the available data are often contentious, as is the case with metrical aspects of bones, fire ecology, or early palynological signals of cereals (see Behre 2007; Rowley-Conwy 1995). Despite this we must assume the existence of specific 'native knowledge systems' (*e.g.* Louwe Kooijmans 2001[c], 71). These are sets of strategies that involve intimate knowledge on animal behaviour, soil conditions and growing habits, as well as the means of handing down the appropriate ways of dealing with them. As such, active manipulation, and concepts such as tending and managing may have been part of the hunter-gatherer strategies.[42] This casts an interesting light on the notion that the actual introduction of domesticates and cultigens took place gradually and without any clear breaks. The presence of these native knowledge systems may have facilitated the accepting and dealing with the first domesticated animals and plants, while the presence of a long availability and substitution phase suggests that the margins of these systems for dealing with the environment were not overstressed. This is not to claim that first farmers were younger (see Rowley-Conwy 1995), but to better understand the internal dynamics of implementing new strategies. This, in line with Zvelebil (1994, 64), accentuates the continuity across the Mesolithic-Neolithic transition and emphasizes the additive nature of agro-pastoral farming, from the perspective of hunter-gatherers.

Extending the broad spectrum economy

In contrast to intensification, evidence for 'low-level food production' (*sensu* Smith 2001, 17) in the 'area' between using domesticates and farming is evident in the wetlands and their margins of the LRA. Various strategies were employed in different combinations (*e.g.* Louwe Kooijmans 2009). An important concept for understanding the nature of these strategies, introduced by Louwe Kooijmans (1993[a], 103), is the notion of the *extended broad spectrum economy* (see also Louwe Kooijmans 1998[a]; 2007[a]; Raemaekers 1999). This notion points to the incorporation of domesticates and cultigens alongside already existing procurement strategies. Economically a reason for this may be found in the diet breadth model developed within behavioural ecology. In this model decision processes depend on factors such as quality, resource density, search and handling costs (Kelly 1995). If more kinds of resources are added, search costs are lowered (Hawkes/O'Connell 1992, 63-64). On the one hand this means that in the rich wetland environment the search costs may have been low due to the diverse resources available (if these were more or less equally high-ranked). Domesticates and cultigens may have have offered further improvement since they would increase productivity and lower search costs, although handling costs would dramatically increase. On the other hand it is unlikely that investment in agriculture would have been large in areas of high hunting and gathering returns (*e.g.* Barlow 2002, 70-75). From an economic perspective, the use of domesticates and cultigens may have been a controlled strategy of risk minimization, *i.e.* simply a case of not putting all ones eggs in one basket. From a behavioural perspective, 'extending' the spectrum of strategies already known may not have been as disruptive as suggested from a 'traditional Neolithic perspective'. As argued above, some practices already may have been known in some form in native knowledge systems. These may have facilitated the use of domesticates and cultigens, while on a socio-symbolic level these novelties may not have been 'alien' (see also Bird-David 1990; 1992[b]; Descola 1994; Ingold 2000).

Other motivations

Other motivations also may have contributed to adopting domesticates and cultigens. Managing relations of exchange, prestige, status, costly display and worldview or *mentalité* have frequently been cited as crucial in the adoption of agriculture (*e.g.* Bender 1978; Hayden 1990; Hodder 1990; Jennbert 1988; Price/Gebauer 1992; 1995; Thomas 1999; Tilley 1996; Verhart 2000; Whittle 1999; Zvelebil 1998[a]; see also Chapter 2). In the LRA, the evidence for non-food procurement is indicative of contact between, foragers and farmers. Despite problems with the interpretation of these finds (Amkreutz *et al.* 2009), they point to early interaction between foragers and farmers that may have involved issues such as prestige, exchange and wealth (*e.g.* Verhart 2000).

In the British Isles, and occasionally Ireland and parts of Scandinavia, there have been interpretations favouring an ideological role for domesticates and cultigens, preceding any significant economic change (Jennbert 1988; Thomas 1999; Tilley 1996; Whittle 1999). It is thought that intensification during the Mesolithic led to the adoption of a new structure of ideas and new material culture before significant economic changes. The subsequent early phase of the Neolithic often is interpreted as peopled by mobile communities. The limited evidence for early domesticates and cultigens led to their interpretation as mainly functioning within and ideological setting. Cereals for example were interpreted as 'special' foods consumed only 'rarely' in ritual context (Jones/Rowley-Conwy 2007, 391). These ideas, remain of importance in interpreting both British and Scandinavian data (*e.g.* Robinson 2007[a]; Stevens 2007), although recently there has been a trend towards favouring economic interpretation again of the first cereals and domesticates, in combination with a rapid, even traumatic transition to agriculture, around 4000 cal BC. This interpretation has been based mainly on a re-analysis of taphonomic conditions and archaeological interpretations (Cooney 2000; Jones/Rowley-Conwy 2007; Rowley-Conwy 2004; 1995), radiocarbon dates (Brown 2007) and isotope analysis (*e.g.* Fischer *et al.* 2007; Richards *et al.* 2003[c]; Richards/Schulting 2006).

For the wetlands and wet margins of the LRA the evidence for an ideological or socio-symbolical role is limited. The context of the first introduction of domestic animals at the site of Hardinxveld-De Bruin could be interpreted as 'cultic': limb bones of cattle, pig, goat, and sheep occur in small concentrations within the general spread of refuse, while the remains of a neonate piglet were probably buried (Louwe Kooijmans 2001[b], 526; 2003, 621).[43] Similarly the Rosenhof bones (Hartz *et al.* 2007), if authentic (Noe-Nygaard 2005), may represent isolated imports of specific and indeed perhaps 'cultic' importance. It is probable that these examples form the material expression of the first contact of the indigenous inhabitants of the western Baltic area with something alien to their system. However, domesticates were soon to form a limited yet consistent contribution to the faunal spectrum of many Swifterbant sites. The first finds of cereals at Swifterbant-S3, the Hazendonk and other Swifterbant sites point to consumption, rather than ritual or socio-symbolic use (see Out 2009, 409). On the contrary, their location amongst other waste deposits in layers of refuse argues in favour of a domestic function. It is the absence of a complete transition to agriculture before the Late Neolithic Single Grave Culture (*contra* Raemaekers 2003) and more especially the continuity of the importance of wild resources within a set of diverse strategies that characterizes the period between 5000 and 2500 cal BC in the wetlands and wet margins of the LRA. In the following these strategies, as aspects of an extended broad spectrum economy, will receive further attention.

7.4.3 Towards integrative strategies

The discussion regarding the Neolithisation in the LRA wetlands and their margins may benefit from a discussion on the subsistence and mobility strategies that were employed in this period, by studying them as successful behavioural adaptations and less so within the context and direction of a process of Neolithisation. This is what is offered by the concept of 'low-level food production' (Smith 2001) and the 'extended broad spectrum economy' (Louwe Kooijmans 1993[a]; 1998[a]). A repertoire of options, instead of a package (Thomas 2003), suited for combining the many natural and, later on, introduced resources in this area. With this characterization in mind it is possible to analyse the various ways in which this extended broad spectrum economy may have functioned in the context of the LRA wetlands. This offers a perspective on these strategies in correspondence with the interaction between communities, landscape and environment.

7.4.3.1 Continued diversity

An important way to approach the workings of an extended broad spectrum economy and the way in which communities relate to their surroundings is by shifting attention from material aspects of culture and subsistence, to the way certain practices and strategies were negotiated in space and over time. This already was touched upon earlier, when the traits of flexibility and continuity were discussed. The emphases in studying cultural or chronological stages in this respect lie not on defining distinct sets of traits, but on tracing shared habits. Behavioural variation of individuals and communities also is expressed *within* cultural systems, not just between them and it is not always possible to define a clearly recognizable, stable set of traits (*e.g.* Madsen/Simms 1998, 267-278). Moreover, as argued earlier, such behavioural flexibility should not be understood as governed by the environment (see Van der Noort/O'Sullivan 2006), but interpreted as an intrinisic characteristic of these communities.

Probing the range

A number of strategies may be listed that were employed by these communities over time. Some can be detected archaeologically, others only can be inferred, based on ethnography and educated extrapolation. Although lacking the archeological resolution a brief characterization may be given.

With the first introduction of domesticates and cultigens, or the associated available knowledge, the behavioural options open to the inhabitants of the wetlands and wet margins of the LRA increased. Partially dependent on the local ecological situation, different choices would have been made from this extended set of strategies. Agricultural practices and the way they were employed, in this respect may be interpreted as of an additive nature (as argued above), expanding the range, rather than drastically changing ways of living. At the same time it should be realised that the presence of farmers and the availability of agricultural knowledge irreversibly changed the socio-cultural and eventually, to a certain extent, the natural environment of local hunter-gatherers. This is what Madsen and Simms (1998, 255-257) refer to as 'matrix modification'. The set of behavioural options increased but this was not without effect. Even those groups in the LRA abstaining longest from the adoption of domesticates and cultigens are influenced through changes in their long distance contacts and by neighbouring communities that chose different paths.

Concerning strategies, a point that has received little archaeological attention (*e.g.* Verhart 2000 for the Meuse valley) is 'symbiosis'. As characterized by Gregg (1988, 42-51; see also Dennell 1985) mutualism, being an aspect of symbiosis involves two populations exchanging goods or services to cooperatively exploit (complementary) resources. This type of relationship is benefical to both, since the products or gains from groups practising different procurement and mobility strategies are likely to be complementary to each other (*e.g. ibid.*; Zvelebil 1998[a]; 2000). Mutualism may be of a facultative or essential nature. The former seems more likely for the LRA and the position of the wetlands in it, because of its estimated low population density and rich resources. Exchange often focuses on complementary resources that requires different strategies as well as time and energy investments. Specialisation may also occur, especially when resources are located in discrete or distant locations or if they require special skills (Gregg 1988, 47, 49). After farmers arrived or agricultural practices were established in the LRA, resulting interaction or conflict may easily have led to some form of symbiosis or interdependence (see also Amkreutz *et al.* 2009). Nevertheless, the emphasis should not only be placed on forager-farmer interaction (*e.g.* Dennell 1985; Verhart 2000; Raemaekers 1999, 135; Zvelebil 1998[a]). This way the indigenous groups in the LRA are perceived as too homogeneous and we overlook the internal diversity within the populations. Another strategy is mobility. For the sites studied there is distinct evidence for both logistical and residential mobility (*cf.* Binford 1980; 1982), while sedentism appears from the Hazendonk group onwards at sites such as Schipluiden and Ypenburg (Louwe Kooijmans 2009). Different types of mobility thus existed simultaneously from the Late Mesolithic onward. As noted by Kelly (1992, 50), when sedentary systems develop, they do not necessarily involve all of a region's people. Some may continue to be residentially mobile engaging in mutualistic relationships with others.

In view of these points an important issue is the degree to which the subsistence, mobility and exchange strategies were combined actively, abandoned and brought into practice again. Unfortunately this point is often hypothetical since in most cases we lack the archaeological resolution to determine contemporaneity of sites and get a grip on settlement systems. Nevertheless, the diversity in strategies existing as late as the Vlaardingen culture and, for instance, the intra-regional diversity in the Delfland region (Louwe Kooijmans 2009), suggest that contemporaneous communities employed different strategies. This points to the availability of a range of behavioural options (*e.g.* Freeman 2012; Layton *et al.* 1991; Terrell *et al.* 2003). This may include switching between strategies, symbiosis, flexible group composition, exchange and various degrees of mobility. Although difficult to establish archaeologically it also suggests the existence of 'dormant knowledge'. Long-term shifts in subsistence strategies require communication and internalization of new or re-newed knowledge, while more frequent shifts and variations also would benefit from the availability of (passive) expertise on techniques and approaches within a native knowledge system. This has been documented for various ethnographic cases (*e.g.* Griffin 1989; Sponsel 1989; Vickers 1989).

7.4.3.2 Integrative strategies

The suggested flexibility may have acted as as a buffer against shortages (*e.g.* Wiesmann 1986, 281-285). It enables groups to deal with environmental and landscape change by shifting their emphasis within the available range of options. It also indicates that while the initial introduction of agricultural practices and Neolithic material culture may have been novel and alien in hunter-gatherer experience, the appropriation, position and implication of these new techniques and products do not seem to have had a disruptive influence on the existing way-of-life and its attached values and ideology. Rather, the consistent contribution of hunting and gathering to the diet and the possibility of shifting the emphasis towards these modes of procurement would suggest the opposite, namely the importance of ideology and values attached to an existence based on wild resources (*e.g.* Amkreutz/Corbey 2008; Barnard 2007; Tucker 2006).

The flexibility of the strategies employed, as well as the extended broad spectrum resource base are a result of an underlying behavioural and social disposition (*habitus*), painting a more dynamic picture of the array of decisions made by these in space and over time. This presupposes the availability of a set of options, strategies, that enables a degree of flexibility in space and over time. This stresses that while we may record an extended broad spectrum economy, of for instance 'low-level food production' and occasionaly catch a glimpse of seasonality, or may confirm sedentism; these are part of a distinct behavioural spectrum. This spectrum, although difficult to define archaeologically, was most likely characterized by a wide diversity in behavioural options such as mobility (*e.g.* Kelly 1992; 1995), symbiosis and interdependence (*e.g.* Gregg 1988), switching strategies (*e.g.* Madsen/Simms 1998) and flux (*i.e.* flexibility in group or village membership through fission and fusion *e.g.* Pedersen/Wæhle 1988), especially within culturally coherent groups. This shifts the emphasis from subistence and the addition of domesticated resources, to the dynamics of the settlement system, including mobility, intergroup interaction and complementary strategies. This repertoire of options, to which agricultural practices form an additive, may be referred to as *integrative strategies*. This term encompasses the range of strategies available and the spatial and temporal combinations that were made from these. It stresses the flexible and pragmatic choices of the communities involved from the available spectrum and interprets them from the perspective of community *habitus* in relation to regionally significant environmental and landscape conditions.

In the following Chapter these integrative studies will be studied in relation to the aspects of sites, site function and settlement systems that characterized the habitation of the LRA wetlands and their margins over time.

Notes

1 Most evidence for the cultural continuum of communities subject to this study has been found in the wetlands and wet margins of the Lower Rhine Area, including the Scheldt valley and parts of Niedersachsen. While this does not imply their absence in the adjacent upland areas (see Chapter 3; Bakker 2003[a]; Raemaekers 1999, 106), it does entail that many people spent at least an important part of their lives in the vicinity of often extensive bodies of water.

2 Landscape and environment are not the same. While the former is mainly a physical distinction and characterization, the latter embodies the living dimension of the former. Nevertheless they cannot be seen as separate and their use here overlaps (also see Ingold 2000; Schama 1995). When landscape or environment is used, this is done with the connotation that the specific wetland landscape is characterized by a specific wetland environment and vice versa. In this sense landscape and environment, in this study, implicate each other and should be considered as related and dynamic. I will therefore mainly use the term environment implying also the associated form of landscape.

3 For an overview of academic discussion on landscape and landscape archaeology see for example Gerritsen (2001, 13-19) or Thomas (2001, 165-177).

4 This accentuates the importance of memory as a 'conductor' for connecting people to the land and the function of specific places in the landscape as *lieux de mémoire* (see De Coppet 1985; Küchler 1993). The multiple historical dimensions attached to landscape and place have become the key argument in what, analogous to the cultural biography of objects (Kopytoff 1986), has become known as the cultural biography of the landscape (see Gerritsen 2001; Kolen 1999; Schama 1995).

5 It may be noted that there is a distinction in the approach towards the Late Mesolithic evidence (Chapter 5), which is documentary and comparative, in contrast to that of the communities in the process of Neolithisation where the theoretical framework is distinctly post-processual and partially phenomenological (see Chapter 6). This distinction is a result of the nature and quality of the data available as well as the line of the successive argument, but is distinctly not intended to create a distinction between (ahistorical, cold) Mesolithic or (historical, hot) Neolithic communities as has been done in the past (see Rowley-Conwy 2001). More importantly, the characteristics of a specific regional landscape and environment context are central to an approach based on the dwelling perspective and an archaeology of inhabitation and also underlie the mosaic character of Neolithisation. It would be interesting for future research to analyse the regional Mesolithic from a similar perspective focusing on the many-sided relations between communities and environment (also see Brouwer 2013).

6 The sculp of species such as whale has been proven ethnographically to be very nutritious and does not leave behind any bones. Extraction camps may be moved to the coast in particular if whales are beached. The implications of the faunal evidence may be biased by factors such as these (pers. comm. G. Dusseldorp 2011).

7 The size of the dune of De Bruin measured 44200 m^2 in phase 1 and diminished to two smaller tops measuring 600 and 800 m^2 in phase 3 (see appendix I and Louwe Kooijmans 2001[b], 512).

8 There is no evidence for regular flooding at S2, although occasional inundation may have taken place (see De Roever 2004, 22).

9 This is further substantiated by an intermediate date (GrA-2055) between the SWB occupation and the later fish traps (see Peeters 2004).

10 Of course the resolution for such continuity is far better in the wetlands, but although the differences in site-use and place continuity in uplands and wetlands are part of the same continuum, differences in patterns and intensity are real (also see Chapter 5).

11 Recently (end 2010 and early 2011) two sites have been published that provide additional information for the Late Mesolithic/Swifterbant and Middle Mesolithic/Swifterbant/Vlaardingen occupation of the area. These are Gouda-Westergouwe (Alma/Torremans 2010) and Rotterdam-Beverwaard-Tramremise (Zijl *et al.* 2011). They could no longer be incorporated in the analysis, but do not seem to alter the interpretations offered. They have been included in Appendix I.

12 While there is distinct ethnographic evidence for the existence of managed herds of semi-wild pigs (see Albarella *et al.* 2007), convincing archaeological evidence for this practice in the LRA is lacking. While this does not mean these practices did not take place it has been decided here to subdivide the wild/domestic pig category if the quantitative counts allow for this.
13 Keeping them in the wetlands may not have provided much offspring, although blood and milk as renewable resources may have provided larger amounts of calories (pers. comm. G. Dusseldorp 2011). However, milk consumption has not been attested for hunter-gatherers and the environmental circumstances argue against the consistent presence of livestock on the dune.
14 This is related to the discussion concerning the absence or presence of Swifterbant in the coversand area (see Crombé/Sergant 2008; Raemaekers 1999; Vanmontfort 2007).
15 Although the actual chronological range of phase A is longer (4900-4100 cal BC), the bulk of the material dates to 4400-4100 cal BC (see Raemaekers 1999, 99). Nevertheless the problems regarding the ^{14}C dating of these phases should be taken into account (also see Appendix I).
16 It is difficult to establish whether domesticated pig also increased substantially, since the there is a considerable difference in the number of positive identifications between layers ABC and DE.
17 It should be noted though that reality may have been more complex. The landscape during VL-1b consists entirely of brushwood peat, yet the previous fauna shift remains intact. Furthermore it is questionable to what extent the size of the dune mattered or really became too small in relation to the contribution of domesticates (pers. comm. Louwe Kooijmans 2011).
18 This involves both the consistent importance of hunting as well as the ongoing contribution of domesticated animals in view of the landscape changes taking place.
19 The ratio between domestic and wild animals, however, is strongly dependent on the category pig/wild boar. While Goossens (2009, 140) opts for a general pig/wild boar category, an attribution of unidentified remains to either category based on positive identifications would suggest a relatively high importance of wild boar.
20 With respect to wild boar one may, however, refer to the discussion concerning the importance of the distinction between wild and domesticated pigs, since there are (ethnographic and historical) case studies indicating that domesticated and wild specimens sometimes were interbred deliberately, creating semi-wild populations (*e.g.* Albarella *et al.* 2007; Gehasse 1995; Raemaekers 2003). Zeiler (2006[a], 410-411), however, points out that these case studies are only of limited importance and, at least for Schipluiden, do not apply on the basis of both differences in the environment and metric arguments.
21 Caution is required since skeletons of otter and beaver contain more (small) elements and are among the most durable (Reitz/Wing 1999).
22 Furthermore they lay down rich reserves of fat in their tail to survive hibernation.
23 Compare for instance the sieved remains of Hellevoetsluis with those of other Vlaardingen sites (see fig. 7.4c).
24 At the TRB site of Slootdorp-Bouwlust, however, a fragment of cod (*Gadus morhua*) was found (Hogestijn/Drenth 2000/2001).
25 This time frame relates to the replacement of bone tissue and hence the duration of the record of the various isotopic elements therein.
26 NB. See Out 2009 for further details regarding botanic food and non-food resources.
27 Individual finds of einkorn (*Triticum monococcum*) at Brandwijk, Barendrecht and Urk also may be interpreted as grains from the top ears of emmer wheat, while a single grain of breadwheat at S3 may have been a deformed grain of emmer. The presence of oats (*Avena* spec.) at Ypenburg probably should be interpreted as the field weed *A. fatua* (see Out 2008[c]; 2009).
28 The evidence for small-scale clearings in the forest in association with *Cerealia*-type pollen as documented by Bakker (2003[a,b]) is less conspicuous with regard to early crop cultivation because of its upland location and late date (*c.* 4050 cal BC). Conversely the evidence for clearings and the presence of Cerealia-type pollen as early as 4770-4580 cal BC along the Baltic coast (Hartz *et al.* 2002, 326) or the recent claims for an initial Neolithic phase with crop cultivation (Jeunesse 2003; Gehlen 2006; Tinner *et al.* 2007) should be regarded with caution in light of the many interpretations possible (see Behre 2007; Rowley-Conwy 2000), both with regard to the identification of pollen of Cerealia-type as well as the mechanisms underlying the development of clearances in the vegetation.
29 Out (2008[c]) for example mentions the scarcity of sickle blades in the Michelsberg culture (also see Schreurs 2005, 308), although it should be mentioned that their presence at sites such as Maastricht-Klinkers and Thieusies (Schreurs 1992) indicates a widespread familiarity with the use of these implements. Scarcity in this respect mainly becomes meaningful in relation to the far better documented LBK sites and thus may relate also to different use and disposal strategies. The find of a single sickle blade at the site of Hüde-I should act as a cautionary tale. The artefact was made on flint of Lightgrey Belgian type and converted into a borer probably before it reached the site (pers. comm. B. Stapel 2006).

30 Tools that may have been used to work such a field have been found in different hunter-gatherer contexts in northern Russia, Latvia and Lithuania (Zvelebil 1994, 55).

31 Often prosaically referred to as 'counterparts elsewhere' (Bakels 2000, 105), 'communities in other ecozones' (*e.g.* Louwe Kooijmans 1993[a], 83), 'upland neighbours' (Raemaekers 1999, 122-123), or 'contemporaneous Neolithic communities' (Crombé 2005[c], 296).

32 The much attested correlation between the degree of sedentism and the extent to which agriculture and specifically crop cultivation may contribute successfully to the economy seems to substantiate this interpretation (see Binford 1990; 2002; Kelly 1992; Kent 1989[a,b]). Nevertheless, caution is required, since sedentism, or a low degree of mobility, does not necessarily imply a greater reliance on agriculture, but may also relate to a multitude of other causes as documented ethnographically and archaeologically, such as dependence on other (aquatic) resources (*e.g.* Ames 2002; Price/Brown 1985; Zvelebil 1994), relations with other groups (Ellen 1988; Gregg 1988; Pedersen/Wæhle 1988), or specific cultural modes of decision or cultural logic (Aldenderfer 2002).

33 It should be noted that there are different uses of the terms permanency, duration, sedentism and sedentary (*e.g.* Louwe Kooijmans 1993[a]; Milner 2005; Rafferty 1985). Here the term permanency is used with respect to the duration of annual occupation (see Louwe Kooijmans 1993[a]). On a different level permanency may also refer to the duration of the use-life of a site, *e.g.* permanent places.

34 At Urk the presence of sturgeon could point to a presence in summer, but since this may involve young specimens, the overall faunal spectrum is not really informative on seasonality (see Oversteegen in Peters/Peeters 2001, 45-46). Similarly, the SWB occupation at P14 minimally indicates a presence in summer and maximally in all seasons (Gehasse 1995, 67-68). At Doel the botanical remains point to a presence from late summer to early winter, on the other hand fish remains and gathered poison ivy also argue for activities in spring, or even late winter (Bastiaens *et al.* 2005; Van Neer *et al.* 2005). Contrastingly at Oudenaarde there are no clear summer or autumn indicators as both attached and shed antler and several species of fish and birds point to a presence in winter and spring (Vanmontfort 2004, 151-152). Hüde I yielded evidence for a minimal presence in late summer and early autumn (*e.g.* Raemaekers 1999), although bird remains indicate some winter activity and there is no hard evidence for absence in other seasons.

35 For some sites a non-sedentary option remains (see Verhart 1992).

36 Furthermore one should take into account aspects such as territoriality and social boundaries (*e.g.* Kim 2002; Lovis *et al.* 2006[b]; Nicholas 1998[a]; 2007[b]; Terberger 2006), the character and changes in mobility (*e.g.* Kelly 1992; Kind 2006; Pasda 2006), maintaining networks of social relations (*e.g.* Whallon 2006; Zvelebil 2006), the spatial location of elements of the production process (Fischer 2003; Lemonnier 1992; Pétrequin 1993; Vanmontfort 2008[b]) and the movement of ideas (*e.g.* Gosden 1994; Hodder 1990; Louwe Kooijmans 1983[b]).

37 This is substantiated by the technological differences that exist between Swifterbant and, for example, Ertebølle pottery, which argues against a single boreal tradition and in favour of a southern origin of inspiration (*e.g.* Andersen 2010; Louwe Kooijmans 2003; 2007; Raemaekers 1997).

38 The appearance of these arrowheads at De Bruin, in combination with the pottery mentioned above argue in favour of a continuation of post-LBK Blicquy-Grossgartach contact.

39 Another (partially polished) adze reportedly was documented even further north at Staphorst-Olde-Meppelerdiep (Van der Graaf 1987). It is not unlikely that the adze found at Staphorst is in fact a so-called *Spitznackige Beil*. These are sometimes made of amphibolite (Klassen 2004, 63). This would, however, form a *tpq* of this find of 4300 cal BC.

40 Axes, for example, while forming valuable tools for creating open places, fields and structures, may also have carried along a powerful sense of acculturation of the wild (*e.g.* Hodder 1990), of the ability to change the environment. They also may have been imbued with a sense of origins, a Neolithic hinterland, occupied by different groups. In this sense axes could have been symbolic for the contacts the axe-owner had and the power managing and exploiting these networks gave him (*e.g.* Verhart 2000; Zvelebil 2000). From another perspective, these functional and symbolic connotations probably made it a valued object for exchange, its life history and age adding to its role in maintaining complex networks of reciprocity, (gift) exchange as well as trade (Mauss 1950; Pétrequin 1993). The scale and complexity of these networks in the Middle and Late Neolithic is demonstrated by the well-known jadeitite axes originating from the Southern Alps and dispersed as far as Scotland and Ireland, or for example axes that have been dredged from the North Sea.

41 Although Zvelebil (1986[a], 6; 1996, fig. 18.1) mentions the contribution of both domesticates and cultigens in the separate stages of the availability model, only the faunal remains form a quantifiable means for measuring the effective contribution.

42 Ingold (2000, chapters 4 and 5) in this respect argues against a break in practices, but in favour of an ongoing concern (*ibid.*, 76, 81). Also see Descola (1994) and Bird-David (1990, 1992[a,b]) for a further analysis of the absence of a clear nature-culture divide regarding these practices. The degree to which actual management and tending practices were part of the native knowledge systems of the wetland communities in the LRA is questionable. The supposedly rich environment and small population size may have limited the importance of expending energy on management or tending for future contingencies.

43 Except for the neonate piglet, it is probable that bones or quarters were brought from wetland margin locations instead of the animals themselves (see Louwe Kooijmans 2001[b]).

Chapter 8

Unsettled issues: settlement systems, integrative strategies and Neolithisation

8.1 Introduction: integrative strategies and settlement systems

The previous chapter demonstrated the importance of an approach that contextualizes regional practices and livelihood of communities from a long-term landscape perspective. In general it may be stated that the communities in the wetlands and their margins distinctly employed a broad spectrum economy which, over time, was extended with crop cultivation and animal husbandry (Louwe Kooijmans 1993[a]; 2007[a]). The actual application of this extended broad spectrum economy in daily practice was hypothesized subsequently by the definition of integrative strategies, *i.e.* the multitude of practices that enabled communities to successfully combine and exploit both natural and domesticated resources. While this touches upon the general perception of resources by hunter-gatherers (see epilogue), its particularities in this study should be understood from the perspective of the inhabitation by these communities of the wetland landscape. This specific behaviour is understood as an innate part of the *mentalité*, the socio-cultural identity of these communities, resulting from their specific interaction with the wetland environment. The flexible, pragmatic attitude towards the array of options available may offer a number of models that are in need of substantiation in the actual data, with respect to economy, permanency and function of sites. Since sites never exist in isolation (Casey 1996), this requires an integration into potentially viable settlement systems over time.

Towards an application

There is a multitude of options for integrative strategies. Several were mentioned earlier, including mobility, symbiosis, interdependence, switching strategies, exchange, and flux (*e.g.* Gregg 1988; Kelly 1995). These assumed practices probably remained important in the study area throughout the Neolithic, but the suggestion of their existence is not informative on the way strategies may have actually been integrated, or on their development over time. In order to provide an informative perspective on this, a coupling with the actual site evidence is necessary. In view of the quantitative and qualitative aspects of the dataset available (see Appendix I and Chapter 4) several sites may be classified for a number of variables in relation to settlement systems. Additional sites may provide locational or other evidence that could accentuate the system and interrelationships involved. The selection of sites is presented in table 8.1. Evidently the number of sites

geographical region **Informative sites**	**coastal**	**salt marsh**	**fresh/tidal**	**peat marsh**	**river clay**	**wetland margin**	**local wetland in upland**	**upland**
Vlaardingen	Voorschoten Leidschendam Rijswijk-Schaapweg Haamstede	Zandwerven Hellevoetsluis	Vlaardingen Hekelingen-III Hazerswoude	Hazendonk	Ewijk	(Homberg) (Berghem)		(Toterfout) (Tilburg) Veldhoven
TRB		Slootdorp				P14		+++
Haz. group	Rijswijk-A4 Ypenburg Schipluiden Wateringen 4		(Barendrecht)	Hazendonk Brandwijk	Nijmegen-Klumke	Het Vormer Gassel Pater-Berthier		Haz. sites Limburg
Late SWB				Schokkerhaven	(Zoelen)	(P14) Kraaienberg		MK Limburg
Middle SWB	deposits absent or		Bergschenhoek S2/3/4	Hazendonk Brandwijk S11 (S21-24/S61)		P14 Urk-E4	Hüde I (Gietsenveentje) (Oudenaarde)	
Early SWB	out of reach			Hardinxveld		Hoge Vaart-A27	(Bronneger)	
Late Mesol.				Hardinxveld (Rotterdam CS) (Rotterdam-Beverwaard 13-17) (Gouda-Goverwelle)		(Maaspoort) (Hoge Vaart-A27) (S11-13/21-24/61/81-84)	Jardinga	+++

Table 8.1 Spatio-temporal overview of informative and less informative (brackets) sites per ecological region. See Appendix I for further information.

available per ecological and geographical region is limited. This means that a simplified conceptual interpretation is required that retains sufficient complexity to incorporate variability adequately.

8.1.1 Site qualities and mobility: criteria

Before accommodating sites into settlement systems, a number of criteria have to be decided upon. These concern (aspects of) site location, site function, seasonality and mobility. Together they form a set of premises upon which the allocation of sites to a settlement system is based.

8.1.1.1 Regional attribution

Sites are located in different geographical and ecological zones. These shift somewhat over time and as such form an important substrate with differential dynamics, both in space and time (*e.g.* Van Gijssel/Van der Valk 2005, 67; Louwe Kooijmans 1993[a], 73; *cf. supra*). Although the actual dynamic environmental situation may have been an important factor in the rationale behind settlement location, function and mobility (*e.g.* Leary 2009; Sturt 2006), the static nature of a settlement system model can account for these dynamics only to a limited extent. Furthermore, with notable exceptions (*e.g.* Hardinxveld, Schipluiden, Ypenburg), there is not always information regarding the micro-regional (ecological) setting of sites. Site locations and the larger geographical and ecological zones that roughly comprise the different landscapes inhabited (*e.g.* Louwe Kooijmans 1993[a]) form the main sources of information. Recapitulating, these include the coastal area with coastal barriers and low dunes. East of this there is a marine to brackish tidal zone with estuaries, salt marshes and creeks, which borders on a freshwater zone with tidal influence. Sites are generally situated on low dunes and levees. East of this area there is a freshwater peat marsh characterized by *donken* as dominant site locations. Further east the riverine area is characterized by fluvial activity, resulting in levees and crevasses, and by (larger) fossil inland dunes. Wetland landscapes also existed in the Scheldt valley and in the IJsselmeer basin. A few additional remarks have to be made. The coastal area only became inhabitable during the 4th millennium cal BC. It can be assumed that before this period the unstable beach barrier environment was unsuitable for residential settlement (see Van Gijssel/Van der Valk 2005, 68; *contra* Raemaekers 2003). Finally, as can be seen in table 8.1, two separate categories have been created. First 'wetland margin' has already been used in this study in a generic way in order to comprise locations in the direct vicinity of wetlands (see Louwe Kooijmans 1993[a]). Distance to the wetland has not been quantified, but may best be characterized as 'close-by' in the sense of roughly 1 kilometer. Second, an additional category (local wetland in upland) was created for sites in local wetland conditions in the uplands such as a stream valley or lake.

8.1.1.2 Dealing with seasonality

As argued earlier (*cf. infra*) the interpretation regarding evidence for seasonal and year-round occupation is beset with difficulties (Dark 2004, 39-40; Milner 2005, 33-35). Only a handful of sites provided clear-cut seasonal information (Hardinxveld-Polderweg phase 1, Swifterbant-S3, Bergschenhoek, Schipluiden, Hekelingen, Vlaardingen and Hellevoetsluis). The overview presented in fig. 7.6

can therefore only be read as indicative of the presence of seasonal information per site over time, not as a qualitative assessment of it. This can be achieved only when taphonomic and methodological issues are taken into account (Chapter 4). It also indicates that the available seasonal information should be coupled with other evidence that is crucial for interpreting site function and mobility (*e.g.* Rafferty 1985).

8.1.1.3 Other criteria

A number of additional criteria should be mentioned that may be employed in defining site function and position in a settlement system.

Micro-regional setting and site location characteristics

This involves both the ecological and landscape dynamics in the direct vicinity of a site and the direct location choice. Secondary arguments, for instance, include the availability of potential arable land (*e.g.* in the coastal area during the Hazendonk or Vlaardingen occupation or at the boulderclay outcrop of P14), repeatedly wet conditions and flooding events (for instance at Swifterbant-S3 and S4, Bergschenhoek and Hüde I), or the specific location choice (Bergschenhoek and Hekelingen). These aspects illustrate the rationality in the choice of a certain settlement location within the given ecological margins, especially from an economic perspective.

Character of waste disposal (see also Chapter 4)

Waste disposal may reflect on permanency of stay, based on the principle that a more consistent long-term site use would lead to a greater distinction between living areas and waste disposal (Schiffer 1995, 31). Of course, post-depositional processes affect waste patterning and result in temporal and cumulative palimpsests (Bailey 2007, 204-207), and ethnography (*e.g.* Kent 1991; 1992; Kent/Vierich 1989) demonstrates that different waste disposal practices exist that relate to factors such as group and site dimensions, duration of stay, presence of water, range of activities conducted, anticipated stay and socio-symbolic or cosmological rules. Still, the extent, composition and thickness of refuse layers may form a coarse-grained factor regarding site use intensity (see for instance the thickness and extent of the Hazendonk layers, Appendix I).

Presence of fields and contribution of domesticated animals and crop plants (table 7.1, fig. 7.4)

A large contribution of domestic animals may indicate more permanent agrarian sites, since a correlation between the degree of residential mobility and the importance of more game has been demonstrated in various ethnographic case-studies (Kent 1989[a]; see Chapter 5). On the other hand, other types of (logistical) mobility may be employed to accommodate the contribution of hunting. For the sites studied here the relatively stable aquatic resources (including fish, fowl, otters and beavers) provide an incentive for lower residential mobility, compared to the (large) game-based argument mentioned above (*e.g.* Binford 1990; Nicholas 1998[a]; 2007[a,b]; Zvelebil 2003[b]; Chapter 5). An assessment depends on the overall sample size and the way in which the attributions of problematic categories (pig-wild boar; cattle-aurochs) have been dealt with. Furthermore, the presence of domesticated animals is not directly informative on permanency because of the possibility of nomadism or transhumance (Bentley/Knipper 2005; Cribb 1991). The presence of all four domesticates may indicate greater permanency, while a more specialist wild spectrum may point to the extractive nature of a site. Taphonomic and behavioural factors also affect our perspective on the importance of crop plants and how these arrived at the site (*cf. supra*). Evidence mainly points to consumption and import of crop products is assumed for a number of sites in the delta (Out 2009, 423). The presence of agricultural fields, indicated by ard or hoe marks, pollen evidence for large-scale clearings and, to a lesser extent, sickles, form good arguments for local production and increased permanency.

Durable building traditions

Another factor of importance is the presence of durable (and regular) buildings used for multi-seasonal or sedentary purposes. While investment and proper construction may point to a higher degree of permanency, it should be noted that building traditions also relate to local traditions, anticipated mobility and available materials (*e.g.* Kent 1991; Kent/Vierich 1989; Marshall 2000; Rapoport 1969). A good example is formed by the Schipluiden site (Hamburg/Louwe Kooijmans 2006) where firm evidence for a sedentary occupation somewhat contrasts with a building tradition of limited structure and durability. Examples of durable buildings include Haamstede, Wateringen-4, Ypenburg (and later Zeewijk). The structures at Swifterbant-S3, Hekelingen, Vlaardingen and Slootdorp cannot be classified as durable. It should be noted that durable housing is not always indicative of permanency. Ethnography reveals non-sedentary interpretations too. Rafferty (1985, 129) mentions the Missouri Hidatsa, who occupied sturdy housing only during the winter months. Marshall (2000, 76-77) mentions the Nuu-chah-nulth who own several large seasonally occupied houses and move sets of planks between the sturdy house frames. In the absence of additional indicators, caution is required in using sturdiness as an indicator for permanency.

'Exotic' artefacts

Artefacts or objects made from materials that could not be procured or obtained locally may also determine the permanency and function of a site in a settlement system. The presence of non-local weed in the botanical assemblage of the Hazendonk (Out 2009), the presence of a fragment of a *Breitkeil* at S3 or non-local flint at Polderweg (Louwe Kooijmans 2003) and various Vlaardingen sites (Amkreutz 2010[b]) are indicative of contacts.

The arguments presented above form a set of variables that, especially in combination and in relation to information on seasonality and site location, present an argument for site attribution. Below the structure of the settlement system and the associated criteria will be outlined.

8.1.2 Defining the system

The classification of sites according to site function and their implementation in settlement systems is necessarily an abstraction of reality based on the quantity and quality of the data available. It is important to establish the degree of permanency involved and in relation to this the type of mobility strategy. This basically comes down to the distinction between sedentary, year-round locations and sites that are used in a seasonal or temporary manner. With respect to mobility a much used and appropriate classification is the one based on Binford's forager-collector model (1980) or Woodburn's immediate-delayed return model (1982; see also Crombé *et al.* 2011[b]; Louwe Kooijmans 1993[a]; Raemaekers 1999, 120-121). A number of drawbacks and repercussions of the use of this model has been discussed extensively earlier (Chapter 5). The existence of various complementary and alternative strategies caution our use of these categories (Lovis *et al.* 2006[a,b]). Moreover, Binford (1980, 12) intended the forager-collector mobility concepts not as polar types of settlement systems, but rather as a range of options. Despite this the definition of hypothetical settlement systems can be based only on classifications of sites. A workable outline will now be given.

Combining strategies and sites

Site classification depends on a number of distinctions and the degree to which archaeological data can be fitted into these categories. A first distinction is between sedentary year-round locations and sites used in a temporary manner. The latter may be subdivided between residential locations used in a seasonal or short-term manner and special activity camps. A mobility system incorporating these site typifications may range from residential to logistical mobility. An important argument related to this is the distribution of (critical) resources. According to Binford (1980, 5-10), residentially mobile systems are more common in areas where the resource distribution is undifferentiated or regular, while logistical systems are more common in situations of spatio-temporally incongruous resources. The dynamic but regionally continuous distribution of relatively rich botanical and faunal resources in the wetlands (*e.g.* Nicholas 1998[a]; 2007[a,b]; Van de Noort/O' Sulivan 2006) argues for spatial congruence, yet many of these resources are available seasonally. This may favour logistical strategies. Based on this, four combinations of strategies and sites are proposed (see table 8.2).

The characteristics of the four site types defined and their archaeological parameters will now be described and these are depicted in table 8.3:

- *Permanently inhabited sites*. These are residential locations that may operate independently, in combination with extractive sites or exchange. They may also operate in conjunction with other permanent or seasonal sites (and thus become designated as 'dependent'). Exchange and expeditions form additional strategies. *Criteria*: complete households; sturdy houses; spatial structuring; large contribution domesticates; presence of all four domesticates; limited contribution of game, fowl, fish; fields: ard marks/palynological signal/ macroremains; seasonal evidence for year-round permanency.

	dependency		mobility		interaction
site↓ / system→	**independent**	**dependent**	**residentially mobile**	**logistically mobile**	**interaction**
permanent	+	(+)		+	+
seasonal		+	+	+	+
short-term		+	+		+
extractive		+	(+)	+	

Table 8.2 Overview of the different combinations of sites, dependency and mobility strategies. Brackets point to optional character. 'Interaction' indicates interaction and exchange with sites outside the direct system.

- *Seasonally inhabited sites*. These are residential locations that are dependent on a counterpart elsewhere, in another season. Seasonal sites function in a logistical mobility strategy with approximately one to three moves per year (*e.g.* summer and winter sites; see Binford 1980; 1982). Occupation may involve one season or cover, though not necessarily include, two to three seasons (*e.g.* late spring-early autumn). *Criteria*: complete households; housing of limited durability; limited spatial structuring; distinct combination of domesticates and wild faunal resources; important role for hunting, fishing, gathering, fowling; evidence for limited local crop production; seasonal evidence for non-annual use.
- *Short-term sites*. In (gradual) relation to the previous category these fit a system of more frequent residential mobility, with stays of up to several weeks. Exchange and expeditions also form additional strategies. *Criteria*: complete households or task forces; shelters or tents; limited site extent; no spatial structuring; limited role for domesticates; importance of hunting, gathering,

Table 8.3 Overview of available criteria for site function, mobility and inter-site relations.

	evidence			
criteria	**permanent**	**seasonal**	**short-term**	**extractive**
group composition	complete HH	complete HH	complete HH or task force	task force
anthropological / artefactual	deciduous teeth, task range, etc.	deciduous teeth, task range, etc.	limited task range	specific task
housing	durable (sturdy?)	limited durability	shelter, tents	none, or shelter/tents
dimensions/structure	+++	++	+	+/-
spatial structuring	spat. structured	limited spat. structuring	*ad hoc*	*ad hoc*/concentrated
extent	+++	++	+	+/-
domestic animals	large contribution; all four present	combination of dom. & wild fauna	limited role, unless nomadic	none
wild animals	limited contribution of game, fowl, fish	hunting, fishing, gathering fowling important	hunting, fishing, gathering fowling important	specific importance of hunting, fishing, gathering, fowling or combi
crop cultivation	fields: ard marks / macro / palynology	limited evidence local crop production	no crop cultivation, limited importance crop products	limited to no importance
seasonality	evidence for several seasons	evidence for restricted part of the year	evidence for restricted part of the year	evidence for restricted part of the year
expected character	*combi evidence year-round*	*indications may point to major season(s) of use*	*(homogeneous) indications (various) seasons*	*task related seasonality*
artefacts	complete range of artefacts, potential expedient technology	complete range of artefacts, potential expedient technology	limited range lithics, limited mobilia (including pottery), curated technology	specific toolkit, limited mobilia (often no pottery), curated technology, limited/no production
	permanent	**seasonal**	**short-term**	**extractive**
dependency	independent (+ extraction)	dependent	dependent	dependent
	dependent ('conjunction' to permanent or seasonal)	on 'counterpart' elsewhere, different season	sequence' of sites exploiting range	satellite sites, local base for small or shorter exped.
relation	*primary site*	*one of primary sites/ bi-modal*		*subordinate to permanent, seasonal, (short-term)*
investment	+++	++	+	+/-
mobility	logistical	logistical, 1-3 residential moves	'more frequent residential mobility', stays up to sev. weeks	logistical/targeted
exchange & expedition	yes	yes	yes/limited	(unlikely/limited)

fishing, fowling; no crop cultivation; limited importance crop products; limited range of lithic artefacts; limited mobilia (including pottery); seasonal evidence for short-term use.

- *Extractive or special activity sites*. These are satellite sites that function in a subordinate relation to both permanent and seasonally occupied sites. Their character in a system of logistical mobility may be more fixed and diverse, requiring increased technological investment, while the 'locations' in a residential system of mobility may be of a more temporary nature. These sites are used by task forces as a local base for smaller or shorter expeditions. *Criteria*: task force; no structures or shelters/tents (often implying absence of evidence for structures); no domesticates; specific importance of either hunting, fishing, gathering, fowling, or combination; limited to no importance crop products; specific lithic toolkit; limited mobilia (especially pottery); seasonal evidence for short-term seasonal use.

Criteria

The criteria per site definition are context-dependent and suffer from the discrepancy between an assumed ethnographic characterization and problematic (often poor) archaeological evidence. Their importance increases when combinations may be made of several criteria. For instance, macroremains of cereals point to consumption, rather than production and become more convincing as an indicator of permanency when combined with sturdy houses and a significant contribution of all four domesticates. Furthermore, because of this qualitative aspect and because of the methodological and taphonomic factors affecting organic remains, no fixed quantitative limits have been set for the contribution of domesticates, or the importance of wild faunal resources, fowling and fishing.

Range of strategies

Having defined the different types of sites and the mobility strategies involved, it is now possible to model a number of strategies in relation to each other (see fig. 8.1). This serves to demonstrate the options available. This overview is necessarily a simplification of reality, both in space and time. In the model a simple distinction is made between 'wetland', and 'wetland margin' or 'upland'. The combination of both categories is based on the notion that the mobility within the territories of the communities studied here, or their interaction with other communities will often be directed at the area bordering on the wetlands (including the coastal barriers etc.). At the same time mobility and interaction further afield cannot be refuted. No further distinction is made with regard to different ecological zones. With respect to the latter we lack the necessary regional resolution to pinpoint the duration and development of distinct system dynamics over time.

The overview is non-exhaustive and exemplary of the hypothetically available range. Below the various options are explained.

A. Permanent sites, logistical mobility system, no residential mobility
This option represents sites that are in use year-round. Additional resources may be procured by means of extraction sites in similar or diverging ecozones as well as through interaction between sites. With respect to food and non-food resources, the complementary site will most likely be situated in a different ecozone.

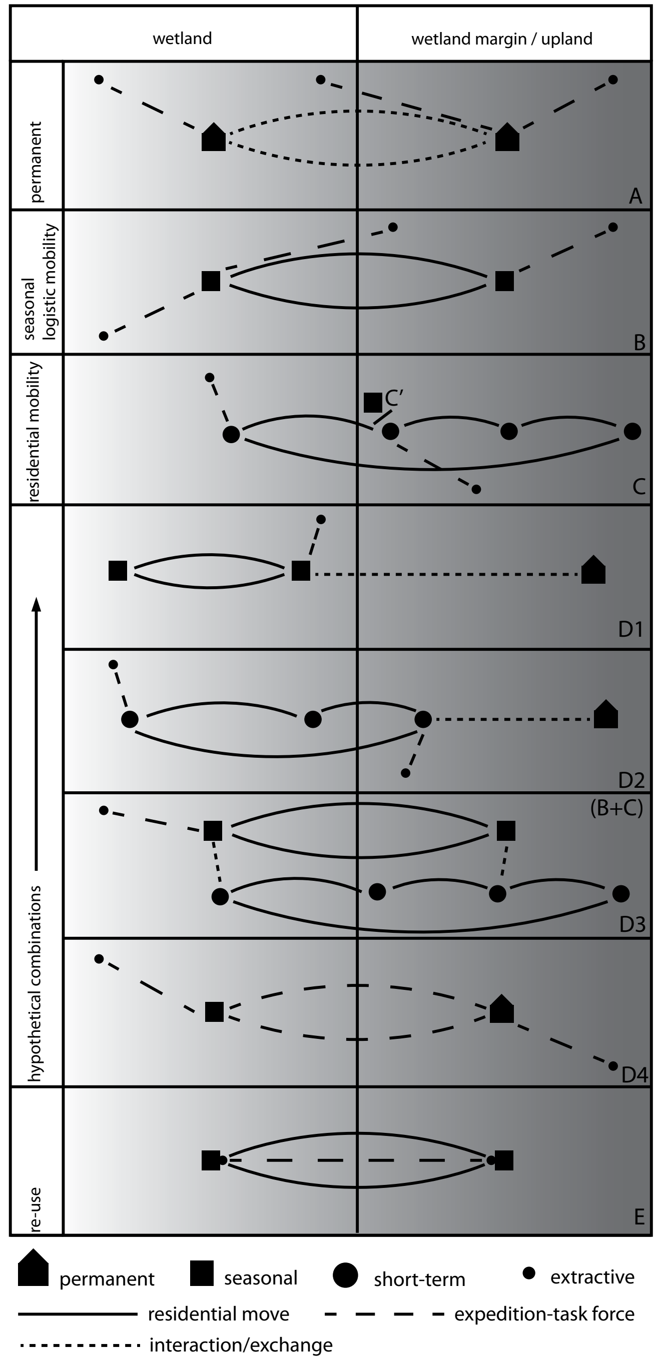


Fig. 8.1 Schematic representation of potential mobility strategies (A-C) and a number of possible combinations of strategies through interaction and exchange (D). The placement of extraction camps is arbitrary.

B. Seasonal sites, logistical mobility system, limited residential mobility Sites are in complementary seasonal exploitation of resources (*e.g.* spring-summer/autumn-winter or summer-autumn/winter-spring). Extractive sites are in use for additional resource procurement.

C. Short-term sites, residential mobility system

A number of sites in the settlement system indicates a short-term seasonal use, requiring an increase in residential moves. These moves may cover different ecozones, most likely in relation to (seasonal) shifts in resources, but moves may also take place within one ecozone due to depletion of resources (*cf.* Binford 1980). Sites are characterized by shorter stays. Extractive sites may be in use for additional resource procurement, although their diversity, size and duration will be more limited compared to logistical systems. C' represents a seasonal site within a residentially mobile system.

D1 Combination. Permanent and seasonal sites, logistical mobility system Permanent site operates in relation to a wetland seasonal system. Extractive sites may be in use for additional resource procurement.

D2 Combination. Permanent and short-term sites, logistical and residential mobility Permanent site operates in relation to wetland-wetland margin residentially mobile system. Extractive sites may be in use for additional resource procurement.

D3 Combination. Seasonal and short-term sites, logistical and residential mobility This is in fact a visualization of the combination between B and C. Seasonal logistical system operates in relation to residentially mobile system, both in upland/wetland margin and wetland zones. Extractive sites may be in use for additional resource procurement.

D4 Combination. Permanent and seasonal site, logistical mobility Permanent upland location operates in complementary system with seasonal site. This involves temporary division of the group. Extractive sites may be in use for additional resource procurement.

E Seasonal sites, logistical mobility system, limited residential mobility See B. Abandoned seasonal site is used as extractive location during off-season.

The options above provide an indication of the range of settlement systems in potential operation. It is, however, in their regional and temporal application that we may find which settlement system may have been in use and may be able to come to a characterization over time. In the following the available informative sites will be discussed per period and interpreted in terms of settlement systems. The reader is referred to Appendix I for further site information.

8.1.3 Late Mesolithic and Early Swifterbant (c. 6500-4500 cal BC)

Information for the earliest period is sparse due to the limited number of sites excavated. Both Late Mesolithic sites as well as early Swifterbant sites with pottery (ceramic foragers) are included. Sites with evidence for domesticated fauna are excluded. The incorporated sites provide information regarding the nature of the hunter-gatherer settlement systems before the introduction of domesticates or cultigens. The sites are mapped in fig. 8.2.

8.1.3.1 Attribution of function

A site-function is attributed to the selected sites, based on a combination of informative variables (*cf. supra*; see table 8.4). For the period under discussion the evidence available is distributed unevenly; Hardinxveld-Polderweg phase 1 forms the main anchor point (Louwe Kooijmans 2001[b]; 2003). The level of structural investment at this location, in combination with the rich dataset on artefacts and

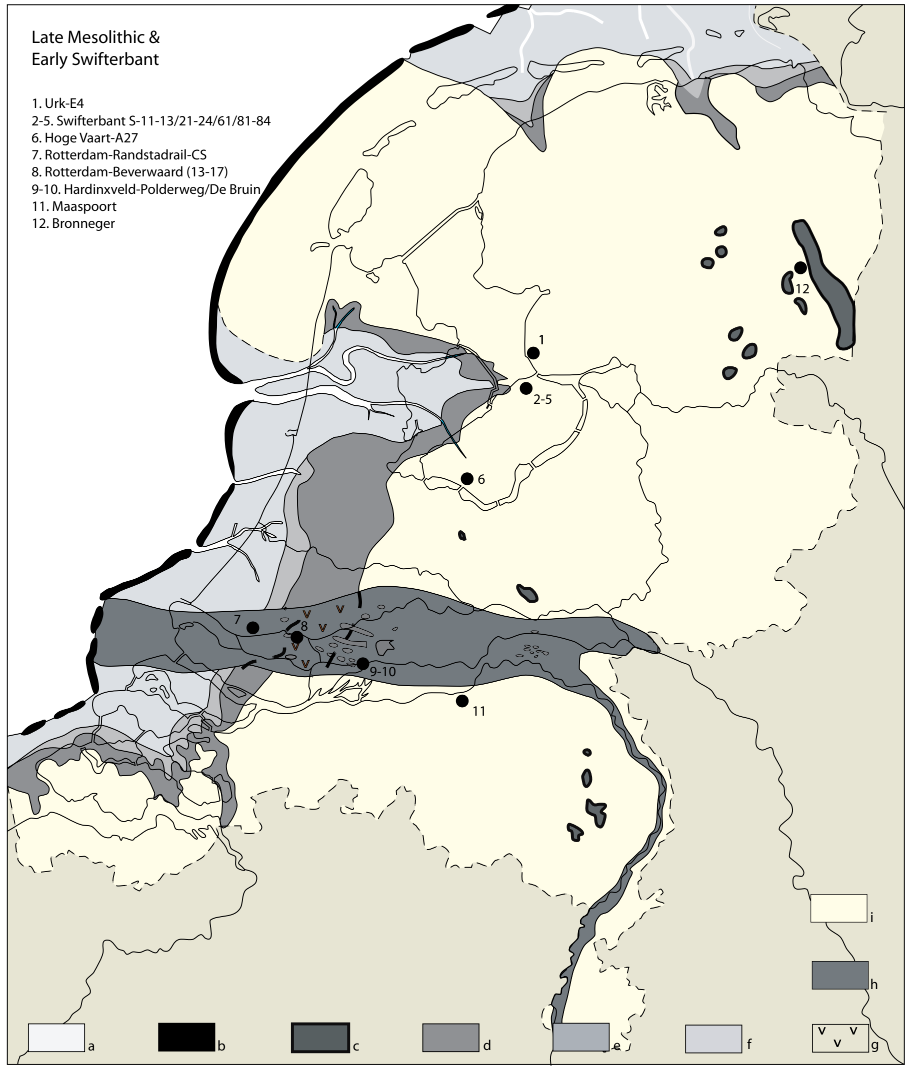


Fig. 8.2 Late Mesolithic and Early Swifterbant sites plotted on the palaeogeographical map for the Early Atlantic period, c. 5700 cal BC (adapted from plate 2 in: Van Gijssel/Van der Valk 2005). Legend: a: open water; b: coastal dunes and beaches; c: raised bog; d: fen peat; e: salt marsh and clay deposits; f: tidal flats; g: local peat formation; h: fluvial deposits and peat marsh; i: Pleistocene uplands

food economy, points to a broad spectrum of activities, aimed at hunting, fishing and gathering, local production of artefacts and accumulation of raw material and products. Sunken dwellings point to a degree of structural investment and permanency, while the presence of burials may underline an attachment to place. The human remains indicate the presence of complete families. The organic and stone artefacts reflect an array of activities congruent with the range of tasks conducted at a base camp. Various artefacts point to the flow and accumulation of products to and at this site, substantiating its residential character (see 7.3.5). Convincing evidence regarding the nature of occupation was provided by the faunal remains. These point to an elaborate exploitation of the aquatic environment with a distinct seasonal character indicative of a winter base camp.

A similar function may be proposed for Hardinxveld-De Bruin phase 2, although the site also yielded distinct summer indicators. This may be explained by a continuation of a winter base camp function (perhaps as a follow-up of Polderweg) and occasional short-term extractive visits in summer (Louwe Kooijmans 2001b, 518), perhaps from the wetland margin. For the other periods of occupation at Hardinxveld (Polderweg phase 1/2 and 2, De Bruin phase 1) no singular season

site	date cal BC	region	location	seasonality	structures	economy+p	type
Hardinxveld-Polderweg 1	5500-5300	peat marsh	riverdune	winter	huts	h/g/f	seasonal
Hardinxveld-Polderweg 1/2-2	5100-4900	peat marsh	riverdune	winter/summer	hearth/concentration	h/g/f+p	extractive
Hardinxveld-De Bruin 1	5475-5100	peat marsh	riverdune	winter?	posts/pits	h/g/f	extractive
Hardinxveld-de Bruin 2	*c.* 5100-4800	peat marsh	riverdune	winter/summer	huts?	h/g/f+p	seasonal+extractive
Hardinxveld-de Bruin 3	*c.* 4700-(4450)	peat marsh	riverdune	winter/summer	huts?	h/g/f+p	seasonal+extractive
Rotterdam-Randstadrail-CS	*c.* 6250-4850	peat marsh	riverdune	indet.	hearths?	(h/g/f)	seasonal/extractive?
Rotterdam-Beverwaard (13-17)	*c.* 5800-5600	peat marsh	riverdune	indet.	hearth	(h/g/f)	seasonal/extractive?
Gouda-Goverwelle	*c.* 5500-4500	peat marsh	crevasse splay	indet.	posts	(h/g/f)	seasonal/short-term?
Maaspoort	6500-5500	wetl. margin	riverdune/ridge	summer?	hearths?	(h/g/f)	seasonal
Swifterbant S11-13/21-24/61/81-84	*c.* 6100-5000	wetl. margin	riverdune	indet.	hearthpits	(h/g/f)	short-term
Urk-E4	*c.* 6000-5000	wetl. margin	riverdune	indet.	hearthpits	h/g/f	short-term
Hoge Vaart-A27-2	5500-4850	wetl. margin	coversand ridge	indet.	hearthpits	h/g/f	short-term
Hoge Vaart-A27-3	4850-4500	wetl. margin	coversand ridge	indet.	hearths, posts, pits	h/g/f+p	seasonal/short-term
Bronneger	*c.* 4850-4550	upland	river side	-	-	-	special

Table 8.4 Basic variables of Late Mesolithic and early SWB sites in combination with inferred site-function; ('?') indicates little or no information; '/' indicates either/or. Hunter-fisher-gatherer economy is established or assumed; brackets indicate limited quantitative of qualitative evidence. Pottery (p) is indicated.

of occupation could be determined. Occupation at De Bruin phase 3 may be interpreted as similar to phase 2. The introduction of domesticates most likely took place at the end of this range and will be discussed for the next phase. The shift in occupation emphasis from Polderweg phase 1 to De Bruin phase 2 suggests the abandoned non-residential location may have been used simultaneously as a 'twin-site', possibly for extractive purposes (Louwe Kooijmans 2001[a], 456-457; 2003, 612). A complementary summer location for the winter occupation of Polderweg phase 1 may have been the wetland margin site of Maaspoort, *c.* 40 km southeast (Louwe Kooijmans 2001, 459). Other river dune sites in the peat marsh area also show evidence of Late Mesolithic or early Swifterbant occupation (see fig. 8.2). The evidence is non-conclusive with regard to site function or season of occupation. Occupation at Rotterdam-Randstadrail-CS may be comparable to the Hardinxveld sites. The recently discovered site at Gouda-Goverwelle may also be interpreted as a seasonal base camp, although current evidence does not argue against a temporary short-term location. This site is situated on a crevasse splay, widening our scope as to the landscape elements inhabited and perhaps the site functions associated with these.

Other sites are less informative, but provide a different emphasis for the period. The river dune and ridge locations of Swifterbant (S11-13/21-23/61/81-84), Urk and Hoge Vaart phase 2 are characterized by clusters of hearthpits. As argued earlier (Chapters 7 and 8), these may be associated with shorter residential stays. An exception is formed by Hoge Vaart phase 3. According to Peeters (2007) the site may be interpreted as an accumulation of short-term hunting camps as identified for the isolated northern cluster, yet pottery (production), pits, posts and evidence for the presence of children point to an, at least at times, more consistent residential function. A site such as Bronneger, situated in a stream valley on the upland, forms an example of other potential site functions, most likely of a ritual character.

8.1.3.2 Different rates of residential mobility

The association of sites with certain types of mobility strategies (*cf.* Binford 1980; 1982; Kelly 1995) and their 'translation' into settlement systems is hampered by the limited number of informative sites. Hypothetical locations have been added to complement the picture. The settlement systems presented in fig. 8.1 are coupled with the modelled mobility strategies presented in fig. 8.3. Starting with the best information available, the winter base camp at Hardinxveld points to a logistical system of mobility with two to three seasonal residential bases (see Louwe Kooijmans 2001[a], 455). The auxiliary function of De Bruin and later Polderweg (when the main occupation shifted from one to the other), as well as the potentially subsidiary function of De Bruin (as an extractive summer location; model E) during phase 2, confirm the existence of logistical system with extractive sites. This may also be assumed for other river dune sites in the donken area. Considering the limited number of moves and long seasonal stays, it is likely that other locations were situated in complementary environments, making Maaspoort and the wetland margin in general a likely candidate (model B). From there the (seasonal) terrestrial resources of the upland may have been exploited, without abandoning the benefits of the nearby wetlands. These locations may also have served as a starting point for more wide-ranging resource expeditions (*e.g.* flint).

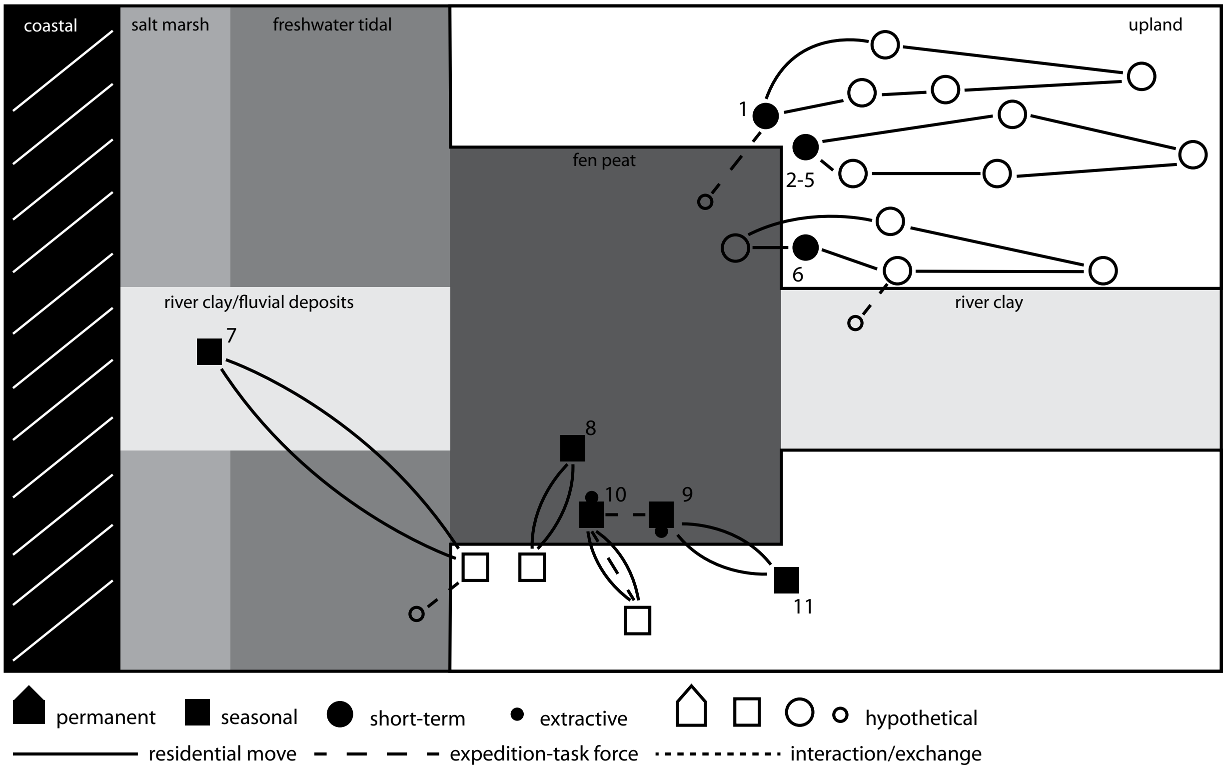


Fig. 8.3 Cartogram of the potential settlement systems and mobility for Late Mesolithic and Early Swifterbant sites. Note that the coastal area at this time was uninhabitable due to the insufficient closure of the coastal barriers and dynamic marine incursions. All site relations are hypothetical.

The inferred logistical mobility of the river dune sites contrasts with the view of mobility further north. The hearthpit sites of Swifterbant, Urk and Hoge Vaart appear to be similar. albeit smaller. versions of locations further inland (*e.g.* Mariënberg, Verlinde/Newell 2006), characterised by shorter stays and increased residential mobility. The wetland margin location of these sites indicates that the wetlands may have been exploited from these locations, or as a next move (model C). Interestingly, occupation of Hoge Vaart phase 3 demonstrates a different use of the site, perhaps related to the increasingly wet conditions surrounding the site. While short-term hunting camps may explain part of the archaeological patterning, certain features (*cf. supra*) point to a more intensive use. The site may have functioned in a residentially mobile system, probably extending into the uplands during other parts of the year, in line with the already mentioned hearthpit sites (model C), or formed a seasonal base in a logistical system (model B).

In conclusion, both logistically mobile systems as well as residentially mobile systems characterize this phase. A crucial factor is the position and importance of aquatic resources as these generally are recognised to provide a reliable and rewarding environment for lowering residential mobility (see Chapter 8; Ames 2002; Binford 1990; Nicholas 1998[a,b]; 2007[a,b]; Zvelebil 2003[b]). Whether distinct combinations exist is unclear. Hoge Vaart phase 3 may represent an intermediate position. The likelihood of a combination of strategies depends on the extent to which the place-bound investment in certain sites may be combined with the different characteristics of mobility and food procurement in residentially mobile systems with a predominantly terrestrial upland focus (model C'). Seasonal group fissioning resulting in smaller family units may form an explanation.

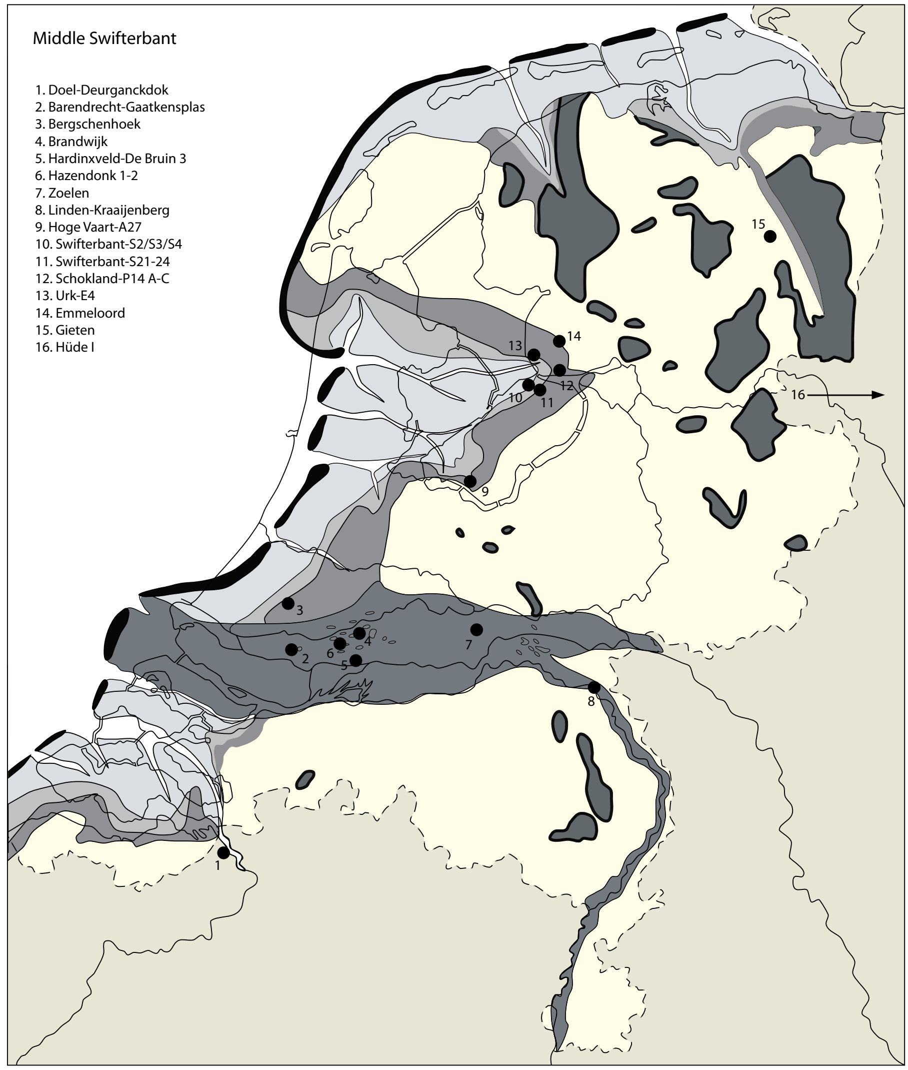


Fig. 8.4 Middle Swifterbant sites plotted on the palaeogeographical map of the Late Atlantic period, c. 4200 cal BC (adapted from plate 3 in: Van Gijssel/Van der Valk 2005). See fig. 8.2 for legend.

8.1.4 Middle Swifterbant (c. 4500-3800 cal BC)

The number of informative sites that was selected for this phase is substantial, although the quality varies. Exemplary is the high-resolution image of the special activity site of Bergschenhoek as opposed to the temporal palimpsest (*cf.* Bailey 2007) of Schokland-P14. Furthermore, the difficulties noted regarding the preservation and interpretation of botanical and faunal remains (*e.g.* local production as opposed to import of crop products) influence attributed site functions. The sites are mapped in fig. 8.4.

8.1.4.1 Attribution of function

The sites selected for this phase, with some exceptions, mainly cluster in the middle phase of the Swifterbant period, *c.* 4600-3800 cal BC (see table 8.5). Domesticates and cultigens now complement the economic picture at some locations. This indicates that changes to the settlement system may have taken place, especially as agriculture is expected to be a pull-factor for sedentism (Kent 1989, 6-7; Raemaekers 1999, 120). However, for these semi-agrarian communities other options appear equally realistic (*cf.* Louwe Kooijmans 1993[a], 90).

With respect to permanency, none of the selected Swifterbant sites meet the criteria discussed for year-round occupation. There are no sites with durable houses. The evidence available (S3; Hüde I; P14) points to frequently repaired or rebuilt, relatively lightweight shelters or huts that appear to be of a short-term, seasonal nature. The contribution of domesticates never exceeds 20% (see fig. 7.4), except at Swifterbant-S3 (34%) and S2 (38%). At these sites pigs dominate the domestic spectrum and these may also be reared sustainably in a nomadic or mobile system (*e.g.* Albarella *et al.* 2007). Sheep and goat are absent at S3. Furthermore, there is no clear-cut evidence for crop cultivation in the form of indisputable fields with ard marks. Crop processing evidence does not imply local production and for some of the sites in the delta import of cereals remains a likely option (Out 2009, 423). The recently discovered potential field at Swifterbant-S4, may, in combination with palynological and other evidence point to local cultivation (Huisman/Raemaekers 2008; Huisman *et al.* 2009), yet this will have been small-scale and of limited economic importance (Cappers/Raemaekers 2008). It could have been embedded in seasonal visits, especially when spring sowing is assumed, as at Swifterbant-S3 (Out 2009, 422).

The presence of indicators for non-permanent use at certain sites, such as houses of limited durability, limited site structuration etc. and the absence of indicators for year-round permanency at these places, implies that residential sites are likely of a seasonal nature. Some sites provide a handle on the season of use. The character of the Swifterbant occupation of the river dunes and for instance the Hazendonk may be seen as a follow-up to Hardinxveld-Polderweg and De Bruin (phase 1 and 2 respectively; see Louwe Kooijmans 2001[b], 518). Limited evidence on seasonality (mainly based on fauna) points to a presence in various seasons (*e.g.* Zeiler 1997, 86, 99). No particular season of use could be determined.[1] The find of chess (*Bromus secalinus*) in the Hazendonk 1 layer (Bakels 1981, 143) may be interpreted as a winter indicator but points to import of cereals at the Hazendonk (Out 2009, 423) and seems confirmed by the associated weed assemblages. Faunal evidence at Brandwijk remains inconclusive with respect to seasonality. The location and characteristics of the site favour a comparison with the Hazendonk.

The Swifterbant levee site S3 yielded seasonal evidence for an occupation from spring to autumn with occasional winter visits (Zeiler 1997, 87). This scenario seems to be confirmed by the argument that winter floodings may have hampered occupation in that season (Raemaekers 1999, 117). The presence of one or two dwelling structures, in combination with consistent reuse of the location and a broad spectrum of resources used, including domesticates and cultigens, affirms its residential role. Seasonal evidence at Swifterbant S2 and S4 was inconclusive. The similarities in setting and archaeology between these three locations, however, point to similarities in function. From this it follows that the potential field discovered at S4 (Huisman/Raemaekers 2008; Huisman *et al.* 2009) may be interpreted as functioning within a non-permanent settlement system.

A seasonal domestic function also applies to Hüde. Hut features, finds and a broad spectrum economy convincingly point to a residential function, yet the light hut structures in combination with evidence of seasonal flooding suggest a non-permanent use. Most evidence on seasonality points to a presence in summer

site	date cal BC	region	location	seasonality	structures	economy w/d/wd+c	type
Brandwijk-L50 (base/top/40-50)	*c.* 4200-3900	peat marsh	riverdune	indet.	posts?	133 / 36 / 164 + c	seasonal
Hardinxveld-De Bruin 3 (end)	(4700)-4450	peat marsh	riverdune	winter/summer	pits	475 / 0 / 61	extractive
Hazendonk 1+2	*c.* 4000-3800	peat marsh	riverdune	summer/winter	pits?	118 / 26 / 17 + c	seasonal+extractive?
Bergschenhoek	*c.* 4300-4000	freshwater tidal	lake margin	winter	platform	9 / 0 / 2	extractive
Swifterbant-S2	*c.* 4500-4000	freshwater tidal	levee	indet.	stakes, graves	369 / 231 / 0 + c	seasonal
Swifterbant-S3	*c.* 4300-4000	freshwater tidal	levee	summer	hut	2528 / 1297 / 0 + c	seasonal
Swifterbant-S4	*c.* 4300-4000?	freshwater tidal	levee	indet.	field?, grave	indet. + c	seasonal
Swifterbant-S21-24	*c.* 4450-3800	peat marsh	riverdune	indet.	graves	indet.	seasonal
Schokland-P14 A-C	*c.* 4400-3600	wetland margin	outcrop	summer/yearround?	graves, posts?	464 / 67 / 357 + c	seasonal
Urk-E4	*c.* 4300-3900	wetland margin	riverdune	indet.	graves, hearths	68 / 39 / 107 + c	seasonal
Hüde I	*c.* 4450-3500	upland	lake margin	summer/winter	huts,hearths, posts	1708 / 49 / 0	seasonal + extractive?
additional sites							
Hoge Vaart-A27-4	4350-4100	peat marsh	ridge	indet.	fish weirs	indet.	extractive
Emmeloord-J97	*c.* 3650-3350	wetland margin	levee	indet.	fish weirs	w / d	extractive
Doel-Deurganckdok-B	4550-3960	wetland margin	ridge	indet.	hearth(pits)	25 / 0 / 0 + c	short-term?
Barendrecht-Gaatkensplas	*c.* 4200-3800	freshwater tidal?	levee	indet.	hearths?	w / d? + c	seasonal?
Zoelen	*c.* 4200-3900	river clay	-	-	grave	-	special
Linden-Kraaienberg	*c.* 4000	river clay	dune	-	pits/posts	-	seasonal?
Gieten	*c.* 4050-3450	upland	pingo	indet.	-	-	-

Table 8.5. Basic variables of selected Middle Swifterbant sites in combination with inferred site-function; ('?') indicates little or no information; '/' indicates either/or.

(see Appendix I; Boessneck 1978; Hübner *et al.* 1988). The botanical and faunal information on seasonality at P14 points to a seasonal presence between spring and autumn (Gehasse 1995, 67) although visits in other seasons cannot be ruled out. With respect to cultivation practices there is no evidence for cultivation at the outcrop of P14 (Gehasse 1995, 61), and insufficient evidence at Urk-E4 (Out 2009, 417, 424). Nor is there convincing evidence for sturdy housing. In view of the other locations it therefore seems that a permanent occupation of P14 is unlikely (*contra* Raemaekers 1999, 117).[2]

Apart from these seasonal sites, a number of other locations may be mentioned that have an extractive or specialist function. Emblematic is the fishing and fowling camp of Bergschenhoek (*e.g.* Louwe Kooijmans 1987). The faunal spectrum in combination with the structural characteristics of the site underline its extractive function in a yearly routine (see Appendix I). The spectrum of bird and fish remains points to a seasonal presence in winter. Other sites such as Hoge Vaart phase 4 and Emmeloord represent extractive locations specifically aimed at fishing. The continuity of these extractive practices at Emmeloord into the Late Neolithic points to the consistency in use of these locations. Another site that may have been of an extractive nature is Hardinxveld-De Bruin phase 3. While seasonal information, in combination with some of its features enable an interpretation of this location as a successor to the base camp function of phase 2 (*cf. supra*), in combination with incidental summer visits (Oversteegen *et al.* 2001, 266) of a potential extractive nature, the overall diminished size of the site (25 x 25 m) rather points to a main function as extractive location (Louwe Kooijmans 2001[b], 514-515). This may have been a gradual development. However, it should be noted that all four domesticates are present at the site at the end of phase 3, although this may have involved quarters instead of live animals, with the exception of pig (*e.g.* Louwe Kooijmans 2007[a]). Sites such as Zoelen and (earlier) Bronneger form an example of other potential site functions aimed at ritual practices such as burial and deposition.

8.1.4.2 Absence of permanency

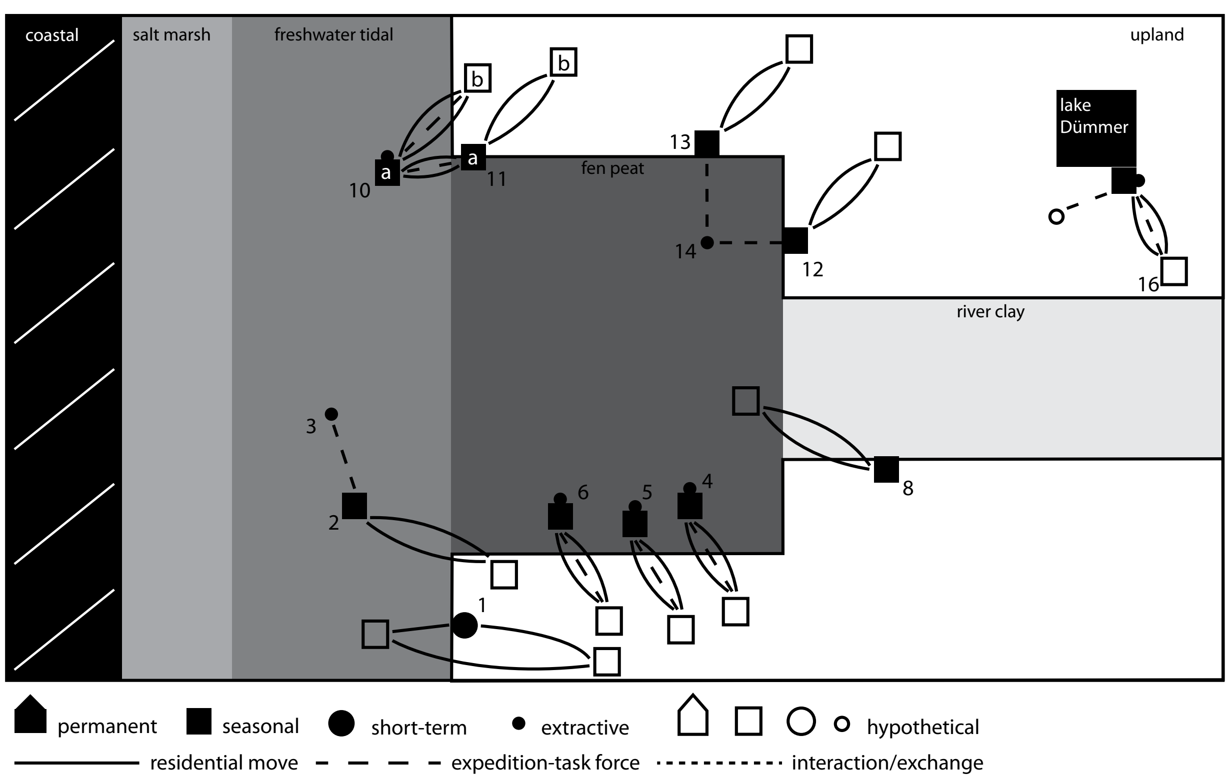
The settlement system belonging to this phase points to a classical system of logistical mobility (model B; *cf.* Binford 1980). Fig. 8.5 presents a model incorporating some of the sites mentioned. It is important to underline here that the ingredients of the extended broad spectrum economy (Louwe Kooijmans 1993[a]; 1998[a]) are combined distinctly with mobility. This involves both animal husbandry and crop cultivation. Since some evidence points to import of crop products, especially for sites in the delta region (*cf.* Out 2009, 423), the limited indications existing for local cultivation at other sites, most notably Swifterbant S3 and S4 (see Out 2009, 424) initially should be interpreted as small-scale, seasonal practices that were rather of an additive nature (*cf. supra*; see also Cappers/Raemaekers 2008).

The seasonal nature of the system raises the question where the (potential) counterparts of the identified sites may be found. Although hard to determine these may point to other (complementary) ecological zones. It, for instance, is plausible that Hardinxveld-De Bruin phase 3, if of a residential nature, functioned in the same system as the previous phases, whereby a location such as Maaspoort remains a plausible counterpart. Linden-Kraaienberg, Brandwijk and the Hazendonk may have operated in comparable systems. Similar suggestions have been made for the

Swifterbant levee sites. Raemaekers (1999, 117) argues that the nearby river dune sites probably formed a dry alternative for the wet winter season (fig. 8.5 option 'a'). If the exploitation of a different ecozone and other (seasonal) resources is required or opted, related sites would have been situated further afield (fig. 8.5 option 'b'). The limited indications for a winter visit may point to incidental returns (model E). Similar wet-dry scenarios, for instance, may also apply to other locations such as Urk-E4 and the Hüde I lake site, where upland settlement may be found within several kilometers. It, however, should not be ruled out that counterparts may be found in other regions. If P14 may be interpreted as a seasonal summer site, than its winter counterpart could be positioned elsewhere, more to the west. Both the winter base camp function of Polderweg as well as the ability to deal with and counter wet living circumstances as demonstrated at Bergschenhoek, Swifterbant-S3 and Hüde I should prevent us from perceiving the wetlands as uninhabitable in the winter half of the year. On the other hand, and in contrast to the previous period, it is evident that both animal husbandry and crop cultivation now form part of the economy. Where their role increases in importance, this of course benefits from dryer, more stable locations at some point during the year. Finally, a site such as Barendrecht-Gaatkensplas demonstrates that not only river dunes were targeted for occupation. The location may have formed a counterpart for the extractive use of a site like Bergschenhoek.

In relation to the seasonal system mentioned above, sites such as Bergschenhoek, Emmeloord and Hoge Vaart phase 4 functioned as relatively fixed extractive locations for these sites. The attachment to place at these locations may have been no less than at residential sites. There are also seasonal indications for short-term,

Fig. 8.5 Cartogram of the potential settlement systems and mobility for Middle and Late Swifterbant sites. Note that the coastal area at this time was stabilizing, although there is no evidence regarding the nature of its use. All site relations are hypothetical.



potentially extractive visits at otherwise seasonally inhabited residential sites, for instance at Swifterbant-S3 (winter) and Hüde I (winter). At the Hazendonk (phase 1 and 2) there are winter indicators as well, but it is not clear what the main season of use was. In any case, evidence at these sites points to an alternating use of the same locations, potentially within the span of a year (see Binford 1982).

Concluding, as illustrated in fig. 8.5, a logistical, seasonally mobile settlement system, using two or more ecozones and incorporating relatively fixed extractive sites characterizes this period. Some sites provide a nuance. The Swifterbant river dune sites of S21-24, for instance, did not provide enough (organic) evidence to be able to place them on a functional par with the levee sites. In line with the previous period, their nature may have been more short-term, although this is hypothetical. Similarly Doel-Deurganckdok is characterized by an absence of domesticates and activities aimed at hunting, fishing and gathering. Some of the material clusters in small patches and the main features detected are probably hearths (Crombé *et al.* 2004, 106; clayey patches). This brings to mind similarities with the hearthpit sites of Swifterbant and Urk and therewith of potentially short-term locations (model C). This would point to more extensive mobility, perhaps in combination with exchange (see for instance model C and C' or D3). In view of the other sites it is also plausible to suggest Doel was a short-term site in an overall system of logistical mobility with seasonal sites (model B). Diverse evidence of sites situated further afield, such as Gieten, Winterswijk, Meppel and Heemse (see Appendix I) as well as the distribution of perforated wedges and stone axes (see Raemaekers 1999, fig. 3.35 and 3.36) also point to the widespread use of the upland, although this need not be residential in nature.

8.1.5 Hazendonk group and Late Swifterbant (c. 3800-3400 cal BC)

The following period involves the occupation of the Hazendonk group as well as contemporary Late Swifterbant sites (Schokland-P14-D-E). Although the phenomenon of Hazendonk ware is geographically more elaborate (for instance incorporating the Meuse valley; Amkreutz/Verhart 2006), the emphasis here lies with excavated sites in, or verging on the Rhine-Meuse delta, in the coastal area, the peat marsh area and the eastern river clay area (see also Louwe Kooijmans 2006[b], 168). Virtually all of the southern coversand area is void of any diagnostic Neolithic pottery (as well as other indicative artefacts). The sites are mapped in fig. 8.6.

8.1.5.1 Attribution of function

In contrast to the previous periods, this phase is characterized by convincing evidence of year-round permanency, based on a combination of arguments regarding location, economy, housing, investment, group composition site structure and seasonality. Apart from these sedentary locations, other sites were used in a non-permanent manner. Unfortunately differential preservation and diverging excavation methodology hamper a singular attribution in those cases. The sites are presented in table 8.7.

The most convincing evidence for year-round permanency has come to light for the coastal Delfland region, with the recently published sites of Schipluiden-Harnaschpolder (Louwe Kooijmans 2006[a]; Louwe Kooijmans/Jongste 2006),

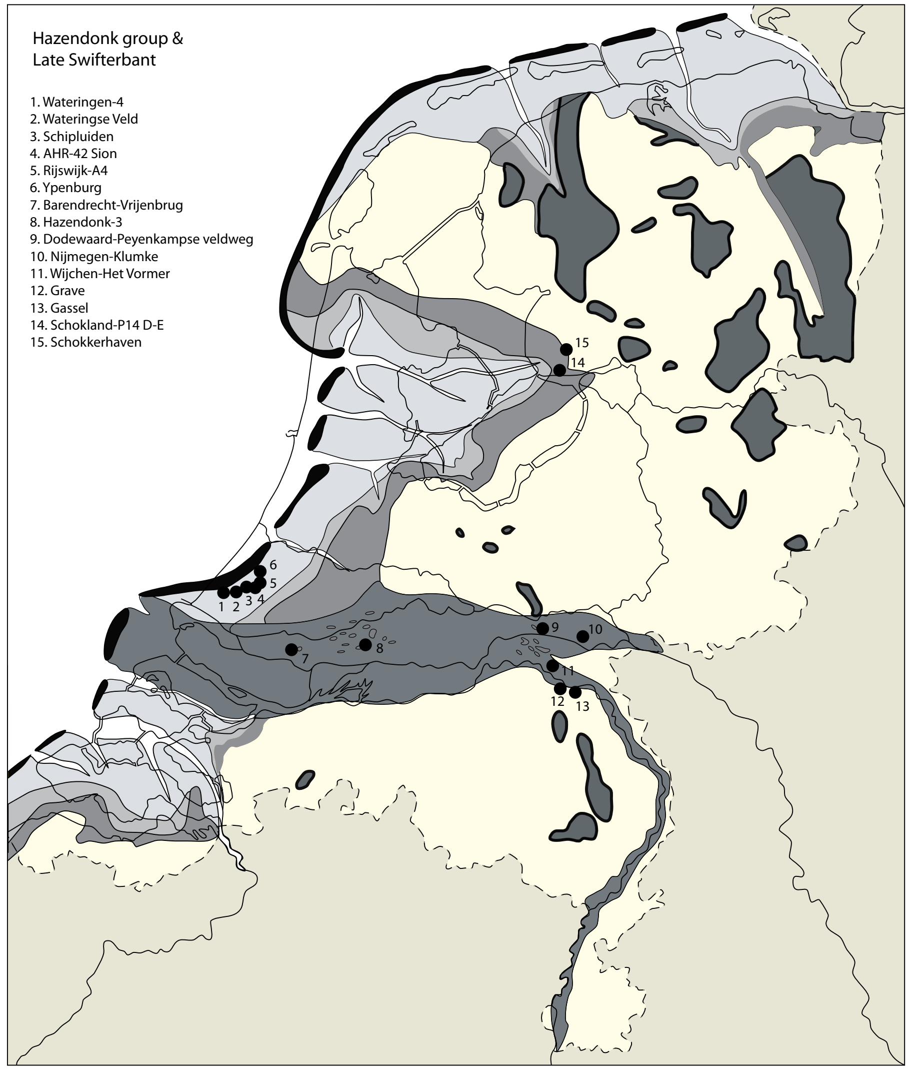


Fig. 8.6 Hazendonk group sites plotted on the palaeogeographical map of the Late Atlantic period, c. 4200 cal BC (adapted from plate 3 in: Van Gijssel/Vander Valk 2005). Schokland-P14 D-E (Late Swifterbant) is included as well. See fig. 8.2 for legend.

Ypenburg (Koot *et al.* 2008) and an analysis of several locations in the Delfland region (Louwe Kooijmans 2009). The various arguments brought to light, some of which have been mentioned above (see Koot *et al.* 2008, 480-481; Louwe Kooijmans 2006[a], 486; 2007[a], 299-305; 2009, 39; see also Appendix I) will not be discussed further here, but provide a firm footing for the permanent (albeit at times interspersed) character of occupation at Schipluiden and Ypenburg. Other locations such as Rijswijk-A4 (nearby and possibly related AHR-42) and Wateringen-4, by extension, may or have been interpreted along similar lines, based on their geographical vicinity and, in the case of Rijswijk, the domestic faunal spectrum (see also Raemaekers *et al.* 1997, 187). Internal differences in composition, layout etc. of Ypenburg, Schipluiden and Wateringen have been interpreted as local expressions of a similar settlement form (Louwe Kooijmans 2009, 39). Wateringen-4, however, also forms a cautionary tale; although a year-round occupation cannot be excluded, there are no clear seasonal indicators for a presence in winter (Louwe Kooijmans 2006[b], 170-171).[3] Furthermore, it can be argued that the number of extractive sites related to the coastal occupation may be limited as a number of complementary ecological regions may be reached

sites Delfland	excavation	size	structure	Nfeatures	Npottery	Nflint
Schipluiden	5500 m^2	70 x 120	clustered	4609	29957	15405
Ypenburg	40.000 m^2	150 x 750	dispersed	2300	>1361	15515
Wateringen-4	2400 m^2	45 x 60	clustered	134	*c.* 4000	1065
sites eastern riverine area						
Nijmegen-Klumke	2900 m^2	100 x 50	-	7	186	321
Wijchen-Het Vormer H	-	12 x ?	-	1	614	41
Wijchen-Het Vormer N	-	50 x 60	-	2	328	52
Gassel	445 m^2	20 x20	concentrated	-	2225	214
Grave-Pater Berthierstraat	80 m^2	-	dispersed	3	192	107

Table 8.6. Several characteristics of Hazendonk sites in the Delfland coastal area and the eastern river clay area.

within the daily radius of 5-10 km (pers. comm. Louwe Kooijmans 2011; Louwe Kooijmans 2006[a]).

Another cluster of Hazendonk sites is located *c.* 150 km further east on several dunes in the wetland margin and river clay area. Unfortunately the limited preservation at these locations prevents a proper functional attribution. Apart from pottery and flint, the sites yielded some posts and pits, but no houses could be determined. Most information was derived from the excavation at Nijmegen-Klumke (Ball/Van den Broeke 2007). The faunal spectrum is dominated by cattle (N=24) in contrast to red deer (N=5) and indeterminate identifications of pig/ wild boar (N=24). Cereal remains point to the presence of emmer (Out 2009, 250). Regarding site location and taking into account the economy of Klumke, a site function similar to the sedentary locations of Delfland may be assumed. There are, however, slight differences with respect to site size, number of features and finds. Although these all relate to factors of preservation and excavation, a difference in scale and intensity of occupation may be noted, possibly indicating a difference in function (see table 8.6). This is apparent especially if the category flint is compared since this should preserve more or less equally and be in equal need. If it is accepted that the reflection of the 'Delfland-sites' would not be different when 'transported' to the eastern riverine area, then it should be concluded that either occupation duration and intensity, or, perhaps less likely, site function were different.

A further site, the Hazendonk, is situated in the peat marsh area. The site location largely explains the different character of habitation. Emphasis was placed on hunting and gathering with an important role for otter, beaver and wild boar, in line with previous use of the site (*cf. supra*; Louwe Kooijmans 2006[b], 170). This seems to correlate to the general absence of features (although some of these may have been situated on top of the dune). The scarce seasonal information may be interpreted as pointing to a use during multiple seasons (*ibid.*; *cf. infra*), which, in combination with the other site characteristics, will have been non-permanent. In relation to the consistency in use of this location and the (extended) broad spectrum of resources exploited or used (see also Zeiler 1997, 85), a function as a seasonal base camp may be expected or a role as a multi-seasonal subordinate site. Whether a site such as Barendrecht-Vrijenburg may be interpreted along similar lines remains unclear due to the limited information available for this location. However, it does point to an exploitation of the freshwater tidal environment and a site location choice involving a levee.

site	date cal BC	region	location	seasonality	structures	economy w/d/wd+c	type
Schipluiden	3630-3380	coastal plain/salt marsh	low dune	year-round	posts, pits, wells, fence, graves	2872 / 4609 / 0 + c	permanent
Ypenburg	3860-3435	coastal plain/salt marsh	low dune	year-round	houses, pits, wells, graves	182 / 177 / 0 + c	permanent
Wateringen-4	c.3625-3400	coastal plain/salt marsh	low dune	year-round?	houses, pits, wells	284 / 173 / 153 + c	permanent?
Rijswijk-A4	*c.* 3800-3400	coastal plain/salt marsh	low dune	year-round	wells, ditch	24 / 1 / 0 + c	permanent
Hazendonk-3	3670-3610	peat marsh	river dune	indet.	-	408 / 37 / 0 + c	seasonal
Nijmegen-Klumke	3770-3530	river clay	dune	indet.	posthole, pits	7 / 25/ 24 + c	seasonal?
Wijchen-Het Vormer	*c.* 3800-3400	wetland margin	low dune	indet.	depression?, pit	-	seasonal?
additional sites							
AHR-42-Sion	3640-3380	coastal plain/salt marsh	low dune	indet.	posts, postholes	0 / 2 / 5 + c	permanent?
Wateringse Veld	*c.* 3800-3400	coastal plain/salt marsh	low dune	indet.	+	-	seasonal?
Barendrecht-Vrijenburg	3650-3380	freshwater tidal	levee	indet.	-	w / wd + c	seasonal?
Gassel	*c.* 3800-3400	wetland margin	dune	-	depression	-	seasonal/short-term?
Grave-Pater Berthierstraat	*c.* 3800-3400	wetland margin	dune	-	posts, pit	-	seasonal?
Dodewaard	*c.* 3800-3400	river clay	crevasse	indet.	ditch	w / d / wd + c	seasonal?
Schokland-P14 D-E	*c.* 3600-3300	wetland margin	outcrop	indet.	graves, posts?	16 / 29 / 24	seasonal
Schokkerhaven	*c.* 3950-3720	wetland margin	river dune	indet.	-	w / + c	seasonal?

Table 8.7. Basic variables of selected Hazendonk sites in combination with inferred site-function; ('?') indicates little or no information; '/' indicates either/or. Also presented are the Late Swifterbant sites of Schokland-P14 and Schokkerhaven.

Another location is the Late Swifterbant site of Schokland-P14 D-E. The use of this location during the later Swifterbant culture mainly seems to point to continuity from the previous period onward. The somewhat higher domestic ratios in layers D-E compared to the previous period (*cf.* Gehasse 1995, 53) should be seen in view of the limited number of bones from these layers. Most post features have been dated relatively to the late Swifterbant culture (Ten Anscher 2000/2001, 84). Based on these considerations the site is interpreted in line with its previous use as a seasonal base camp. The nearby location of Schokkerhaven is characterized by wild faunal remains as well as cereals, but does not allow any further nuance with regard to site function.

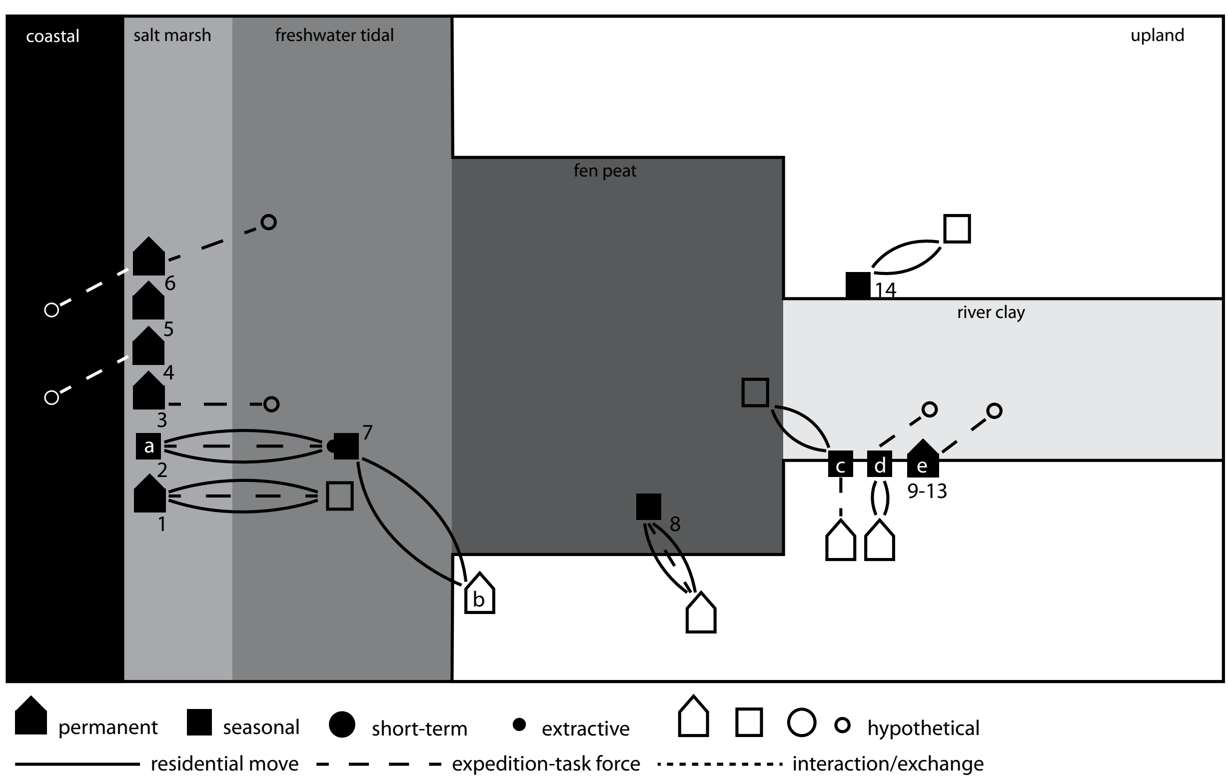
8.1.5.2 Not all is permanent

A model of the settlement system of the Hazendonk group is depicted in fig. 8.7 Evidently the sites situated in the Delfland area functioned as the first permanent settlements (see Louwe Kooijmans 2009). These year-round inhabited locations form the residential and functional bases from which the environment was exploited. This may happen in conjunction with extractive locations, most likely situated in complementary ecozones such as the peat marsh or freshwater tidal area (model A). Two additional remarks, touched upon earlier, should be made. The first of these concerns the notion that while the Delfland region may have provided the most suitable area for permanent settlement, this was predominantly a conscious cultural choice. Evidence of this may be found, for instance, at Schipluiden where during occupation the direct environmental conditions of the site changed from brackish to fresh and the inhabitable area slowly decreased. The economic range and ratio aspects, however, remained constant (Louwe Kooijmans 2006[a], 64). Secondly and building upon this, against an ecologically largely similar background different habitational and economic choices were made between nearby settlements, which underline this element of choice and group agency involved (see Chapter 6; Louwe Kooijmans 2009, 51). Against this background the role of Wateringen-4 in the settlement system may be understood as one of the composite parts of Ypenburg (Koot *et al.* 2008) and therewith as a permanent location. One could also stress the increased importance of hunting red deer at this site (see table 7.4a), the absence of seasonal signal and the less intensive rebuilding and repairing of the dwelling structure as an indication of a non-permanent use, but that may over-stretch the argument. A non-permanent use has been suggested distinctly for the dunes in use at the Wateringse Veld (Bakker/Burnier 1997; Louwe Kooijmans 2009), although a more precise functional attribution is still lacking there.[4] If Wateringse veld (and perhaps Wateringen) functioned as seasonal settlements, then it is likely its counterpart was situated in a different ecozone (model B, or E). So far evidence for this is lacking. At a distance of *c.* 40 km, the levee site of Barendrecht-Vrijenburg situated in the freshwater tidal area would provide such a counterpart, especially in view of the later Vlaardingen evidence. This option has been visualized (option 'a'). Barendrecht, however, may also have functioned in relation to a permanent settlement in the wetland margin (option 'b'), while Wateringse veld could have been a special purpose location in relation to one of the other coastal sites.

Further east in the river clay area and wetland margin area the characteristics and different reflection of Hazendonk sites, prevent a functional attribution as permanent location analogous to the Delfland settlements. Either we are dealing with permanent locations with a shorter or different use-life (model A), or with temporary seasonal sites perhaps related to cattle herding and potentially in function of permanent upland coversand sites (model D4), or even through a network of exchange (model D1). These upland counterparts may be situated at a short distance to the south, yet none have been discovered so far. Among the river-clay sites the small size of the concentration at Gassel and the presence of a possible hut (Verhart/Louwe Kooijmans 1989, 105-107), may underline the temporary nature of some locations. If taphonomic factors are not completely responsible for the different character of these sites in the eastern riverine area, then a seasonally mobile component in the settlement system should assumed. The three options mentioned above have been marked in fig. 8.7, with 'c', 'd' and 'e'. Based on the combination of evidence available, option 'e' may be most likely for Nijmegen-Klumke.

The continued (logistical) mobility in this period is perhaps best attested by the Hazendonk. Although there is no single season of occupation, use of the site should be interpreted as temporary. Based on the character of the finds and the focus in the faunal spectrum on otters, beavers and increased large game hunting, two options spring to mind. The first is that of a specialist extractive location in relation to an agricultural settlement on the wetland margin (model A, with an extractive location in a different ecozone), perhaps situated in the vicinity of Maaspoort (see Louwe Kooijmans 2006[b], 169-170). The thickness and extent of the occupation layer, the spectrum of finds including pottery and the broad spectrum nature of the economy including fish, birds, domesticates as well as

Fig. 8.7 Cartogram of the potential settlement systems and mobility for Hazendonk sites. Note that the coastal area at this time was available. All site relations are hypothetical.



(imported) emmer and barley, however, somewhat contradicts visits of a short-term extractive nature aimed at trapping otter and beaver. In this light the location may be seen as a successor to earlier Swifterbant use of the site, in which case it was used as a seasonal base camp. This might have functioned within a logistical, seasonally mobile system (model B), or within such a system, in connection to permanent settlements on the wetland margin or upland (model D1). Based on the current evidence a distinct choice cannot be made. In view of the Delfland sites and potential function of the Hazendonk sites in the riverine area, a subordinate role would be likely. This would position the Hazendonk in an auxiliary, but not strictly seasonal, relation towards permanent settlements on the wetland margin (model D4). This option has been depicted in fig. 10.15. In contrast the site P14 seems to represent a more general domestic function. This argues against a subordinate role in relation to more permanent sites elsewhere and in favour of a counterpart, located in a complementary ecozone (model B).

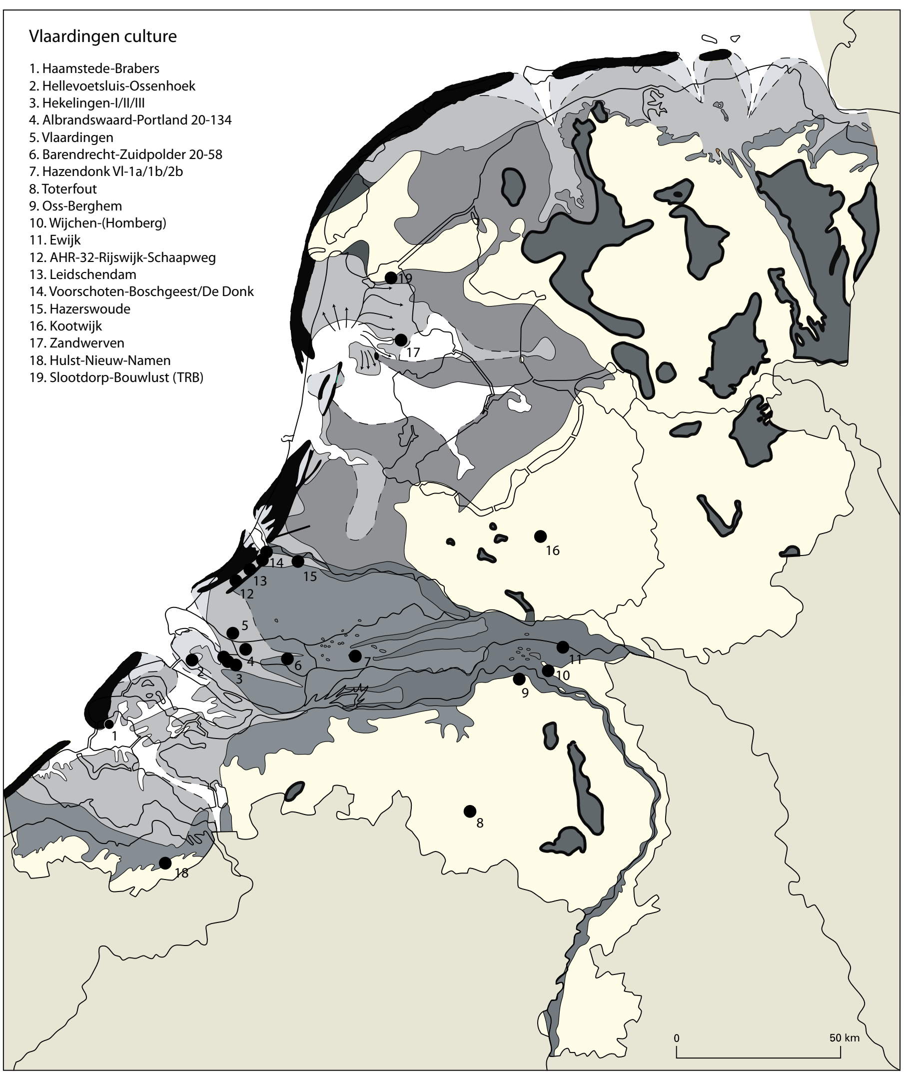


Fig. 8.8 Vlaardingen culture sites and the TRB site Slootdorp, plotted on the palaeogeographical map of the Early Subboreal period, c. 3000 cal BC (adapted from plate 4 in: Van Gijssel/Van der Valk 2005). See fig. 8.2 for legend.

8.1.6 Vlaardingen culture (c. 3400-2500 cal BC)

Finally the settlement system of the Vlaardingen culture will be discussed. Both well-excavated sites and several less informative locations have been included. Sites attributed to the Stein group, such as the recently discovered site of Veldhoven-Habraken (Van Kampen/Van den Brink in prep./2013), are not included, because they are situated further afield and because it is still far from evident how, or to what extent Stein and Vlaardingen interrelate (see Van Gijn/Bakker 2005; Verhart 2010[b]). The TRB wetland site of Slootdorp-Bouwlust has been included. The sites are mapped in fig. 8.8.

8.1.6.1 Attribution of function

Vlaardingen sites in the coastal region form a continuation of the increased evidence for sedentism that characterized the previous period. Several sites convincingly may be characterized as inhabited year-round. A number of other locations continue to provide a nuanced perspective regarding the overall degree of permanency in the settlement system and point to diverse choices being made. The sites are presented in table 8.8.

In line with the previous period the most convincing evidence for agricultural sites with year-round permanency is to be found in the coastal and salt marsh region. The evidence (*cf. supra*; durable houses, site location, dominance of domesticated species in the faunal spectrum, ard marks etc.), is not distributed evenly, probably due to differences in preservation and excavation methodology. Haamstede-Brabers, situated on the broad coastal barrier, yielded good evidence for a number of rather sturdy houses (Verhart 1992). Both Voorschoten (Boschgeest and de Donk) and Leidschendam yielded faunal spectra dominated by domesticated fauna, comprising all four species. The site of Rijswijk-Schaapweg confirmed this picture with butchering and consumption evidence of cattle, ovicaprids and pigs as well as chaff remains of emmer (Rieffe *et al.* 2006). In line with Schipluiden and Ypenburg, settlements located immediatly east of this zone, in the salt marsh area, are also largely characterized by a domestic agricultural signal. The sites of Zandwerven and recently Hellevoetsluis-Ossenhoek (Goossens 2009; 2010) also yielded ard marks (in combination with palynological information) and therewith distinct evidence for crop cultivation. Hellevoetsluis also provided evidence of durable structures, most likely houses and part of a palisade with deep posts. Based on these indications it is appropriate to designate the sites situated in the coastal and salt marsh area as agricultural settlements with year-round permanency. Hellevoetsluis, however, does point out the importance of wild resources. These contribute 40 % of the faunal spectrum. The many fish remains also point to the importance of this particular resource. The site therefore was not fully agricultural. Seasonal evidence indicates that fur animals and water fowl probably were hunted in winter (Goossens 2009, 138), but there is no evidence for absence in other seasons.

The freshwater tidal area, bordering on this region, is characterized by a different type of site. The area was probably less suitable for agriculture and year-round occupation (Raemaekers 2003, 744) and the faunal assemblages of Vlaardingen and to a lesser extent Hekelingen III are dominated by wild species. At Vlaardingen seasonal indicators (mammals, fish and birds) both point to a presence in summer as well as winter (birds; *cf. infra*; Clason *et al.* 1979; Louwe Kooijmans 1987, 250).

At Hekelingen III no distinct season of use could be determined (see Appendix I; Prummel 1987). The fish remains form a strong indicator for a presence between spring and autumn, the many bones of sturgeon pointing to a presence between May and July. The mammal info does not contradict this, although fur bearing species may have been hunted in winter. Some species of bird particularly point to winter presence. Perhaps Hekelingen and Vlaardingen were reused at that time for fowling activities.

The spatial layout and structures at both sites seem to confirm a limited degree of permanency. Both at Vlaardingen and Hekelingen the distribution of waste largely coincides with features and activity areas. The absence of a developed spatial segregation of habitation and disposal areas indicates a shorter-term stay (*sensu* Schiffer 1995). The evidence for dwelling structures confirms this idea. At Hekelingen there is evidence for small lightweight shelters or huts that were repaired and rebuilt, while Vlaardingen shows evidence of postclusters representing frequently rebuilt houses that are of a different nature than, for instance, the ones from Haamstede. Other Vlaardingen sites at Hazerswoude and Barendrecht currently do not seem to contradict such a conclusion (however, see Diependaele/ Drenth 2010, 145). The small-scale nature of the site of Albrandswaard (several hearths, hazelnut shells and burnt and unburnt fishremains) indicates the presence of extractive sites in this area.

For the peat marsh area the functional attribution of the Vlaardingen occupation of the Hazendonk is problematic. In line with the previous occupation (Hazendonk-3), the rather specialist faunal assemblage (otters and beavers), in combination with the wetland location of the site would argue in favour of a subsidiary function, perhaps as an extractive site in relation to wetland margin locations. On the other hand, domestic animals remain part of the faunal assemblage, albeit small. Vlaardingen-1b and 2b also yielded macroremains of crops, although these could of course have been imported. The seasonal evidence remains inconclusive, incorporating both summer as well as winter indicators (*cf. infra*; Zeiler 1997, 86), but there is evidence for some structural and artefactual investment. During Vl-1a a track of branches was made. A human skull also dates to this phase. Vl-1b yielded a canoe, a paddle blade, a bow, and a wooden bowl. Most striking was a wooden palisade surrounding and area of some 35 m in diameter (Louwe Kooijmans 1985; see Appendix I). In combination with the amount of pottery documented and the distribution of the waste layers and the amount of material it is plausible that the site was used intensively. Recently Louwe Kooijmans and Verbruggen (2011) argued that a part of the Hazendonk during VL-1b probably was used in a residential manner. The increased importance of terrestrial hunting (red deer and wild boar) contrasting with the more aquatic focus of the previous period (see Zeiler 1997) may also be brought in relation with this. Furthermore for Vl-2b a very slight increase in cattle should be noted (Zeiler 1997, 34), but may not be of significance. Based on these characteristics the Hazendonk sits uneasy, both with an extractive as well as a permanent site function. Although the specialist nature of the faunal assemblage at times argues against the more all-round (extended) broad spectrum of most seasonal sites, domestic species and resources were brought to the Hazendonk and investment and use-intensity seem to surpass the small-scale nature of extraction camps. Furthermore terrestrial hunting increased during phase 2b. Based on these considerations a seasonal domestic function, perhaps with an extractive function during another part of the

site	date cal BC	region	location	seasonality	structures	economy w/d/wd+c	type
Haamstede-Brabers	3340-2900	coastal	coastal barrier	-	houses (3), structures, posts	0 / 1 / 0	permanent
Voorschoten 2-5	*c.* 2900-2500	coastal	coastal barrier	-	-	42 / 263 / 0	permanent
Voorschoten 6-13	*c.* 2900-2500	coastal	coastal barrier	-	-	36 / 84 / 0	permanent
Leidschendam	*c.* 2850-2500	coastal	sand ridge	-	houses (2), granary?, posts	51 / 404 / 10	permanent
Zandwerven	*c.* 2700-2300	salt marsh	sand ridge	-	pits, posts, ard marks	1 / 47 / 0 + c	permanent
Hellevoetsluis	3000-2800	salt marsh	sand ridge	-	postholes, fence/palisade, ard marks	966 / 1364 / 0 + c	permanent
Vlaardingen	*c.* 3200-2600	freshwater tidal	levee	summer/winter	houses (2), posts, concentrations	1549 / 668 / 0	seasonal
Hekelingen-III	*c.* 3200-2800	freshwater tidal	levee	spring-summer/winter	concentrations, post clusters, burial (structure)	618 / 609 / 0 + c	seasonal
Hazerswoude	*c.* 2800-2500	freshwater tidal	levee	-	hearths, postholes	w / d / wd + c	seasonal
Hazendonk-VI-1a	3270-3090	peat marsh	river dune	-	track of branches	-	seasonal+ extractive?
Hazendonk-VI-1b	3260-2960	peat marsh	river dune	spring-autumn/winter	palisade	411 / 52 / 0 + c	seasonal+ extractive?
Hazendonk-VI-2b	2580-2480	peat marsh	river dune	spring-autumn/winter	-	302 / 24 / 72 + c	seasonal+ extractive?
Ewijk	*c.* 3100	river clay	levee	-	posts	20 / 528 / 1	permanent?
additional sites							
Voorschoten-De Donk	*c.* 2900-2500	coastal	sand ridge	-	hearths, pits, postholes	1 / 72 / 0	permanent
AHR-32-Rijswijk-Schaapweg	*c.* 2900-2500	coastal	coastal barrier	-	-	0 / 30 / 0 + c	permanent
Hekelingen-I	*c.* 3200-2800	freshwater tidal	levee	-	posts, pit	284 / 107 / 0	seasonal
Hekelingen-II	*c.* 3200-2500	freshwater tidal	levee	-	-	1 / 11 / 0	seasonal
Barendrecht-Zuidpolder 20-58	3343-2466	freshwater tidal	levee	-	post	w / d / + c	seasonal?
Albrandswaard-Portland 20-134	2877-2581	freshwater tidal	levee	-	hearths	w	extractive
Wijchen-Homberg	*c.* 3300-2900	wetland margin	dune	-	-	-	permanent?
Oss-Berghem	3300-2900	wetland margin	coversand	-	-	-	special?
Hulst-Nieuw-Namen	3400-2900	wetland margin	slope	-	-	-	permanent?
Kootwijk	3300-2900	upland	coversand	-	-	-	special?
Toterfout	3400-2900	upland	coversand	-	-	-	permanent?
TRB site							
Slootdorp-Bouwlust	3500-3100	salt marsh	artificial	autumn-winter/summer	house/hut, posts/stakes	462 / 256	seasonal

Table 8.8 Basic variables of selected Vlaardingen sites in combination with inferred site-function; ('?') indicates little or no information; '/' indicates either/or. Also presented is the TRB site Slootdorp-Bouwlust.

year would be most likely. For phase VL-1b such a seasonal residential function even seems a minimal option. This will be discussed further below.

Finally, sites in the wetland margin and upland areas complete the spectrum. Ewijk, located in the river clay area is characterised by a high contribution of all four domesticates in the faunal spectrum. Postholes that were discovered on top of the levee may have formed part of the settlement, arguing in favour of a sedentary site. The levees and the river environment may also have been seasonal locations used in relation to a cluster of sites situated on the wetland margin near Wijchen and Bergharen, where several Vlaardingen sites have been found (see Teubner/Tuyn 2010). Berghem and even Hulst have also yielded evidence for Vlaardingen occupation. Unfortunately preservation at these locations prevents a functional attribution. Only the site locations argue in favour of year-round permanency. A few sites are situated further afield. At Kootwijk on the Veluwe a Vlaardingen pot was discovered. The isolated nature of the find, argues in favour of a pot deposition (Louwe Kooijmans 2010[b]). At Toterfout, finally, a small-scale excavation yielded pottery, flint and stone material that may be attributed to the Vlaardingen culture (Van Beek 1977). Based on its geographical location, the site may have been a permanent agricultural settlement. However, its southern location and the quartz temper of the pottery may also be in favour of an attribution to the Stein group, despite rim perforations (see Verhart 2010, 220-221). Because of their specialist nature or questions regarding cultural attribution, these sites will be left out of consideration.

A final location that is included is the TRB site Slootdorp-Bouwlust, characterized by a faunal spectrum with an emphasis on red deer. The seasonal indicators favour a presence during autumn and winter and the cluster of posts indicates a frequently repaired or rebuilt structure. The location of the site in a salt marsh and the repetitive reinforcement of the living area (Hogestijn/Drenth 2000/2001, 44) substantiate the idea of a non-permanent seasonal use of this site. Deciduous teeth indicate the likely presence of complete families.

8.1.6.2 Continued mobility

The settlement system of the Vlaardingen culture generally is interpreted in relation to four geographical regions, each with characteristic site types (*e.g.* Van Gijn/Bakker 2005; Raemaekers 2003; 2005). The first group, located on the coastal dunes and intracoastal ridges, is characterized by houseplans, bone assemblages dominated by domestic animals and some evidence for crop cultivation. The second group involves levee sites such as Hekelingen and Vlaardingen with less evidence for permanent occupation and a lower contribution of domesticated animals. River dune sites such as the Hazendonk with a wild faunal spectrum form the third group. A fourth group consists of sites on the river clay such as Ewijk, the wetland margin, such as Wijchen, and, further afield on the uplands, Hulst and Toterfout, for which an agricultural function may be assumed. This subdivision of Vlaardingen sites has been interpreted as representing elements of a settlement system. Raemaekers (2003, 744-745) suggests that the first group of settlements was probably inhabited year-round by family groups focusing on cereal cultivation and animal husbandry. Sites in the fourth group by extension may be interpreted along similar lines. It is argued (*ibid.*) that sites in the second group were probably inhabited on a seasonal basis by task forces involved in fishing, fowling, hunting and perhaps crop cultivation. Produce might then be transported back to base sites as known from the coastal area and may have served to survive the lean winter period (Raemaekers 2005[a], 273). River dune sites such as the Hazendonk were interpreted as special activity sites, linked to permanent settlements elsewhere (*e.g.* Louwe Kooijmans 2007, 299; Raemaekers 2003, 745; 2005[a], 273). This suggests that the location of the main sites was determined by the possibilities for nearby cereal cultivation and animal husbandry. These, according to Raemaekers (2003, 745) shifted from being an extension to the broad spectrum subsistence base, to being the major subsistence strategy.

This subordinate interpretation of the Vlaardingen settlement system forms a straightforward explanation, yet the option of an alternative, more heterogenous system is possible as well. The first interpretation is based importantly on the idea that agricultural sites with (an assumed) sedentary occupation form the main element in the settlement system, while locations with an important contribution of wild resources and a location that seems less ideally situated for animal husbandry or crop cultivation function in a subordinate role. This interpretation foregrounds the role of agriculture in relation to Neolithisation. An alternative perspective may provide a different emphasis, focusing on aspects of continuity and on the characteristics of the involvement of the indigenous communities in the process of Neolithisation in this area.

Alternative options

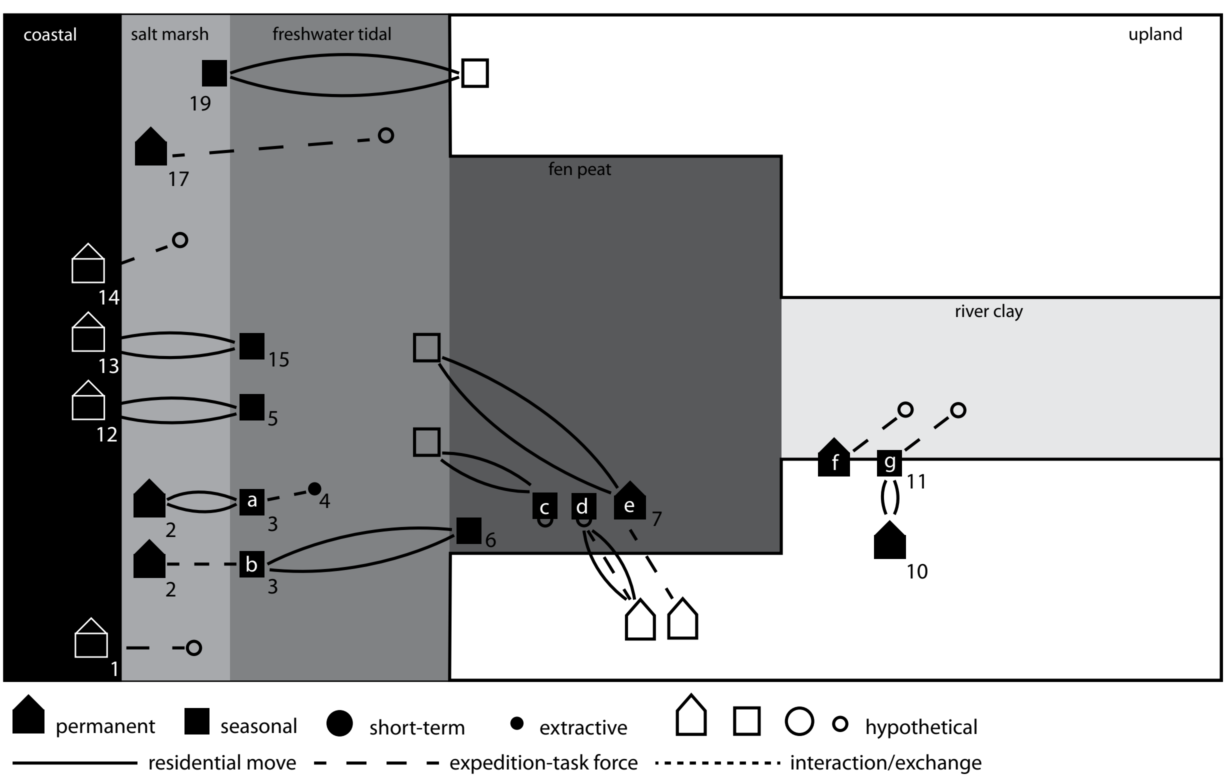
An alternative interpretation of the settlement system may stress the role of the continued flexible use of integrative strategies, although their exact composition remains difficult to establish. Argumentation may be based (partially) on the intra-regional diversity that was mapped for the Hazendonk group as well as on the indications of distinct differences between sites in habitation and economy as mapped for the Vlaardingen locations (*e.g.* Louwe Kooijmans 1993[a], 103; 2009).

The settlement system of the Vlaardingen culture is modeled in fig. 8.9. It is probable that the coastal sites represent permanent agricultural settlements (model A), potentially with extractive locations in adjacent ecozones.[5] Such a system may also be extrapolated to the wetland margin setting around Wijchen, based on the potential for agriculture there. The salt marsh sites of Zandwerven and Hellevoetsluis would also befit a year-round agricultural attribution, when emphasizing the ard marks at both locations and sturdy structures at Hellevoetsluis. The significant contribution of hunting (40%) to the subsistence at the latter site, however, does warn against overestimating the role of agriculture in the food economy and, at least hypothetically, opens up a possibility for an alternating use during the year within a mobile system (model E).

In the freshwater tidal zone a different picture emerges that cannot be wedded to an exclusive permanent occupation, nor to an existence mainly based on agriculture. The dominance of wild fauna, especially the cattle-red deer ratio, points to the importance of hunting within a broad spectrum economy (Hazerswoude, Hekelingen and Vlaardingen). This is combined with lightweight, repeatedly curated structures or shelters and indications for a seasonal presence, both for Hekelingen-III and Vlaardingen. The nature of settlement, however, is distinctly residential, including some evidence for mortuary practice (cremations and an excarnation platform, see Louwe Kooijmans 2007[b]), and probably involving complete households. For these sites a seasonal occupation seems most appropriate (model B), perhaps with intermittent extractive use (model E). Another option is a coupling of these sites with permanent, agricultural locations in the salt marsh or coastal area. Such a relationship has been suggested for Hellevoetsluis, located in the vicinity of Hekelingen-III (*c.* 15 km; Goossens 2010, 169). This would either involve group fissioning during part of the year (model D4) or intensive interactive relations of exchange (model D1). These have been marked 'a' and 'b'. The Albrandswaard extractive site may have functioned in relation to sites in both areas, and Barendrecht may have formed a potential counterpart for Hekelingen in the second scenario.

A similar choice affects the function of the Hazendonk during part of its Vlaardingen occupation (marked 'c', 'd', 'e'). It surpasses the nature of a small-scale extractive site, especially during VL-1b, where the palisade, the distribution and amount of waste and the importance of terrestrial hunting point to a more substantial use that may have been permanent (option 'e'; see also Louwe Kooijmans/Verbruggen 2011). This indicates it functioned in a seasonal system with presence in more than one season (model E), it was used by part of the group, during part of the year (model D4), or it functioned in an intensive relation with a wetland margin location (model D1). In the latter case the specialist activity of trapping otter and beaver, which remained important during the entire use of the site, may be perceived in relation to exchange with a margin site (perhaps in return for domesticates and crops). Similar suggestions have been made for the Baltic area (Zvelebil 1998[a]; 2006). Relational analogies characterized by such interaction, for instance, are formed by the ethnographically documented Hudson's Bay company fur trade with native Americans (*e.g.* White 1991), or the labour and product relationship between the Mbuti pygmies and the Bantu (Turnbull 1983). Further east in the river clay area Ewijk is characterized by a distinct domestic faunal

Fig. 8.9 Cartogram of the potential settlement systems and mobility for Vlaardingen sites. Note that the coastal area at this time was available. All site relations are hypothetical.



spectrum. The site either represents the marginal zone of a year-round sedentary site (model A; marked 'f') or is a seasonal location for cattle grazing, most likely in relation to permanent settlements in the Wijchen area (model D4; marked 'g').

Finally, the site of Slootdorp probably functioned as a seasonal base in relation to a permanent site situated elsewhere, most likely on the northern Pleistocene soils. It indicates that even within a characteristically Neolithic culture such as the TRB-culture, certain elements and groups in the settlement system adapted considerably to make use of the wetland environment. To what extent this also provides insight into the cultural coherence of these communities remains to be seen.

8.1.6.3 Cautionary tales and alternatives

Based on the available evidence it is currently not possible to define one singular settlement system for the Vlaardingen culture. A subordinate system in which agricultural settlements form the key sites seems to be a too straightforward interpretation. The requirements for successful crop cultivation and animal husbandry and the time and investment involved would make the coastal region, including the salt marsh and the wetland margin the most appropriate area for this. There are, however, a number of sites and arguments that indicate that reality at times was more complex and that a perspective focusing on this diversity and thereby allowing for a more heterogeneous settlement system may form a complementary interpretation.

Economy

Regarding subsistence, crop products found outside of the appropriate regions for cultivation may have been exchanged with communities in, for instance, the coastal or salt marsh area (see Out 2009, 423). These may have been the same communities using both regions. This way Hellevoetsluis produce may have ended up at Hekelingen-III (Goossens 2010). On the other hand, although ard marks are lacking in the freshwater tidal area and further east, crops may have been grown locally as well. This would distinctly involve small-scale practices of cultivation (*cf.* Bakels 1988, 161) aimed at producing a (limited) harvest as an addition to the wild resources (in an extended broad spectrum economy). Similar indications for local cultivation have been suggested and discussed for earlier periods (Cappers/Raemaekers 2008; Out 2009, 412) and documented ethnographically (*e.g.* Griffin 1989). The difference between minimal surplus producing systems and ancillary cultivation systems, or their combination (see Freeman 2012 and Chapter 7) adds a further aspect of choice and diversity to this. The idea of a settlement system with agricultural and largely non-agricultural sites here thus depends on the (quantitative) importance attributed to crop products (see also Bakels/Zeiler 2005, 327) and their role in subsistence. These considerations may also reflect upon the contribution of domesticates and become even more complex if nomadic specialization (*cf.* Cribb 1991) and exchange are involved.

System

Related to these economic issues and operating side by side to cultural preferences are fundamental behavioural rules, underlying the subsistence and mobility system, including aspects of optimization and risk minimization (Winterhalder/Kennett

2006, 11). If the incorporation and contribution of domesticates and cultigens is optional rather than traditional, then investment in agriculture likely will have been lower in areas of high hunting and gathering returns (Barlow 2002, 70-75). This then raises the question whether scheduling and management of time and resources allows certain combinations of sites. Does the high proportion of hunting and, likely, fishing at Hekelingen and Vlaardingen combine well with agriculture at the same sites, or investment in agriculture at sites that may have been occupied by the same group during other parts of the year (*e.g.* Hellevoetsluis or Leidschendam)? Why would a seasonal move of (part of) the group be preferable compared to task forces from fixed coastal settlements, or perhaps relations of exchange? What does annual group fissioning say about the 'fully Neolithic' character of the agricultural sites in view of the increased time and energy inputs traditionally associated with an agricultural existence (Harris 1989, 20; Winterhalder 2006, 298-303; Zvelebil 1986[a])? These questions not only reflect upon an annual modeling of mobility, for which we often lack the necessary resolution, but also relate to other issues such as investment in structures and facilities, local knowledge, group tradition, environmental dynamics, territorial claims etc.

Houses

While these issues cannot be resolved easily, other factors also colour a choice between a subordinate or a more heterogeneous system, with respect to the Vlaardingen settlement system. Regarding material culture, houses of a durable (sturdy) nature have been argued to be indicative of increased permanency (*cf. supra*; Louwe Kooijmans 1993[a], 92). The Haamstede structures and potentially those of Hellevoetsluis argue in favour of this type of occupation in the coastal region, especially in view of the Wateringen and Ypenburg houses from the preceding Hazendonk occupation. Other regions lack these structures and show evidence of more frequently curated lightweight structures or shelters (Vlaardingen and Hekelingen). For the Haamstede site Verhart (1992, 93-95) argues that, based on its location, the assumed importance of hunting, and the nature of other Vlaardingen structures, permanent habitation may not have taken place. While this is hypothetical based on the evidence available some caution is required when other indicators are absent (*cf. supra*).

Material culture

Another perspective is offered by the lithic component in the material culture spectrum. As argued earlier, one of the significant characteristics of the Vlaardingen sites as a whole is the heterogeneous nature of their lithic raw material supply (see table 7.2). Several coastal settlements are characterized by artefacts produced on rolled flint (nodules). A use of northern flint has been suggested for Zandwerven as well as Leidschendam. At the Hazendonk there is a combination of (mainly) terrace flint and import products from the Rijkcholt and Hesbaye area, while both Hekelingen and Vlaardingen are characterized by an important contribution of 'exotic' flint deriving mainly from Spiennes or northern France (probably the Boulogne coastal area). This is less so at Hellevoetsluis. Although new research regarding the identification of the various source materials is in place (Amkreutz 2010[b], 22), there are characteristic differences representing site-specific resource networks. If, for instance, the coastal and freshwater tidal sites are assumed to operate dependently within one settlement system (*e.g.* Van Gijn/Bakker 2005; Raemaekers 2003), then one would expect more similarities in the (transported) raw material component.

History, choice and flexibility

A final nuance is offered by a historical perspective. In addition to perceiving the Vlaardingen culture settlement system as a subordinate system with key agricultural sites (*cf.* Raemaekers 2003), one may adopt a point of view that stresses the historically flexible and adaptive relationship with the wetland environment. In this respect the agricultural components are perceived as options within a spectrum, implying that different combinations and emphases in procurement and mobility may have operated simultaneously. The existence of such group agency has been demonstrated earlier for the Hazendonk group in the Delfland coastal area. Although this concerned sedentary settlements in an ecologically homogenous setting (see Louwe Kooijmans 2009), and although ecological arguments, at this time, form the primary, and only archaeological, explanation for the differences between (Vlaardingen) sites located in different ecozones, a more culture-wide extrapolation of this behaviour and the group agency associated with it may be in place regarding the long-term continuity in communities, practices and landscape dynamics involved. The long-term existence of this behaviour is substantiated by the historically flexible use of the wetland landscape in previous periods (*cf. supra*). Some of the sites arguing in favour of such a tradition will be discussed later on.

By means of conclusion

It is difficult to decide on a singular settlement system for the Vlaardingen culture. Based on factors of permanency and previous occupation, the coastal and salt marsh sites may be perceived as permanent year-round settlements, with an important agricultural character. In this respect it is plausible to suggest a subordinate relationship with sites located in other ecological zones. It may even seem illogical to assume different types of settlement systems operating simultaneously, especially when sites are situated in each others direct vicinity, such as Hellevoetsluis and Hekelingen, or when sites with a specialist character are involved, such as the Hazendonk with its game dominance. On the other hand, when the emphases are placed elsewhere, different options emerge that may reflect on, at least part, of the settlement system. Agriculture (cultigens and domesticates) may have formed a varying and relative contribution at a number of sites. Houses were of different structure, design and durability and different raw material networks operated at the same time. When incorporating mechanisms and strategies, such as (partial) group mobility, inter and intra-group exchange and complementary resource specialization, a more heterogeneous image of a settlement system emerges. The complex internal logistics defining these settlement systems remain difficult to determine or grasp archaeologically, but they do form an aspect of past existence that is real and should be taken into consideration. Moreover, in view of the consistent characteristics of the long-term interaction between communities and the wetland landscape and the issues of flexibility and pragmatism discussed earlier, this is a worthwhile perspective to incorporate. Concluding, it may be stated that although largely of a hypothetical nature the heterogeneous characteristics that potentially underlie the Vlaardingen settlement system and that build upon an extensive use of the integrative strategies available form a complementary perspective on determining and interpreting (subordinate) site relationships.

8.1.7 Conclusion

The overall aim here has not been to define the settlement system of the Vlaardingen culture or previous periods, nor to determine the composition of integrative strategies over time. Based on the current evidence, it is argued here that such a definition cannot yet be made and that only rough periodical trends may be sketched. The most important of these seem the following. For the Late Mesolithic, including the ceramic Mesolithic of the Early Swifterbant period, site characteristics and their landscape locations suggest that, apart from potentially residentially mobile systems on the northern coversand, logistically mobile systems were in operation. In the case of the delta sites of Polderweg, De Bruin and potentially Maaspoort a settlement system seems to have developed with an important focus on wetland exploitation from wetland or wetland margin settings that is characterized by an increased degree of permanency and investment (*cf.* Chapter 5; see also Nicholas 1998[a,b]; 2007[a,b]; Van de Noort/O' Sullivan 2006). In the following period this system of logistical mobility characterized by seasonal sites in combination with extraction camps becomes the 'standard' for the Middle Swifterbant occupation in the research area. This logistical mobility seems to have been combined with animal husbandry, exchange of crop products, or small-scale local cultivation. There is no conclusive evidence for year-round permanency, while some sites (most notably Doel) indicate the continued possibility of short-term occupations. In view of Binford's argument (1980; 1982) of a continuum of opportunities ranging from residential to logistical mobility, it seems appropriate to expect intermediate types of mobility in relation to site location and exploitation of the environment. During the Hazendonk and Late Swifterbant occupation two types of settlement systems emerge. On the one hand several sites in the Delfland coastal area provide convincing evidence for year-round permanency, in combination with an important contribution of agricultural resources. This, however, is combined with distinct differences in type of occupation, subsistence spectrum and other aspects such as burial (*cf.* Louwe Kooijmans 2009), arguing in favour of an important degree of group agency. Other sites continue to provide evidence, albeit of limited quality, for the continuation of seasonally occupied locations in a system of logistical mobility. During the Vlaardingen occupation we see a continuation of this system with year-round permanency and an agricultural subsistence base. Most evidence concentrates in the coastal area, including the salt marsh. The main question is whether these sites in this period should be perceived as the main elements in the settlement system, as such making sites in other regions (most notably the freshwater tidal and peat marsh area) subordinate locations with an auxiliary function. Based on the current evidence available, this study argues that such a conclusion is premature.

Different options, contrasting sites

When emphasis is placed on agricultural contribution from a perspective dealing with (economic) Neolithisation, then a subordinate system would be the most plausible option. When emphasis is placed on the long-term characteristics of the communities involved in relation to landscape and environment interaction, then a more heterogeneous system may be supposed. In general it can be argued that a certain development in site function and settlement system, as sketched above, existed and that there was a general development in settlement types and interaction (see fig. 8.10). Yet, certain sites continue to form a cautionary tale with respect to the general nature of such a development. A few examples may be highlighted (see above and Appendix I for further details). For the Middle Swifterbant period the site of Schokland-P14 provides the best location for an emphasis on the contribution of agriculture to the extended broad spectrum economy. The evidence from multiple phases of occupation, however, more convincingly points to seasonal use of this location and an emphasis on the exploitation of wild resources. Swifterbant-S3 and S4 furthermore point to the way in which these agricultural components may have been incorporated in logistical mobility. For the Hazendonk period, the agricultural signal of the Delfland sites is contrasted by other locations that indicate different site functions. In the coastal area Wateringse Veld and to a lesser extent Wateringen-4 represent locations that may have been occupied in a non-permanent manner. Barendrecht-Vrijenburg and Gassel also point out the existence of non-permanent, seasonal or short-term sites and extractive locations in other areas. These form a contrast to the permanent agricultural settlements. For the subsequent Vlaardingen period these contrasts exist as well. Sites such as Hekelingen and Vlaardingen demonstrate the continued presence of seasonally occupied residential sites operating next to or in relation with permanent coastal settlements. The Hazendonk, in this case, sets even more of an example. Situated in the encroaching peat marsh, the specialist economy of this site during its previous occupation phases, focusing on

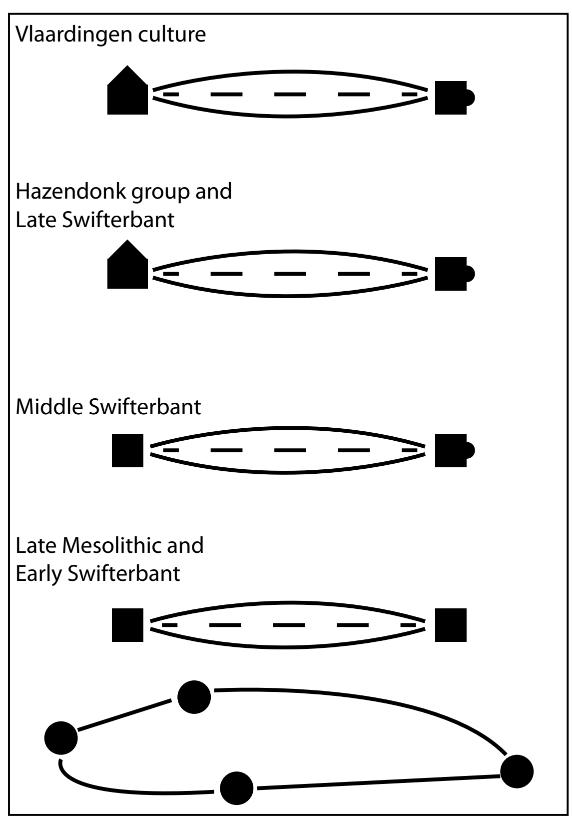


Fig. 8.10 General development of the site relationships and mobility type in the settlement systems from the Late Mesolithic to the Vlaardingen culture.

otter and beaver, became more terrestrial in nature during the Vl-1b phase. In combination with the palisade and the amount and distribution of refuse, an at times residential function of this site may be assumed as well as a certain degree of permanency. Similarly, the TRB site of Slootdorp-Bouwlust forms a seasonally occupied residential site. It may indicate the existence of an element that adapted to the exploitation of the wetland environment in the otherwise generally fully Neolithic TRB culture. It also points out the question whether this site is a local adaptation of the TRB culture, or whether the latter is the 'cultural veneer' of a regional wetland adaptation.

The main contribution of this chapter with regard to the interpretation and development of settlement systems then is to emphasize that certain sites contrast with what would be expected when modeling settlement systems and community interaction from a parsimonious perspective. Partially the origin of these contrasts hypothetically may be placed with the long-term characteristics of these communities in their dealing with the wetland environment and the related aspects of flexibility and pragmatism that have been discussed here. They indicate the continued existence of diversity in settlement systems and strategies of these wetland communities. In any case these sites with their divergent characteristics signal the existence of a past reality that is far more complex and that deserves attention in our interpretations.

A note on integrative strategies and settlement systems

The considerations mentioned above, may seem abstract at the level of settlement systems. Due to the qualitative and quantitative nature of the evidence available we have to hypothesize on the character and combination of the integrative strategies involved. Nevertheless, some long-term particularities may be noted, some of which may be documented, others (partially) inferred (*e.g.* 5 and 6).

1. The diversity in wetland landscapes that were occupied, used and combined, comprising the five major ecological zones mentioned earlier.
2. The different orientation of raw material networks and their implications regarding hinterland, territory and cooperation.
3. The different characteristics and emphases in the subsistence spectrum, accounting for the contribution of hunting, fishing and fowling versus animal husbandry and the difficult question regarding local production versus exchange and/or transport of crops.
4. The differences in housing, structures, settlement layout and other practices.
5. The importance of a degree of residential mobility whether independent or in relation to a permanent settlement.
6. The potential options involved with respect to mechanisms such as group fissioning, task division and exchange.

Most of these aspects are characteristic for most of the occupation of the wetlands and their margins during the time period between 5500/4500-2500 cal BC (depending on the first introduction of domesticates and cultigens). From that perspective it is assumed that they reflect part of the behavioural as well as socio-ideological identity of the communities involved. As such they form more or less measurable aspects of the *mentalité* of the groups inhabiting this wetland landscape. Based on this it may be argued that with the long-term and large-scale trend of an increasing reliance on agriculture and an increasing importance of permanency the overall composition of the integrative strategies involved changed or developed. On the other hand their underlying importance may have remained constant as they continued to offer flexible and pragmatic ways of dealing with the wetland landscape. This innate coupling of communities, strategies and environment may provide a good framework to study these communities from a long-term perspective. It also offers a perspective on the particular developments of Neolithisation in this area. This will be discussed in the following paragraphs.

8.2 Discussion: making a short story long again?

The interpretation of the duration and development of Neolithisation in the 'Dutch delta' has been characterized mainly as a long-term and gradual process spanning some two millennia (Louwe Kooijmans 1993[a]; 2007[a], 305-307; Raemaekers 1999). The transition as a whole has generally been viewed against the background of the 'availability-model' (*cf.* Zvelebil/Rowley-Conwy 1984) in which the LRA situation has been characterized by long availability and subsititution phases. In the past decade the 'long transition model' has been challenged by a 'short transition model'. Raemaekers (2003) argued that the availabe evidence also can be interpreted to suggest a short transition in which the consolidation phase is reached in or perhaps before the Hazendonk group. Based on the ideas expressed above, I want to demonstrate that this interpretation and the choice between a short and long transition model is strongly dependent upon the premises and definitions chosen (*cf.* Louwe Kooijmans 2007[a], 307). A perspective focusing on indigenous behavioural aspects in relation to landscape accentuates different sides of the transition to agriculture. In view of these a long transition model seems most plausible.

8.2.1 Cutting a long story short: premises

The argumentation for the short transition model is based on a number of premises. The first of these is the custom, in archaeological discourse, to describe the process of Neolithisation in terms of food production (Raemaekers 2003, 740). The ratio between wild and domesticated animals (preferably ungulates) forms the best index to measure this since it reflects dietary contribution, is reasonably well represented archaeologically and quantifiable. This ratio may be used to define the three stages of the availability model (*cf.* Zvelebil 1986[a]; Zvelebil/Rowley-Conwy 1984; 1986). Raemaekers (2003) avoids the difficult distinction between domestic and wild pig by creating a separate pig category.

The faunal representation at Swifterbant, Hazendonk and Vlaardingen sites may be mapped for these three categories which, generally, results in an apparent substitution phase during the Swifterbant culture and a consolidation phase in the Vlaardingen culture. Raemaekers (2003, 744-746) argues that the domestic faunal contribution in combination with evidence for sedentism and cultivation in the coastal area during the Hazendonk period indicates that the actual consolidation phase may be placed in or even before the Hazendonk period. This interpretation is supported by the argument that the faunal assemblages differ more with respect to different environments, than they do over time in a similar environment (Raemaekers 2003, 745). Furthermore, it is argued that the coastal erosion that took place before 4000 cal BC prevents the discovery of potentialearlier Swifterbant sites with an agricultural 'signature'. Based on this coastal agricultural argument, the absence of earlier evidence and similarities in the use of landscapes over time, it is proposed that the process of Neolithisation in the Dutch delta was likely short (*ibid.*, 746).

A circular argument?

I want to comment upon the underlying ideas of this approach here. In particular I want to touch on some of the model's premises, such as the interpretation of subsistence, and the function of sites and their position in the settlement system. With respect to subsistence, the lumping of domesticated animals, wild fauna and pigs in three groups blurs the internal differentiation between sites (*cf. supra*). Moreover, the category of pigs remains multi-interpretable. However, while a comparative study of terrestrial meat consumption may be the most informative, the importance of other resources, such as fish and fowl should not be underestimated (*e.g.* the isotope study at Schipluiden; Smits/Van der Plicht 2009; Smits *et al.* 2010). For instance, while the 50% domesticates boundary is passed at Wateringen-4 (Raemaekers 2003, 133), sites where natural resources dominate continue to exist until the Vlaardingen culture. Next to this, the prime position that is given to faunal remains in the context of the 'availability model' and the way in which other data are interpreted forms another determining factor in mapping the development of Neolithisation. The (beginning of) the end of the Neolithisation process in a certain region is formally set at the moment when domesticates (and cultigens, *cf.* Zvelebil 1998[a]) account for 50% or more in the assemblage of a single site. This 'formal' arrival at the Neolithic then also colours the manner in which the subsistence spectra of nearby sites as well as site function and settlement systems are interpreted in a dualistic manner.

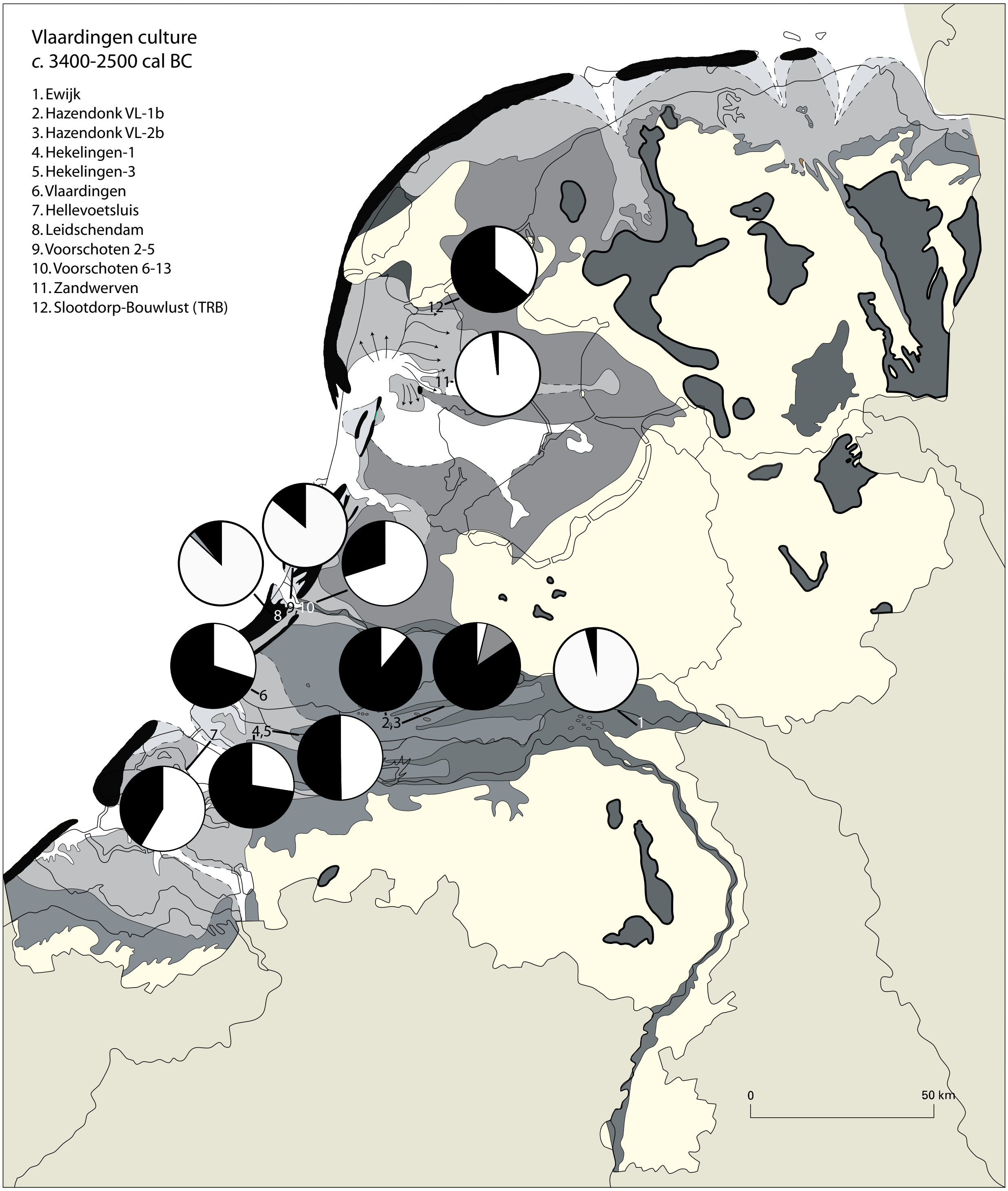
An additional factor is whether the sites with the strongest Neolithic signature are used as the central elements in the settlement system, or whether a more heterogeneous approach is adopted. In the case of the former, it is attractive to suggest a linear development. It has been argued that the Swifterbant culture was probably characterized by a residential mobility system, because of the presence of seasonal sites and absence of evidence for year-round occupation or long-term residential settlements in dryland areas (Raemaekers 1999, 121). Based on similarities between the faunal spectra of the Hazendonk group and the Vlaardingen culture (Raemaekers 1999, 160), this residential mobility is then contrasted with a system of (more) logistical mobility for these periods, characterized by the appearance of year-round agricultural settlements (*ibid.*, 1999, 192; 2005, 276).[6] These, from the Hazendonk period onward, have often been interpreted as the central elements in logistical systems (*cf. supra*; Raemaekers 2003; 2005[a]; see also Louwe Kooijmans 2007[a], 299). As argued by Raemaekers (2003, 745) the location of base camps became determined by the possibilities for nearby cereal cultivation and animal husbandry. These shifted from being an extension to the broad spectrum base to being the major subsistence strategies.

These considerations demonstrate that the choice for a shorter or longer transition to agriculture in the study area depends upon the emphasis that is placed upon certain elements of subsistence and the settlement system. It also depends on the interpretation of residential and logistical mobility, and whether a prominent role is attributed to sites characterized by Neolithic characteristics and year-round permanency.

8.2.2 An approach of alternatives

In chapters 7 and 8, emphasis in the interpretation of the developments in the study area during the transition to agriculture has been placed differently. Regarding subsistence, the interpretation of faunal remains is not aimed primarily at the contribution of domesticates. For the Swifterbant culture the restricted data available only allow for a limited comparison, yet point to choices being made that importantly yet not exclusively relate to the environmental situation (see 8.1). At P14, for instance, the available space and conditions on the outcrop did not lead to a convincing emphasis on domestic resources and agricultural practices. Similarly, the site location choice at Swifterbant and the Hazendonk did not favour an important agricultural function, while at the latter site cattle forms an important contribution to the economy in the first phase, contrasting with the importance of, for instance wild boar and pig at S3. In this respect Raemaekers (1999, 113, 117) argues that the wide variation in the natural surroundings of the Swifterbant sites is not reflected in the mammal bone spectra, suggesting a cultural preference rather than exploitation of the specific possibilities of the natural environment. Although this forms a factor, this argument seems overstated. It is argued here that ecological margins form a primary factor in explaining the economic diversity witnessed, yet communities made choices from a set of options (within the ecological margins). This provides a number of variations combining domestic and wild resources with a distinct degree of residential mobility. Later, within the Hazendonk group year-round permanency is documented for (coastal) sites with an important agricultural contribution, yet the Delfland case-study indicates that different subsistence choices still were being made by contemporaneous communities, even in comparable ecological settings (Louwe Kooijmans 2009). This underlines that while natural differences account for most of the variation between sites situated in separate ecozones, and archaeologically often will form our only means of investigation, the element of choice and group agency should be taken into consideration. In relation to this, the isotope data collected at Schipluiden (Smits/Van der Plicht 2009; Smits *et al.* 2010) demonstrate that marine resources made up an important part of the diet at that site which, based on faunal and botanical evidence would be characterized as terrestrial and agricultural. Based on the argument of cultural continuity this continuation of choices made on the community level may also be suggested for the subsequent Vlaardingen culture where we see both a distinct agricultural element emerging that is rooted in the previous Hazendonk group as well as an ongoing emphasis on the exploitation of a variety of wild resources and an occupation and use of various wetland zones. This diversity with respect to the contribution of wild and domestic resources is demonstrated in figure 8.11.

It may be argued that the diversity we see in subsistence with respect to wild and domestic resources is already present during the Swifterbant period and continues into the Vlaardingen culture. Coastal and (hypothetically) wetland margin sites offered the best conditions for livestock herding and crop cultivation, yet domesticates and cultigens were not confined to that area, nor was their importance within that area always consistent.[7] The presence of earlier agricultural coastal sites in the Swifterbant culture (*cf.* Raemaekers 2003) seems unlikely since the area would have been too dynamic to farm (pers. comm. Louwe Kooijmans 2011). This argues for a late start of truly agricultural settlements (not



before the Hazendonk group), but moreover points to these being part of a more elaborate range of settlements with a seasonal character and an important focus on wild resources. Overall, rather than the dietary contribution of domesticates and cultigens, it is the intra and interregional differentiation with which these resources were exploited that seems most defining for the developments taking place. This continuity in using and combining the integrative strategies available indicates that the contribution of domesticates and cultigens should be analysed primarily against the environmental background but should not be predominantly interpreted from a 'farming perspective' (Amkreutz 2010[b], 19).

This is substantiated by the evidence available on settlement systems and the way in which integrative strategies, including mobility and exchange, may have functioned within these (see 7.4 and 8.1). Next to the earlier mentioned appearance of year-round permanency, it is the variability in strategies and mobility, as evidenced by faunal spectra, housing, seasonality, site location choice and site structure that forms a constant factor over time. Combined with the fact that we are dealing with indigenous communities and regional cultural developments, it is plausible to see the later evidence of diversity as rooted in the Mesolithic (*e.g.* Louwe Kooijmans 1993[a], 103). There is thus a certain continuity in the ways of employing flexibility and combining integrative strategies.

8.2.3 What about 'the uplands'?

The focus in this chapter has been on elucidating the characteristics of the subsistence and settlement system of the LRA wetland and wetland margin communities. It is the question whether these wetland settlements formed the 'wet part' of a settlement system that also included upland or dryland sites, for instance on the Pleistocene coversands of Brabant, the Veluwe or the Drenthe-Frisian coversand area.

The chapters dealing with the Late Mesolithic occupation have indicated that a wetland orientation of certain communities is likely (see Chapter 5). For the Swifterbant culture, there is evidence of chance finds away from the delta, but these (Winterswijk, Bronneger) are situated locally in wetland settings (stream valleys etc.). Other evidence, such as the distribution of perforated wedges (Van der Waals 1972), or more recently arrowheads (Crombé/Sergant 2008; Niekus 2009) and the presence of palynological signals (Bakker 2003[a,b]), points out that the Pleistocene landscape definitely was used during the Swifterbant culture. The evidence is difficult to interpret due to differences in taphonomy (see Chapter 4). In general (and for now) a logistical (task-related) exploitation of the uplands instead of the existence of a distinct domestic and occupational SWB upland counterpart appears likely. While evidence of absence does not imply absence of evidence the argument here may be based on the nature of the evidence in the wetland and wetland margin area. The distinctly residential wetland orientation attested there indicates that these areas formed an important aspect of the settlement system and mobility rounds of these communities. As argued earlier it should be questioned whether this investment allows the existence of an equally important upland counterpart or presence. Crombé *et al.* (2011,11-12; Crombé/Sergant 2008) also comment upon the absence of Swifterbant sites in dryland areas, since all of the Belgian sites are situated in the Scheldt floodplain. In correspondence with this study they see the wetland orientation of the Swifterbant communities in relation to a Final Mesolithic displacement towards lower and wetter grounds (which expanded rapidly in relation to the sea-level rise). The hinterland would be used predominantly in a non-residential manner. For the subsequent Hazendonk group and Vlaardingen communities an additional argument may be given by the fact that most evidence also concentrates on the wetlands.[8] Apart from these arguments there is increasing evidence from the Middle Neolithic onwards that some areas

Fig. 8.11 Vlaardingen faunal complexes, including the TRB site Slootdorp-Bouwlust, divided by wild (black), domesticated (white) and indeterminate (grey), plotted on the palaeogeographical map of the Early Subboreal period, c. 3000 cal BC (adapted from plate 4 in: Van Gijssel/Van der Valk 2005). See fig. 8.2 for legend.

verging on the wetlands and their margins were inhabited by the Michelsberg communities, and later by those of the TRB culture and Stein group.[9] It seems therefore that the wetlands and their margins formed an important (cultural) basis for the communities studied here.

8.2.4 Neolithisation: a long transition again?

The answers to questions regarding the development of Neolithisation remain a matter of choice, based on the premises chosen (see Chapter 2). It should also be realized that a discussion on the process of Neolithisation differs from defining (an artifical) boundary for the Neolithic. Concerning the latter issue, this study argues against such a distinction being made for the study area and the communities involved. The appearance of settlements with a faunal composition incorporating 50% domesticates or more, as well as increased evidence of crop cultivation and sedentism can be positioned in the mid of the 4th millenium. In view of the approach taken by Raemaekers (2003), this argues in favour of a shorter transition to the Neolithic; being completed at the time of the Hazendonk group or even before (if absence of evidence is taken into account (*ibid.*, 746)). While the period of transition is less extended (*c.* 1800 instead of 2500 years), it remains gradual in nature, since evidence abounds for the continued importance of wild resources. The emphasis, both with tracking Neolithisation as well as in determining the nature of the settlement system, often lies with the 'Neolithic' side of the spectrum. The contribution of domesticates and cultigens to the subsistence base is interpreted as having shifted from an extension to being the major subsistence strategy (*cf. supra*). While evidence for this scenario initially appeared most convincing for the Vlaardingen culture, excavations at Wateringen and more recently at Ypenburg and Schipluiden have pushed back this threshold, enabling a shorter transition.

Re-adressing the balance

This perspective, although it informs us on the duration of the transition to agriculture, limits insight into the dynamics of the period and the communities involved. If emphasis is placed on the strategies and behaviour of these groups, a different picture emerges, one that stresses continuity and an incorporation of novel practices and products that did not lead to abrupt changes, instead of a 'relentlessly' advancing Neolithisation. Focusing on behaviour highlights the way communities dealt with the potential changes in this period. It stresses the flexible, pragmatic manner in which they operated in the wetland landscape and made use of the resources available. Mobility, wild resources and heterogeneity of subsistence between sites remain typical as late as the Vlaardingen culture. In this respect, the idea that cereal cultivation and animal husbandry shift from being an extension of the broad spectrum subsistence base, to being its major component is a matter of perspective. Firstly, not all of the sites of the Hazendonk group and Vlaardingen culture demonstrate convincing evidence regarding the primacy of animal husbandry, crop cultivation and sedentism: a number of residential sites was inhabited seasonally (see 8.1) and shows an important contribution of wild resources. As argued above, their placement in a subsidiary role with respect to sites of a more agricultural nature is a matter of debate and currently of alternative interpretations. Secondly, in those places that are most suitable for agriculture, *i.e.*

the sites in the coastal area, evidence for its contribution in the Hazendonk period (*cf.* Louwe Kooijmans 2009; Smits *et al.* 2010) and to a lesser extent during the Vlaardingen culture (*e.g.* Hellevoetsluis; see Appendix I; Goossens 2009) point to differences in importance between sites. Choices were not always aimed at expanding the agricultural component of the spectrum. Thirdly, the adoption of domesticates and cultigens does not inform us directly on their impact on the lifeways of these communities. In other words, an increased or increasing contribution of domesticates and cultigens as well as sedentism may have become part of the repertoire of options, characterized here as integrative strategies.

It may be argued that while from our perspective the appearance of Neolithic elements (objects, practices, agriculture and sedentism) may form crucial developmental stages characterizing the process of Neolithisation, they may have been incorporated and assimilated into already existing practices of living in the area. Viewed from the position of the communities involved, continuity in *habitus* is a characteristic aspect of these groups. From that perspective it is more appropriate to conclude that the process of Neolithisation had not yet ended in or during the Vlaardingen culture and to opt for a gradual and long transition to agriculture.

8.3 Unsettled issues, continued practices

Chapters 7 and 8 have dealt with behavioural flexibility, pragmatism and community agency in the succession of communities from the Late Mesolithic to the Vlaardingen culture. This was done from a long-term perspective focusing on habitation, the diversity of strategies employed and the integrated relationship between communities, landscape and environment.

8.3.1 Land owns people

As argued in 7.2, landscape and environment are not neutral (Pollard 2000) and form an important constituent of the identity of a region's inhabitants. They also form a factor for understanding the actions and decisions of local communities (Brück 2005; Louwe Kooijmans 2000; Schama 1995). The wetlands and wet margins of the LRA can be defined as an area characterised by diversity. The environment was relatively rich. At the same time there is evidence for landscape dynamics. The coastal area only stabilized during the 4th millennium and sites in the intracoastal plain, the riverine marshes and northern lagoons slowly submerged due to rising groundwater levels. The landscape thus changed continuously. Much of this change will have been gradual and slow, while other changes may at times have been quick, unexpected and dramatic (Leary 2009; Sturt 2006). Living in such a dynamic environment meant that inhabitants had to deal with changing patterns of expectation and anticipation. They had to adapt or cope with altered circumstances, to maintain their way-of-life, at least by temporarily reducing the effects. The sites yield evidence of the ways in which people dealt with these changes, for example by reinforcement, mobility, abandonment or shifts in site function. The fact that sites were only temporarily abandoned, or changed function rather than being given up shows flexibility on the part of the communities, but also constancy in the importance of specific places.

It is suggested here that living in a wetland landscape transcends purely ecological and temporal boundaries and on a more metaphysical level influenced the characteristics and behaviour of these communities. The wetlands and the way they were occupied over time forged a regional identity (*e.g.* Harrison 2004; Van de Noort/O'Sullivan). Understanding the characteristics of this type of inhabitation may also shed new light on the process of Neolithisation in this area.

8.3.2 Subsistence and settlement systems

Chapters 7 and 8 stressed the continuity in the varied use of resources and strategies. While over time the contribution of domesticates and cultigens increases and sedentary settlements appear, indicating progress from a Neolithic perspective, there is evidence for the continued importance of wild resources, of flexible and pragmatic combinations of strategies and of mobility.[10] This means that the extended broad spectrum economy should be studied not only for the contributions of wild and domestic fauna, but also for the way in which the available resources were used and to what extent this follows logically from the local ecological situation. It appears that within the margins of the environment there was a certain degree of liberty in 'composing' the menu. With regard to settlement systems the role of the 'upland' and the relationship between sites in different regions is unclear. However, next to a model that combines upland and wetland elements in one settlement system, as has been suggested before (*e.g.* Van Gijn 1989; Van Gijn/Bakker 2005; Raemaekers 1999, 123; Louwe Kooijmans1986; 1993[a]), the (earlier) idea of specifically, though not exclusively, wetland oriented communities has been raised. The mapping of Neolithisation, through material and economic contributions favours an early start of the Neolithic, or the consolidation phase (*cf. supra*; Raemaekers 2003), implying a major role for residential (semi-) agrarian sites in the coastal area during the Hazendonk and Vlaardingen periods and more subsidiary functions of locations elsewhere in the Delta. However, the absence of convincing residential upland indicators for the period studied (in combination with ethnographic case studies offering different options), and the dynamic conditions in the coastal area previous to *c.* 4000 cal BC, argue against this scenario. While the settlement system develops through the addition of year-round permanent sites from the Hazendonk group onwards and the increasing role of agriculture, these essentially form an addition to the options that were available. This emphasizes the continuity existing for many of the underlying characteristics of the wetland and wetland margin settlement system, rooted in the Late Mesolithic. From this long-term perspective, economic and habitational diversity become meaningful features of the way communities deal and interact with their surroundings.

8.3.3 Neolithisation: no need for novelties?

Defining the environment of the indigenous communities as rich in resources and dynamic in character implies the absence of an economic need for change. Having adapted in a sustainable manner to (wetland) life, does not easily give rise to any incentives that might disrupt this type of living, while the changing, wet and at times unpredictable circumstances prevent evident economic benefits to be gained from a switch to agriculture in contrast to the situation on the uplands (*e.g.* Dusseldorp/Amkreutz in prep.).

The faunal, botanical and seasonality evidence of wetland sites during the process of Neolithisation partially substantiates this. Although there is an increasing reliance on domesticates and cultigens, this is never culture-wide or absolute. It concerns local to regional switches to a greater reliance on agriculture, especially in the drier coastal or, hypothetically wetland margin or upland areas. These are contrasted by other contemporary sites where wild resources, often in combination with mobility, characterize occupation. The analysis of the evidence presented above yielded a picture of subsistence and habitation in these wetland environments, based on a flexible, pragmatic use of options. The increasing availability of 'Neolithic novelties', especially domesticates, cultigens and the knowledge required were used in a similar manner, not as superior options, but as an addition to the existing spectrum.

In the mosaic

This somewhat deconstructed idea of Neolithisation does not mean that there is no larger story to tell, or that the transition from forager to farmer was not about important economic and social changes that eventually restructured society. It is, however, about the appreciation of the diversity in lifeways of, at least for the LRA, more than two millennia of hunter-gatherer-farmer communities.

The use of ethnographic, archaeological and historical parallels offers a rich background for understanding the many ways in which these systems could be sustainable for so long. It pointed out the importance of an increase in behavioural options with the availability of new knowledge and technology. Apart from that, it stressed how communities may benefit from mutualistic behaviour, both in relations of exchange and interaction, as well as in interdependency or symbiosis (Gregg 1988; Jochim 2006; Verhart 2000). This substantiates the idea that instead of dealing with a variety of sites used for different functions by the same community, we might be dealing with a variety of lifeways of different communities with the same cultural background. This perspective was supported by the supposed ability of groups to switch between strategies, (Freeman 2012; Layton *et al.* 1991; Madsen/Simms 1998; Rowley-Conwy 2001).

With these broadened horizons it is interesting to review the LRA groups against the perspective of their natural environment. Many of the strategies adopted during the 5th and 4th millennium cal BC may be classified as 'extended broad spectrum economies' (*sensu* Louwe Kooijmans 1993[a]). This characterization should not be seen as static. The evidence points to diversity, and, in view of the wetland setting described above and its relation to the communities living therein, a flexible exploitation of the extended broad spectrum options that existed. This led to the idea of 'integrative strategies', a term which seeks to underline the ability to draw on a repertoire of behavioural options and various modes of food procurement. This was a crucial feature of sustainable habitation in the wetlands and wet margins of the LRA. The emphasis therewith shifts from the addition of domesticated resources to the diet and their relative importance, to the dynamics of their use.

Implications with respect to rhythms

The approach taken here is in fact an archaeology of inhabitation, centred on the notion of dwelling (Brück 2005; Pollard 2000; Ingold 1993; 2000; see Chapter 6) and on the active and recursive relationship between humans and their natural environment (*e.g.* Barrett 1994; Gosden 1994; Pollard 2000; Whittle 2003). Meaning and significance come into existence through their incorporation into a regular pattern of activity (Ingold 2000, 153). The repetition of these routines provided the 'ontological security' for life to go on (Whittle 2003, 22). Their rhythm (*cf.* Lefebvre 2004) is at the heart of existence and throws light on issues of change and repetition, identity and difference, contrast and continuity. Extrapolating this idea to the process of Neolithisation identifies it as a potent source of 'new rhythms' some of which will have been disruptive, requiring considerable attunement (see Chapter 6; Lefebvre 2004).

If we focus upon the inhabitation of the wetlands, however, it can be argued that there were no sudden or definitive transitions, nor any culture-wide adoptions. When domesticates and cultigens played a more dominant, important role, this was mostly the case in coastal or upland locations from the second half of the 4th millennium onward. These sites existed alongside other locations with different strategies, while there was also considerable variation within one region. It could be argued that many of the tasks familiar to the small group of hunter-gatherers camping at Polderweg were still in practice two millennia later. If we then accept that daily practices, tasks and routines create a collective sense of identity and belonging (*e.g.* Edmonds 1997; 1999; Ingold 2000; Wells 2001, cited in Van de Noort/O'Sulllivan 2006, 79), it is evident that a strong sense of continuity in collective tradition may be documented for the LRA. Change was present, but overall these groups were rather conservative.

The fact that there is such clear evidence for 'Mesolithic' continuity (in technology, habitation and economy) argues in favour of the consistency of certain types of *habitus* and the existence of a valuation or respect for the traditions and rhythms handed down from the ancestors. This may be explained by the character of the environment, often inhibiting or constraining the possibilities for change. While this will have been an important factor, it cannot be denied that during the entire period the choices made by local communities, even those living in suitable areas, often were characterized by flexibility and pragmatism, never completely abandoning the values and benefits of a hunter-gatherer existence. This suggests the existence of a *mentalité*, characteristic to communities of hunter-gatherers and hunter-gatherer-farmers (see Louwe Kooijmans 1993[b], 136-137; 2000, 324; Raemaekers 1999, 189) that was persistent and influenced their position in the adoption of agriculture. In this study this aspect of *mentalité* has been coupled particularly with the inhabitation of the wetlands and their margins and the creation of a regionally specific attitude and identity (see also Van de Noort/O'Sullivan 2006, 67-68). To understand this wetland attitude, it may be more profitable to adopt a behavioural perspective instead of one that tracks the introduction of domesticates and cultigens. Although there are many difficulties involved in identifying and delimiting a common socio-cultural theme, it may be possible to define a sense of what was shared, and create the idea of a moral community (Whittle 2003, 17, 67-69). From such a perspective, the absence of drastic change and the slow and never complete avulsions of new rhythm tie in with the way in which these communities were connected with and embedded in their environment.

Notes

1 Zeiler (1997, 86, 99) indicates that the site was used at least between spring and later autumn or early winter. He argues that the presence in other season may relate to occasional visits. These may have been of an extractive nature. (A roe deer (VL-2b) may have been killed in midwinter, while swan bones (Vl-1v and 2b) point to a presence between late autumn and early spring. Sturgeon again points to a presence between spring and (early) autumn). Overall, the evidence available is too limited to decide with certainty on a particular or main season of use.

2 It should be noted that the balance between wild and domestic fauna at P14 is strongly dependent on the choices made. If antler is left out of the counts (as has been done in this study) than the importance of red deer is limited, especially when compared to cattle. Lauwerier *et al.* (2005) also leave out beaver which is not done in this study since it provides both an important source of fur as well as meat. The contribution of pig versus wild boar is difficult to establish since the limited positive identifications of either species prevent an attribution of the mixed category pig/wild boar. However, although the faunal spectrum of P14 may be more agricultural depending on this balance, the overall characteristics of the site regarding occupation and seasonality argue against its function as a permanent site with a main agricultural function (see also Appendix I; Raemaekers 1999).

3 While the absence of ample winter indicators may also be part of local choice in subsistence (Louwe Kooijmans 2009, 39-45), it is not impossible to argue that Wateringen-4 may have been inhabited seasonally (for instance a main occupation in summer and an extractive task in winter). Furthermore the botanical and artefact evidence point to local consumption of crops, but not necessarily to local cultivation (Out 2009, 99). This brings to mind the seasonal occupation of Swifterbant-S3 several centuries earlier, although there are obvious differences regarding site location, domestic-wild faunal ratio and the house structure.

4 Ypenburg phase 11/K yielded an even higher percentage of red deer (see Louwe Kooijmans 2009, fig. 10), yet the assemblage of this phase is rather small for comparison.

5 It should be noted though that many locations in complementary ecozones, to a certain extent, could be reached well within the daily range of action of *c.* 5-10 km.

6 According to the concepts as proposed by Binford (1980; 1982), the use of residential and logistical mobility here (*cf.* Raemaekers 1999; 2005[a], 267-277) is incorrect. According to Binford (1980) residential mobility is geared towards frequent residential moves in order to exploit resources, while logistical mobility implies a lower number of residential moves and exploitation of resources from logistical sites using special taskforces that go on expeditions to procure far-removed resources. In this respect the Late Mesolithic site of Hardinxveld-Polderweg could be interpreted as a winter base camp in a logistical system, while the site of Bergschenhoek could be explained as an extraction site in a logistical system. A system of logistical mobility is not characterized necessarily by the absence of residential mobility. It rather involves a difference in degree. The application of residential and logistical mobility according to Raemaekers (1999; 2005[a], 267-277) therefore is based on the false assumption that logistical mobility, according to Binford (1980) necessarily involves fixed sedentary sites. This is not the case.

7 The Delfland case-study (*cf. supra*; Louwe Kooijmans 2009) in this sense may be hypothetically relevant for the element of choice existing within the later Vlaardingen culture and the preceding Swifterbant period (Amkreutz 2010[b]), although its archaeological significance is lost to the explanatory value of natural differences when comparing sites situated in different ecozones.

8 For the Hazendonk group some peculiar exceptions of isolated sherds may be noted further south Amkreutz/Verhart 2006).

9 This should be nuanced. Apart from the distribution of axes, MK presence in the coversand area is limited (there is more convincing evidence of presence in the Meuse valley for instance; *cf.* Verhart 2000). For the Stein group the recently excavated houses at Veldhoven form a case in point (Kampen/Van den Brink, in prep.) as well as evidence of settlements in the river clay area, such as at Linden-Kraaienberg (Louwe Kooijmans/Verhart 1990). For the TRB culture evidence is more 'visible' due to megalithic burial monuments and the characteristic decoration on pottery (pers. comm. Louwe Kooijmans 2011).

10 For instance, isotopic evidence from Schipluiden demonstrates that wild resources were still dominant in at least some populations in a period for which it has also been argued that the process of Neolithisation had ended (*cf.* Raemaekers 2003).

Chapter 9

Synthesis

To unsettle the Neolithic we must move beyond essentialised concepts. To rewrite the Neolithic we must not generalise; we need highly detailed studies from many particular contexts. To rethink the Neolithic we must not assume homogeneity of human behaviour or archaeological phenomena; the value is in the particular (Bailey/Whittle 2005, 7).

9.1 Introduction

The aim of this final chapter is to summarize the results brought forward in this work, and to provide an answer to the main research question.

Based on the theoretical framework sketched in the introductory chapters (2-3), this thesis argues that the process of Neolithisation may be best defined as a mosaic of processes and developments, which benefits from being studied from a regionally coherent context. This work deals with the cultural succession from the Late Mesolithic to the Vlaardingen culture, with a geographical emphasis on the wetland and wet margins of the Lower Rhine Area (LRA).

The main question of this thesis focuses on how the gradual nature of the process of Neolithisation in this area may be understood from the perspective of the communities involved. Simultaneously it offers a reflection on the characteristics underlying the cultural continuity in the studied time frame and region. This particularly involves the development of long-term community characteristics in relation to their landscape and environmental setting. This indigenous approach foregrounds environment not as an ecological context of margins and opportunities, but rather as an active agent in shaping community identity and disposition. It is from this integrated perspective that a number of aspects regarding Neolithisation in the LRA have been studied, the results of which will be summarized and contextualized here.

First, the qualitative characteristics of the available dataset for the study of the transition to agriculture in the Lower Rhine Area (LRA) in relation to the upland-wetland discussion will be presented (see also Chapter 4). Secondly, the regional diversity existing within the Late Mesolithic and its settlement system in connection with landscape and ecological aspects is discussed (Chapter 5). In particular the Late Mesolithic communities in the wetlands contrast with upland oriented communities with respect to mobility, settlement system and lithic industry. This demonstrates that the characteristics of the Late Mesolithic communities form a diverse background for Neolithisation. For the wetlands these contrasts offer a perspective on the nature and temporality of Neolithisation and its distinct Mesolithic roots. The final part of the synthesis narrows its scope to this area and the long-term characteristics of the habitation, land-use and settlement system of the Swifterbant-Vlaardingen successors. These aspects are studied in view of the continuous indigenous development and in relation to the characteristics of its wetland and wetland margin occupation (Chapters 7-8).

9.2 Assessing the evidence

Before dealing with the archaeology of the Late Mesolithic and Neolithic communities in the LRA from an interpretative perspective, it is important to estimate the qualitative potential of the available dataset in the LRA study area. Chapter 4 provided a geographical reflective analysis, incorporating a range of taphonomic, formative and methodological factors influencing the dataset and the research performed. One of the central issues concerned the dichotomy existing in organic (material) and spatio-temporal preservation between qualitatively rich wetland and more meagre upland sites and datasets (*e.g.* Coles/Coles 1989).

From the perspective of preservation, wetland sites are at least partially representative of their less well-preserved, contemporaneous upland counterparts and (as such) greatly contribute to an understanding of the process of Neolithisation. Concerning economic choices and habitation characteristics, wetland sites did not exist in isolation and most likely functioned in wider settlement systems, which included other areas (*e.g.* Raemaekers 1999, 123). The idea of an upland-wetland distinction therefore is our own creation instead of reflecting a past reality or geological awareness (Louwe Kooijmans 1997, 111). Based on these considerations it is argued that a geographical distinction between wetlands and uplands should not be seen as absolute, but as gradual.

It is, however, also important to include a complementary perspective. The differences that may be documented between wetland and upland sites and datasets primarily result from preservation under different conditions, within different geogenetic sediments, relating to different environmental and landscape circumstances in the past (*e.g.* Groenewoudt 1994). At the same time, to inhabit these areas required different skills and strategies and resulted in different ways of life. Ethnographically, the existence of such connections between communities and specific landscapes has been widely attested (*e.g.* Descola 1994). This is distinctly the case for wetland environments (*e.g.* Harrison 2004; Van de Noort/O'Sullivan 2006). From a behavioural perspective therefore, distinct differences may exist between communities. In this respect the occupation and exploitation of the extensive wetland environments of the Delta and its intrinsic environmental characteristics are related factors that should be incorporated when studying these communities.

Therefore, while developments in the wetlands may provide the best perspective upon (aspects) of archaeological patterning elsewhere, they simultaneously deserve an analysis and interpretation of their own, based on the specific geographical and ecological qualities they possess and how these influence regionally specific behaviour and habitation.

9.3 The Late Mesolithic: a diverse background

Building from these landscape and environmental perspectives, the Late Mesolithic occupation of the LRA was studied through a selection of qualitatively informative, mostly excavated, sites in a number of (regional) settings (Chapter 5). The analysis aimed to increase our understanding of the existing indigenous substrate and the diversity of Late Mesolithic occupation in relation to the characteristics of subsequent communities caught up in 'Neolithisation' (Clark 1980, 5; Madsen/Simms 1998, 258-260).

The analysis focused on the differences in settlement systems and character of occupation of sites situated in different regional environments, including the southern and northern coversand landscape, the wetlands and wetland margins and river valley locations. The main contrast resulting from this comparative approach characterised occupation on the southern coversand as relatively short-term and barely structured, most likely functioning within a system with a high degree of residential mobility (probably several days to a number of weeks). At the other end of the spectrum wetland locations such as Hardinxveld-Polderweg and Hardinxveld-De Bruin are characterized by longer-term stays of up to several months. These sites are distinct persistent places (*sensu* Schlanger 1992) that also demonstrate an increased investment in their structuring and resource procurement. These locations most likely formed seasonal residential bases in a system characterized by logistical mobility (*cf.* Binford 1980). Many of the other sites on the northern coversand, in the wetland margins and in river valley settings may be interpreted as differing in degree rather than kind in relation to these opposites. River valley sites in this respect better fit the wetland profile, while sites on the northern and southern coversand are alike in many respects as well.

Complementary lines of evidence

A site- and settlement-system-oriented approach was chosen. This approach combined different complementary lines of evidence. One part focused on the position of sites in the landscape. From the integrated perspective of 'texture', 'grain' and 'redundancy' (Cribb 1991; Chapter 5), different aspects of 'settlement grammar' (*ibid.*) were discussed including site location, settlement structure and investment. The other part dealt with the technological, typological and raw material characteristics of the studied lithic assemblages.

9.3.1 Sites in the landscape

Regarding site location choice and site structure, the relatively large dataset for sites on the southern coversand demonstrated a distinct homogeneity in patterning. Low coversand dunes in the vicinity of small peat fens and streams were chosen as site location relatively often. These sites often stretched over considerable distances and developed incrementally over a considerable period of time. Additionally there is little evidence for investment in the form of structures such as shelters, although the existing taphonomic bias should be taken into account (see Chapter 4). Site structure and location choice are comparable for the northern coversand. Similar locations in the vicinity of water were sought after and although there are some landscape-related differences, for instance in water drainage, the overall character is similar (see palaeo-geographical map '5500 cal BC'; Vos *et al.* 2011, 43). Evidence for investment (pits, hearths, structural stones) is more distinct, especially when elaborate hearthpit sites such as Mariënberg are taken into account, yet the signature of occupation is comparable.

The site location choice and settlement structure of the sites in the wetland(/margin) group and in river valleys is, to a certain extent, different. Distinct wetland locations such as the Hardinxveld sites demonstrate a considerable degree of investment in a variety of features, including dwelling structures and graves. In view of the occupation span (see Louwe Kooijmans 2003) it indicates a diversified structural investment, corresponding with the structured use and reuse of specifically targeted sites in the landscape (see also Louwe Kooijmans/Verbruggen 2011). The location of activities at sites argues in favour of consistent traditions and choices over time through which these locations became persistent places. People returned to these places and structured them according to the same set of rules and practices for a long time. Because of this and the increasingly limited availability of other suitable places in the surrounding area (see Mol 2001[a]), it is likely that this concerned the same group over time. A number of the other sites, such as Hoge Vaart, Urk and the Swifterbant sites, are situated in landscapes that were becoming increasingly wet. Their occupational characteristics differ in degree. The river valley sites around Liège are not situated in an extensive wetland, but in a floodplain environment. They also display evidence for structured investment and longer-term stays.

9.3.2 Evidence from assemblages

The differences sketched above are mainly based upon an interpretation of aspects of site location choice, settlement structure and investment in places. They are reinforced by the characteristics of the associated lithic assemblages, which are much less affected by differential preservation.

Assemblage composition yields a homogeneous picture for the large dataset of sites on the southern coversand. These contrast with the assemblages of the wetland locations at Hardinxveld. Other sites take up an intermediate position.

A large proportion of points in the tool spectrum is characteristic of the coversand assemblages, in particular in the south. Furthermore, both in tools and debitage, blade production and blade-based products make up a clear component. Both the blades and the formal tools represent a curated component of the technological tradition. This is further supported by the use of the high quality raw material of Wommersom quartzite, in particular for the production of formal tools such as trapezes. This contrasts strongly with the wetland sites, where the technological and typological characteristics of the assemblages point to the production of non-formal tools and an expedient technology, with an important role for retouched flakes.

These coarse-grained distinctions are proposed to be informative on the activity range performed at sites, site function and mobility. The relative importance of flakes versus blades relates to these aspects in view of issues such as reliability, bulk, access to resources and mobility type (see Chapter 5). A larger contribution of formal tools and curated technology is mostly typical for groups with a high(er) level of residential mobility, whereas expedient technologies and informal tools are often associated with groups characterized by a lower mobility and longer residential stays (*e.g.* Andrefsky 2005; Binford 1983 (1979)).

The characteristics of raw material procurement support the sketched contrast. For most of the coversand sites as well as the river valley and wetland margin sites, procurement focused mainly on local flint sources. On the southern coversand, Wommersom quartzite formed an additional important component and may have been partly procured through embedded mobility, in combination with targeted expeditions and exchange. At the wetland sites of Hardinxveld a different system existed, since all raw material had to be brought in from considerable distances, implying an important role for logistical mobility, mainly ‘radiating’ from one location.

9.3.3 Context for occupation

The structural and assemblage characteristics sketched above should be interpreted in relation to the landscape and environmental setting. The evidence mainly allows the comparison and contrasting of opposites along a continuous scale. In that respect, the southern (and northern) coversand landscapes form one end of the scale. These areas are generally characterised by a closed-canopy forest (*e.g.* Bakels 1978; see Chapter 5) and in such a relatively homogeneous environment, locations near peat fens or streams would be the most attractive settlement areas. These places represented the conjunction of a diverse set of natural resources (including raw material and presence of water) and formed a buffer for occupation. The limited extent of these areas led to rapid depletion of available resources, which in combination with expected regeneration time prompted frequent residential moves (Kelly 1995). The knowledge on other locations and their relative abundance in the landscape would lower the cost of moving. This is substantiated by the probable focus on terrestrial fauna which often requires mobile and active encounter strategies (Binford 1980; 2001, 269-280; Chatters 1987). These factors support the archaeological patterning, which is characterised by extensive site complexes formed often over considerable spans of time by a multitude of visits to the same locations. As argued, the lithic analysis supports this idea.

At the other end of the spectrum there is the aquatic environment of the Dutch delta and, to a more limited extent, certain floodplain locations. These provide different habitational possibilities and offer greater opportunities for mobility and occupation. These wetland environments are trophically rich, providing many aquatic and related resources, such as fish, beavers, otters and waterfowl. They may be characterised as heterogeneous in type and variation, but with a relatively consistent distribution (Nicholas 1998[a]; 2007[a]). This means that attractive and diverse combinations of resources are available. As such these environments are best exploited by a collector-type strategy, characterised by logistical mobility (Binford 1980; Brouwer-Burg 2012), longer residential stays and larger groups (Binford 1990). Furthermore the nature of both the environment and its resources would also favour passive procurement strategies and investment in facilities such as dwellings, traps and canoes. This is substantiated by, for instance seasonality evidence as well as finds at the Hardinxveld sites and the river valley sites of Liège and Remouchamps. These characteristics in combination with the availability of suitable locations would also lead to a more place-focused system of persistently visited sites. The expedient characteristics of the assemblage and the logistical characteristics of the raw material procurement appear in line with this perspective.

9.3.4 Settlement systems and Neolithisation

Of course when interpreting settlement systems, the distinction outlined above is not absolute as these may have incorporated sites at both ends of the proposed spectrum. However, there was likely a significant difference in degree between systems that were more oriented to the exploitation of wetland resources and those with an upland-terrestrial focus (see also Chapter 5). In the case of the wetland locations it is argued that these may have been attractive for occupation in the winter season, since their environments provide sufficient resources for lean periods (see Binford 1990). The seasonal signal of Hardinxveld-Polderweg (Louwe Kooijmans 2003), which may be interpreted as a winter base camp, perhaps functioning in relation to a complementary wetland margin location during summer, may support this contention. The typological and technological similarities between assemblages of the southern coversand and the river valley sites around Liège, in combination with similarities in the characteristics of lithic resource procurement, suggest a comparable scenario.

While ethnographic evidence indicates the diverse and complementary ways in which groups may combine strategies as well as split and aggregate in relation to resources and their predictability (*e.g.* Kelly 1992; 1995), the overall difference between sites at opposite ends of the spectrum, with respect to aspects such as site use, technology, raw material and food procurement and mobility, indicates the existence of relatively divergent lifestyles. These opposite ends do not preclude combinations but do support the existence of communities with socio-cultural and economic differences. This argues for the existence of diversity in the Late Mesolithic substrate. Similar landscape- and environment-related differences have recently also been alluded to from the perspective of behavioural and chronological studies (Brouwer 2011; 2013; Crombé *et al.* 2011[b]).

9.3.5 The Mesolithic roots of Neolithisation

It is evident that an understanding of the characteristics of Neolithisation benefits from an understanding of the indigenous groups involved in the process (Madsen/Simms 1998; Zvelebil 2004[b]). For the LRA, the diversity in the Late Mesolithic substrate in relation to the distance to and influence of farming communities shaped the nature and temporality of the transition to agriculture even before the LBK entered the study area around 5300 cal BC. A general premise is that in particular for wetland and wetland margin communities, specifically those of the (wider) delta area, there was little economic incentive to adopt aspects of agriculture. This fits Binford's notion that in settings with little aquatic potential, especially when there is stress over resources, relatively quick moves directly towards agriculture could be expected under packed conditions (1990, 149). In the case of the LRA moreover, the limited suitability of the wetland area to (Danubian) crop cultivation (Bakels 1986; Out 2009, 411-424) and the distance involved in the interaction necessary for agricultural practices to be adopted formed a factor of importance that should be taken into account (Amkreutz 2009). This creates a situation where, in the absence of direct competition over resources or stress, the initiative and character of the process is predominantly determined by the indigenous communities living in these areas. This may be contrasted to the situation in the southern part of the LRA, where hunter-gatherers with a significant upland component and terrestrial diet perhaps experienced competition over resources with Neolithic farmers sooner. When mobility no longer offered a 'way out' this may, hypothetically, have led to relatively swift transitions.

For the wetland communities, and reasoning from an archaeological perspective, this resulted in evidence for a gradual transition, starting with the procurement of foreign flint and artefacts, followed by indigenous pottery production and the piecemeal introduction of domesticates to experimentation with crop cultivation (see De Grooth 2008; Louwe Kooijmans 2007[a]; Out 2009). Socio-culturally it implies the absence of a necessity for economic change or more intensive interaction and a distinctly internally controlled introduction and process whereby important aspects of the initial Late Mesolithic communities remained unchanged.

The Mesolithic diversity and the wetland component in particular provide the context for the successive communities that developed. As argued earlier the Swifterbant-Vlaardingen cultural succession may be seen as heirs to these Mesolithic wetland communities. The available archaeological evidence (*e.g.* Chapters 7 and 8) regarding site distribution, procurement practices and characteristics of material culture, argues in favour of a significant (though not absolute) wetland orientation of these communities, as well as cultural continuity (*e.g.* Louwe Kooijmans 1998[a]). These communities were further studied here with the idea that their role and trajectory within the process of Neolithisation was mainly self-imposed and controlled. This affords the opportunity to study these communities, and the characteristics of Neolithisation, from an essentially long-term (indigenous) perspective rooted in the Late Mesolithic and in relation to the long-term relationship and interaction of these groups with the wetland environment.

9.4 Neolithisation in the wetlands: a long-term community perspective

Building on the analysis of the Late Mesolithic, the scope in the second part of this thesis was narrowed to the wetland and wetland margin environment and the successive communities (Late Mesolithic to Vlaardingen culture) inhabiting that area. Central to the analysis is the recursive relationship between communities and their environment in relation to the nature of the process of Neolithisation. Most human-environment approaches in relation to Neolithisation are predominantly of an economic or functional character and socio-ideological aspects are mostly incorporated implicitly. In this study the human-environment relationship takes on a more explicit social and ideological role, offering a complementary perspective on Neolithisation by focusing on regional long-term community characteristics.

The roots of this community-environment perspective were theoretically anchored in an archaeology of inhabitation in which the regional context and historicity of such a relationship is stressed (see Chapter 6; *e.g.* Barrett 2001; 2005). Reasoning from the dwelling perspective and its social character (*cf.* Ingold 2000), elements of routine practice, or *habitus*, are incorporated in the analysis outlining the nature of the relationship between communities and their environment. In this respect environment, or rather the perception of environment, is deemed formative or structuring in the development and characteristics of the communities involved (*e.g.* Brück 2005; Whittle 2003). With regard to the wetland environment this involves a combination of geological, geographical and ecological aspects of the wetland landscape and the occupational margins they offer, as well as an incorporation of the structural and structuring conditions of these landscapes (see Barrett 2000) and how these may have been (phenomenologically) experienced.[1]

The results shed light on the communities and their *mentalité* in relation to issues of land-use, livelihood, mobility and settlement systems. They also provide a complementary perspective on the regional nature and temporality of

Neolithisation in the study area. This argues for the study of communities and their environmental context as 'total phenomena' (*cf.* Balée 1998[b]).

9.4.1 Wetland environment and dynamics

The geomorphological and ecological characteristics of the wetland landscape have been outlined in Chapters 3 and 7. From an economic and functional perspective the wetlands and their margins have been defined as a very rich environment, similar to many wetlands (*e.g.* Van der Noort/O' Sullivan 2006; Nicholas 2007[a,b]). Their trophic qualities and diversity set them apart from upland environments such as the coversand areas in the LRA. Additionally, they were defined as relatively dynamic landscapes. Processes such as unexpected flooding, waterlogging, peat growth, changing constellations of resources, changing routes and networks, disappearing (drowning) and emerging land, places and landscape features, increasing distances to upland regions, changes in fresh or brackish conditions were all part of these dynamics. While the underlying long-term geological processes of erosion, sedimentation and environmental change (Vos/Kiden 2005) largely escape human perception, their effects may be noticeable within generations and lifespans and can be sudden or unexpected, affecting everyday life. These characteristics must have placed a strain on resource reliability, on patterns of anticipation and planning, territoriality and mobility.

The wetland landscape as a medium in these processes was likely a factor of perceived importance (see Cooney 2004, 325), yet people in these wetland environments lived with these cyclical as well as unexpected changes. The structure of their way of life was not dominated or altered by environmental changes (Van de Noort/O'Sullivan 2006, 25; see also Leary 2009) as their inhabitation of this landscape incorporated mechanisms to flexibly deal with these. This raises questions as to the interwovenness of people, places and the environment and how wetland landscapes were active agents in forging local identities (Chadwick 2004). Reasoning from the dwelling perspective, landscape and its environment are interpreted as characterised by certain structural conditions, but simultaneously have a structuring agency in relation to the communities living in them. They are therefore more than an abstract physical and ecological background determining (economical) opportunities and risks, but are also dwelt-in and experienced, in particular through routine practice. As such they recursively contribute to shaping the social identity of their inhabitants (*e.g.* Barrett 2000; Cooney 2000; Ingold 2000).

9.4.2 Wetland communities: land-use and livelihood

In the approach of a dwelling perspective the aim was to document the regional *habitus* (*cf.* Bourdieu 1977) of communities over time. This offers a long-term perspective on the characteristics of inhabitation in the area and on the nature of the structuring principles underlying it. The human-environment interaction and its specific influence on the communities inhabiting the LRA wetlands and wetland margins has been documented in particular for aspects of procurement as well as mobility and seasonality. These topics reflect fundamental choices and behaviour regarding the general characteristics of livelihood of these communities and as such also influence other fields of practice. The main results will be discussed below.

Procurement

Practices of (food) procurement offer an informative perspective on community-environment relationships. In general the evident rich trophic qualities of the area did not urge inhabitants to quickly switch the mainstay of their subsistence procurement to crop cultivation or stock farming. Instead these activities were incorporated into what had been common practice since the Mesolithic (see also Zvelebil 1994, 64), forming an extension of the existing broad spectrum economy (*sensu* Louwe Kooijmans 1993[a], 103; 1998[a]). Of relevance is also the notion that while domesticates and cultigens increasingly contributed to subsistence, the practices and native knowledge of hunting, gathering and fishing remained important.

The composition of the subsistence spectrum at site-level, best illustrated by the faunal remains, primarily reflects the natural exploitation possibilities with respect to hunting (including fowling and fishing) and farming. While the overall contribution of domestic animals to the diet increases over time, their predominance is mainly a feature of coastal (and potentially wetland margin) sites from the Middle Neolithic Hazendonk group onwards. As late as the Vlaardingen culture, sites located in other areas demonstrate a more varied composition of the faunal spectrum and wild resources remain an important component in subsistence at these sites.[2]

The contribution of crop cultivation is difficult to establish. It is difficult to define between 'no or limited evidence for crop cultivation' or 'some evidence for limited crop cultivation' (see Out 2009, 445). There is positive evidence for small-scale cultivation at the northern Swifterbant sites, and firmer evidence for coastal locations from the Hazendonk period onwards. At the wetland sites in the southern part of the delta, transport of crops remains an option alongside small-scale local cultivation (*e.g.* Out 2009). Because of the limited available arable area (*e.g.* Bakels/Zeiler 2005, 327) and particular physical and ecological conditions, crop cultivation in large parts of the wetland area necessarily took place on a limited scale. The continuous and stable contribution of gathered plants further suggests that crop plants and small-scale cultivation were simply added to the already existing plant food spectrum (Cappers/Raemaekers 2008; Out 2008[d]).

With respect to subsistence, or rather procurement (see Bird-David 1992[b]; and discussion in Chapter 8), the defined characteristics complement the idea of an 'extended broad spectrum economy' (*cf.* Louwe Kooijmans 1993[a]). It may be argued that the LRA wetland communities were non-exemplary regarding the implications of the introduction of animal husbandry and crop cultivation (Zvelebil/Lillie 2000): these elements were successfully 'added to the mix', without resulting in drastic changes to society or settlement system. Developments occurred gradually and did not include all (culturally) contemporaneous sites. A diversity in choices existed that although limited to the regional environmental and physical context, also allowed for a certain element of group choice (agency), preference or tradition (see Chapter 8).

Seasonality and mobility

The nature of community-environment relationships and in particular aspects of site-use, mobility and the settlement system are also illustrated by the available evidence on seasonality in combination with material site-based characteristics.

While interpretation is hampered by the limited number of sites and the necessity of extrapolation of the available data, there is convincing evidence for long-term wetland-oriented communities (see Chapter 8). Settlement systems incorporated margin locations and possibly sites further afield on the sandy upland, but appear to have been centred on the inhabitation of the wetlands.

It is argued that while activities were seasonally specific, there is no season in which wetlands were not (residentially) inhabited. This includes residential occupation during the winter as demonstrated at Hardinxveld-Polderweg (Louwe Kooijmans 2003), or 'summer-sites' such as Swifterbant-S3 (Zeiler 1997). This domestic occupation of the wetlands continued as late as the Vlaardingen culture and is supported by evidence for a substantially 'wild' component in the economy and overall site composition of residential wetland locations such as Vlaardingen, Hekelingen, Hazerswoude and Hellevoetsluis. There thus appear to be no distinct archaeological indications for a shift towards an exclusively extractive use of the wetlands and wetland margins (and a focus on optimal farming locations in the settlement system) before the Early Bronze Age (see Louwe Kooijmans 1993[a], 101). As such there is convincing evidence for an ongoing domestic, residential use of the wetland area until the Vlaardingen culture, in addition to the appearance of year-round occupation of settlements in the coastal area (from the Hazendonk period onwards).

The evidence for year-round occupation of settlements from the Hazendonk period onwards and evidence for a significant contribution of animal husbandry and local crop cultivation (*e.g.* ard marks) at some sites, point out that aspects of the settlement system changed. Overall there is a trend from seasonal residential moves, combined with logistical mobility in the Late Mesolithic and Early Swifterbant period, to permanent settlement combined with logistical mobility from the Hazendonk period onwards. Although these permanent agricultural settlements take on an important 'fixed' role, it is part of a range of options and seasonal occupation of semi-agrarian to non-agrarian residential settlements is attested up to the latest phase of the Vlaardingen culture in some eco-zones The residential (seasonal?) function of the Hazendonk site during Vlaardingen phase 1b forms a case in point (see Louwe Kooijmans/Verbruggen 2011). Mobility thus remained important.

In conclusion there appears to be a strong element of continuity in the way the wetland area is used over time. This also relates to non-food raw material procurement. The familiar tracks, pathways and contacts probably provided the channels for knowledge on farming and other aspects of Neolithic life to reach these communities. In general it appears that many of the Mesolithic routines relating to raw material procurement remained in place.

Continuity and flexibility as communal traits

The following general conclusions with regard to the human-environment interaction and characteristics of regional inhabitation were reached. First there is a clear cultural and behavioural continuity, which finds expression in the consistent range of practices and strategies employed.[3] Places were used over long periods of time and procurement remained characterized by an often central core of hunting, gathering, fowling and fishing to which domesticates and cultigens were added. Similarly there was no wholesale shift to sedentism, (parts of) communities remained residentially mobile. There is therefore a consistency in the way these communities dealt with the wetland environment and its (spatio-temporal) dynamics for almost three millennia.

Second, with regard to the nature of this behavioural continuity, these communities demonstrate an ongoing flexibility in inhabiting the wetlands. Site use is stable (see Amkreutz 2013[b]; see also Tringham 2000[b]), yet site function may change and is subject to both shifting short-term seasonal use patterns as well as long-term shifts in function over time. At the same time a broad range of procurement strategies is in operation, while residential mobility remains an option as well. Moreover, community choice appears not always to be optimal if we take into account the specific ecological and physical site circumstances. Therefore the central theme (or socio-behavioural trait) that may be defined for these communities is flexibility. This means that they were characterized by a ready, responsive capability to adapt to new and changing requirements and circumstances; a certain pragmatism.

Of importance is the notion that while this defining trait should be understood against the particularities of the wetland environment it is also, and perhaps became more so, an innate quality of the communities involved. In view of the documented behavioural continuity and its flexible nature over time, a distinct element of intra-cultural agency emerged, most probably at the regional level of the settlement system. This is evidenced by diverse choices that were made with respect to subsistence and habitation, at sites with the same cultural affiliation in different geographical regions, but, more importantly, also at contemporaneous and adjacent sites with a comparable ecological background (see Louwe Kooijmans 2009). This points to community-based choices and group agency regarding resource procurement, mobility as well as the incorporation of Neolithic elements (*i.e.* the contribution of domesticates and cultigens).[4]

From a long-term perspective this flexible aspect of inhabiting the LRA wetlands and their margins seems to have endured over time and appears to be a characteristic feature of the inhabitation of this area.

9.4.3. Integrative strategies

The changing patterns in the wetland mosaic and their consequences were buffered by the opportunities the wider region offered as well as the disposition of the communities involved.[5] Interestingly, the way in which these communities dealt with their environment also informs us on the character of social memory, how society perceives itself, the surrounding landscape and its position in it. Both *practice* and perception are the result of a long-term interaction between communities, landscape and environment. Reasoning from this it may be stated that people were not dominated by the whims of the natural environment (see also Van de Noort/O'Sullivan 2006, 25), but rather adjusted technical, economic and social aspects of their way-of-life to new circumstances *without* fundamental change. By attuning to the changing environmental and landscape mosaic in space as well as time, they managed to consolidate their (way of) livelihood and buffer against shortages (*e.g.* Leary 2009, 232-235).

This characterisation is in line with the understanding of the development of an extended broad spectrum base of subsistence proposed by Louwe Kooijmans (1993[a]), where Swifterbant, Hazendonk and Vlaardingen communities incorporate agricultural products and eventually practices alongside continued hunting, fishing and gathering. While this perspective mainly stresses the (economic and practical) addition of new elements to the spectrum, it is argued that other aspects, such as mobility, exchange and group composition, also form aspects of a range of options. This shifts the emphasis from composition to practice and to an operationalisation of the extended broad spectrum economy. The active transformation of the repertoire of options into adaptable combinations is distinguished here as characteristic of these communities. This concept has been defined as integrative strategies (see Chapter 7).

The composition of these integrative strategies, such as mobility, symbiosis, interdependence, group fissioning and exchange was 'fluid' in nature. Their exact configuration at specific points in time, or for specific sites is difficult to attest because of the equifinality of different explanations. Nevertheless, the regional signature based on the evidence of subsistence, seasonality, (residential) mobility and inferred structure of the settlement system, points to a consistent underlying behavioural and social disposition or *habitus*. It shifts the emphasis from subsistence and the addition of domesticated resources, to the dynamics of the settlement system, including mobility, intergroup interaction and complementary strategies and the long-term position of the communities involved.

The role of domesticates and cultigens

The perspective offered above argues that the distinctive repertoire of options emerged out of the communities' long-term relationship with the wetland environment and its (potentially) dynamic character. At the same time this behavioural flexibility was partially decoupled from direct environmental motivation and posited as a shared trait characteristic of these groups. It was argued that the long-term relationship between these societies and the wetland environment over time gave rise to a cultural system appreciating flexibility. In the long run, flexibility thus became decoupled from responses to immediate environmental fluctuation, and became an element that invaded their cultural repertoire. This implies that it also influenced how they dealt with 'Neolithic novelties' (*e.g.* domesticates, cultigens, technology and sedentism). Despite the potential novel and alien aspects of the initial introduction of agricultural practices and Neolithic material culture, their appropriation, position and implication do not seem to have had a disruptive influence on the existing way-of-life and its attached values and ideology.

With respect to food procurement the attested continuity in practice and the consistent contribution of hunting and gathering to the diet also suggests the importance of ideology and values attached to an existence based on wild resources (*e.g.* Amkreutz/Corbey 2008; Barnard 2007; Tucker 2006). This is supported by ethnographic case-studies. While these cannot provide an ideal parallel for the LRA situation (lacking similar spatio-temporal scale, ecology and technological footing), their added value lies in the degree to which underlying common principles may be determined. They offer an idea of the diverse adaptations among small-scale societies in combining various subsistence and mobility strategies and shed light on the position of husbandry and crop cultivation in particular. There is convincing evidence for the existence of communities using and combining wild and domesticated resources. The main idea evolving from this is that adopting producing modes of food procurement did not always have the impact we often assume it did, from the etic perspective of Neolithisation (see Whittle/Cummings 2007). The image is rather one of a range of pursued strategies, the use of which is sometimes haphazard, experimental or even careless. Both from a long- and short-term perspective (see Appendix III; Chapter 7) comparable characteristics may be noted that argue for a flexible attitude towards combining and switching between domestic and wild resources. This indicates that there may have been little incentive to adopt agriculture as the main economic system on a society-wide scale.

In view of our LRA wetland case-study this underlines that these new resources and practices probably formed a welcome addition to the pragmatic consolidation of the way-of-life of these wetland hunter-gatherers, rather than a new opportunity.

9.4.4 A new perspective on settlement systems

In line with the perspectives offered above, the available evidence for site-use and mobility at Late Mesolithic to Vlaardingen wetland sites was reviewed in terms of settlement systems and land-use and subsequently modeled in Chapter 8. The limits of the available data prevent a definitive definition of settlement systems, but allow the distinguishing of larger-scale periodical composition over time.

The following developments are seen. During the Late Mesolithic and the Early Swifterbant period, logistically mobile systems were in operation besides potentially residentially mobile systems on the (northern) coversand. Delta sites such as the Hardinxveld locations and possibly Maaspoort point to a settlement system focused on wetland exploitation and are characterized by an increased degree of permanency and investment (see Chapter 5). This logistical system with seasonal sites and extraction camps appears to become the 'standard' during the Middle Swifterbant occupation of the research area. Mobility was combined with animal husbandry, import of crop products, or small-scale local cultivation. Evidence for year-round occupation of sites is absent. Since we are dealing with a continuum from residential to logistical mobility systems (*cf.* Binford 1980), other, more residentially mobile systems or combinations may be expected in relation to site location and environmental exploitation, in particular when upland locations were included in the settlement system.

For the Hazendonk and Late Swifterbant occupation two types of settlement systems were defined. A number of sites continues to provide evidence for a continuation of seasonal occupation in a system of logistical mobility. This is now combined with locations, such as most of the Delfland sites that provide evidence for year-round permanency and an important role for agricultural resources. Of importance is the noted group agency, leading to diverse choices at adjacent Delfland sites (see Louwe Kooijmans 2009). For the subsequent Vlaardingen occupation there is continued evidence for year-round permanency and an agricultural subsistence base, predominantly in the coastal areas. In the freshwater tidal and peat marsh areas (in particular) continued (seasonal) logistical mobility and non-permanent sites are attested.

Complementary systems?

The central question is whether the development of sedentary sites with an important role for agriculture should be seen as the determinant in the interpretation of settlement systems. If so, then the composition of the Hazendonk group and Vlaardingen settlement system is hierarchical. The (coastal) locations with permanent occupation form the main components and other, temporary sites or locations with a significant contribution of wild resources function in relation to these sites in an auxiliary manner. This implies that the location of the main sites was determined by the possibilities for nearby cereal cultivation and animal husbandry and that agriculture shifted from being an extension of the broad spectrum subsistence base, to being the major subsistence strategy, determining spatial strategies (see Raemaekers 2003, 745; 2005[a], 276). From a perspective focusing on economic aspects of Neolithisation, or the transition to agriculture as such, the interpretation of a subordinate system forms a logical step. However, in line with the arguments brought forward earlier, regarding the flexible disposition of these communities and their adoption of integrative strategies, a more heterogeneous approach may be employed.

The first interpretation is importantly based on the idea that agricultural sites with (an assumed) sedentary occupation form the main element in the settlement system, while locations with a large contribution of wild resources, or that are less ideally situated for animal husbandry or crop cultivation, function in a subordinate relationship. This interpretation foregrounds the role of agriculture with respect to Neolithisation. It does not necessarily take into account whether agriculture is in fact actually the main (caloric) contributor to subsistence, as is for instance called into question by certain faunal assemblages or the isotope signature of the Schipluiden inhabitants (see Chapters 7 and 8), nor whether the location of a sedentary site is in fact determined by its potential for agriculture. An alternative perspective provides a different emphasis. Based on the evidence for flexibility, pragmatism and integrative strategies, this perspective argues for a number of options existing side by side. These include sedentary sites, potentially occupied in relation to auxiliary locations, as well as the continuation of ('completely') logistically mobile systems, including seasonal residential mobility. Since the wetland communities were arguably in contact, interaction, exchange, mobility and group composition remained important factors in facilitating access to resources and accommodated community choice. Rather than a new step this may be interpreted as a further consolidation of a system already in existence.[6]

Integrative strategies and settlement systems

Due to the qualitative and quantitative limitations of the archaeological evidence, the character and combination of the integrative strategies and the composition of mobility in the settlement system remain abstract. A number of general long-term particularities supporting this perspective may however be found in the archaeological record. These include the fact that the diversity in wetland landscapes remained in (residential) use. There appears to be no distinct shift to coastal areas or wetland margins to facilitate agriculture. Differences remain in the subsistence spectra which point to diverse choices regarding the emphasis placed on hunting, gathering and fishing in relation to animal husbandry and crop cultivation as well as with respect to local production versus import. There continue to be differences in raw material networks, for instance regarding the lithic raw material for the Vlaardingen culture at a number of wetland sites (*e.g.* Amkreutz 2010[b]; Verhart 1992), implying differences in hinterland, territory and cooperation. It is less plausible to assume that all of this diversity would be reflected in a single type of settlement system. Differences also apply to site architecture and structure, such as building practices and settlement layout and size. Mobility, including residential mobility, remains an option for the entire studied period and should, according to ethnographic analogy, be complemented by allowing for additional mechanisms, such as group fissioning, task division and exchange.

To conclude, it is argued that the characteristics detailed above are typical for most of the occupation of the wetlands and their margins during the time period between 5500-2500 cal BC. They reflect both the behavioural adaptation as well as socio-ideological identity or *mentalité* of the communities inhabiting this wetland landscape. As such they characterize the role of these groups in relation to Neolithisation.

9.5 Neolithisation: a long transition

The study of the communities from the perspectives discussed above has repercussions for the interpretation of the process of Neolithisation (see Chapter 8). This in itself is importantly a matter of choice, based on the premises chosen (see Chapters 1 and 2) and it should be stressed that a discussion on the process of Neolithisation differs from defining a(n artificial) boundary for the Neolithic.

Concerning the development of Neolithisation, this study argues that for the area studied and communities involved, distinguishing a Neolithic boundary may obscure insight into the developments taking place. In view of the widely used availability model (*cf.* Zvelebil/Rowly-Conwy 1984) the archaeological evidence for the transition to agriculture in the LRA has been interpreted as indicative of a short process. The occurrence of settlements with a faunal composition incorporating 50% domesticates or more, as well as increased evidence of crop cultivation and sedentism can be positioned in the middle of the 4th millennium. This would place these sites at the consolidation stage of the availability model and thereby at the end of the transition to agriculture. Based on this Raemaekers (2003, 744-746) argues in favour of a shorter transition to the Neolithic: being completed at the time of the Hazendonk group or even before, if absence of evidence for Swifterbant coastal sites is taken into account (*ibid.*, 746). This is based on the domestic faunal contribution at a number of sites, in combination with evidence for sedentism and cultivation in the coastal area and supported by the argument that the faunal assemblages differ more with respect to different environments than they do over time in a similar environment (Raemaekers 2003, 745). The contribution of domesticates and cultigens to the subsistence base is interpreted to have shifted from an extension to being the major subsistence strategy (*cf. supra*) in that time frame. While evidence for this scenario initially appeared most convincing for the Vlaardingen culture, excavations at Wateringen and subsequently at Ypenburg and Schipluiden have pushed back this threshold, enabling the interpretation of a process of Neolithisation in the Dutch delta that was likely short (*ibid.*, 746).

9.5.1 Premises of a short transition

Based on the perspectives of the integrated relationship between communities, landscape and environment, the existence and implications of a short transition to agriculture are questioned here. Argumentation for the short transition model is based on a number of premises that focus on the 'Neolithic' side of the spectrum. The most important of these is the custom to describe Neolithisation in terms of food production (Raemaekers 2003, 740). The ratio between wild and domesticated animals (preferably ungulates) is often used as an index for this. Problematic in this respect is the fact that lumping domesticated animals, wild fauna and occasionally pigs (difficult to determine) into three separate groups presents an oversimplification of the actual situation and blurs differences in choice and spectrum between sites. Comparative studies of terrestrial meat consumption, caloric value and factors such as the contribution of fish and fowl to the diet (as demonstrated for instance by the isotope study at Schipluiden; Smits/Van der Plicht 2009; Smits *et al.* 2010), or the distortive effects of partial processing of hunted animals in the field (*e.g.* Faith/Gordon 2007) and taphonomy on bone preservation are not taken into account. Apart from this biased faunal perspective, a problem lies in the fact that a prime position is given to its implications within the availability model: the (beginning of the) end of the Neolithisation process in a certain region is set at the moment when domesticates (and cultigens, *cf.* Zvelebil 1998[a]) account for 50% or more of the assemblage of a single site, which then determines the interpretation of both site function and settlement system. This brings forth the question for instance whether certain sites in the Hazendonk group that surpass the 50% boundary are informative on the nature and position of later Vlaardingen sites with a predominantly wild faunal count. In other words, if sites with the strongest Neolithic signature are used as the central elements in the settlement system, it is attractive to suggest a linear development (*cf. supra*; see Chapter 8).

9.5.2 Perspective for a long transition

Evidently the choice for a shorter or longer transition to agriculture in the study area depends upon the emphasis placed upon certain elements in subsistence and the settlement system. This particularly involves the interpretation of residential and logistical mobility and the role attributed to sites characterized by a predominantly domestic fauna and (potentially) year-round permanency of occupation. Here it is argued that when emphasis is placed on the strategies and behaviour of the wetland communities, a picture emerges stressing continuity and an incorporation of novel practices and products that did not lead to abrupt changes. It is the intra- and interregional differentiation in the way different resources were exploited rather than the dietary contribution of domesticates and cultigens that mark the developments taking place. Foregrounding these characteristics as the outcome of long-term community-landscape interaction, makes them central to the way these communities interacted with their environment as well as resources. In view of this, a long transition model seems most plausible.

From that point of view two aspects should be highlighted with respect to Neolithisation. First, while from a modeled perspective the appearance of Neolithic elements (objects, practices, agriculture and sedentism) may mark distinctive developmental stages, their use or adoption does not directly inform us on their impact on the lifeways of these communities. These elements, including domesticates, cultigens and the practices involved, became part of the repertoire of options that characterizes the integrative strategies defined. Reasoning from the position of the communities involved and their continuity in *habitus* and supported by ethnographic evidence, it may be argued that agricultural developments, including sedentism, were incorporated into existing practices of living in the area. Instead of them forming a distinct developmental stage, changing lifeways and livelihood, they can be perceived as epiphenomena of continuing an existing way-of-life. Second, if the introduction and adoption of domesticates and cultigens should be understood as an 'extended broad spectrum economy'(*cf.* Louwe Kooijmans 1993[a]) then the emphasis in developments may also be placed with the consistency of this system, rather than with the appearance and contribution of its 'extended' aspects. This perspective is supported by a number of characteristics discussed in Chapters 7 and 8. Of importance in this respect is the diversity that remains characteristic of the composition of the food economy and the contribution of domesticates and cultigens across settlement systems. Although part of the diversity is explained by differing environmental contexts, part is also based on community choice as demonstrated for sites with a comparable ecological background. Additionally it includes the continued contribution and potentially symbolic role of wild resources and the continued evidence for mobility, including residential mobility, as an important feature of the settlement system (or part of it). Furthermore the diversity existing in networks for raw material procurement as well as other non-food elements of site use, building practices as well as ritual expression may be mentioned.

When the characteristic elements of the communities in the cultural succession between the Late Mesolithic and the Vlaardingen culture are foregrounded, there is evidence for long-term continuity. This involves a lifestyle characterized by flexibility, group agency and a successful combination of integrative strategies inclusive, but not in service, of agriculture.

The dimensions of this characteristic flexibility and pragmatism are related to ecology, but should primarily also be understood as a cultural choice. Additionally it should be stressed that the long-term continuity mapped and interpreted as reflecting a specific wetland *mentalité* also influenced how these groups shaped their adoption of agriculture and interacted with those elements we define as Neolithic.

9.5.3 Neolithisation and 'new rhythms'

The continued flexible *habitus* underlines the consistent central role of the suggested integrative strategies and is supported by the variability in site function, resource composition, mobility and raw material networks that can be documented as late as the Vlaardingen culture. The combined evidence supports the interpretation that this also included the integrated economic role of domesticates and cultigens and the position of sedentism.

Reasoning from this perspective, the continuity in livelihood from the Late Mesolithic onwards corroborates a long and gradual transition. The process of Neolithisation did not end before the Early Bronze Age in this respect, when the majority of the evidence points to a mainly sedentary agricultural lifestyle (see also Louwe Kooijmans 1993[a]; 2007[a], 307). Recently this was underlined by the study of the Late Neolithic SGC wetland site of Keinsmerbrug, which pointed to distinct behavioural variability and an important contribution of wild faunal resources at a location that was used in a short-term seasonal manner (Smit *et al.* 2013, 211-222).

The implementation of 'new rhythms'

In view of the above it could be stated that the process of Neolithisation was as it were 'slowed down' in the wetland and wetland margins of the LRA. Reasoning from the specific interaction between communities and the wetland environment, it is important to analyse the spatio-temporal implications that the introduction of Neolithic products and practices may impose. The fundamental routines in the livelihood of the communities were characterized by specific rhythms in practice and repetition (Ingold 2000, 153; Lefebvre 2004), central to a regional *habitus* and defining issues such as identity and difference, contrast and continuity. In line with this idea the process of Neolithisation may be identified as a potent source of 'new rhythms', some of which were potentially disruptive. However, from the long-term perspective of the communities involved, evidence for any sudden transitions or culture-wide adoptions is lacking. As argued above, more agriculturally oriented sites existed alongside other locations with different strategies, mobility remained important and variable and there is evidence for diversity regarding resource procurement, site structure and characteristics of habitation, even within ecologically homogenous regions. This implies that from a culture-wide perspective most Neolithic practices and products rather than forcing or initiating change, were attuned to the existing rhythms of livelihood of the indigenous communities present. The overall evidence for 'Mesolithic' continuity (in technology, habitation and economy) further supports the consistency of this type of *habitus* and the valuation of the traditions and rhythms handed down from the ancestors.

9.5.4 European perspectives

The heterogeneous character of the process of Neolithisation that emerges for the LRA wetland area as described above fits the image of a mosaic of Neolithisation as envisaged by Tringham (2000[a]; see Chapter 2). Recent research, for instance in Southern Scandinavia (Sørensen/Karg 2012) and Central Europe (Kind 2010), points to a similar process where indigenous Mesolithic communities take on an active and significantly determining role in the temporality of the process of Neolithisation and the composition of its elements (see also Bollongino *et al.* 2013). Sørensen and Karg (2012, 16) point out that while the agrarian expansion into Southern Scandinavia itself was a quick process, between 4000 and 3700 cal BC, there may have been a certain cultural dualism in its aftermath. This may have involved hunter-gatherers living on the coast and lake shores that quickly adopted new material culture and husbandry (herding), but for quite some time continued their hunter-gatherer lifestyle until the end of the Early Neolithic (I) period. The transition towards an agricultural way of life in Scandinavia is defined as a complex and continuous process of migration, integration and gradual assimilation of neighbouring farmers and hunter-gatherers (*ibid.* 11, 17). It is interesting to note that wetland-oriented hunter-gatherers in particular incorporate these Neolithic elements, while continuing their Mesolithic way of life. From a similar perspective

Kind (2010) reviews the evidence for Neolithisation in Central Europe. He argues for a quick dispersal by way of knowledgeable individuals, so-called 'managers of Neolithisation' that initiated a process of acculturation (2010, 457). While these ideas are controversial regarding the colonization hypothesis of the LBK, Kind (*ibid.*, 458) does point out that the transition itself should be viewed as a heterogeneous process of indigenous groups in contact with each other, that acted in different ways, pursuing varying solutions to the challenges of environment and subsistence, stressing that this is clearly a continuation of the Mesolithic.

The value of both brief examples lies in the fact that they complement our perspective on the transition to agriculture by distinctly shifting the focus to the active and determining role of indigenous Mesolithic communities involved. They are recognized as important actors in shaping the process of Neolithisation, at least partly on their terms. The latter aspect in particular is of course something that should be understood from an integrated human-environment perspective, an approach that is in line with the scope of this work.

9.6 Total phenomena: human-environment relationships in the wetlands

This study has placed centre stage the recursive relationship between communities and their environment. This relationship has been determined as something experienced and essentially social, central to the existence of these communities and an important factor in the creation of a certain regional *mentalité* or moral community. This perspective served to help understand the long-term (behavioural) characteristics of the successive Swifterbant, Hazendonk and Vlaardingen communities, but also offered a complementary approach for understanding the process of Neolithisation and the gradual nature of the transition to agriculture in this area. In the following this human-environment perspective is placed in a reflective framework focusing on the importance of an approach of 'total phenomena'.

9.6.1 Community-land relationships

The idea of a moral community (*cf.* Whittle 2003) presupposes an integrated existence of landscape, environment and related ecosystems with human social behaviour (Balée 1998[b], 24; Barton *et al.* 2004, 253; see also Schama 2004). Instead of adhering to Cartesian lines (*e.g. domus-agrios*; see for instance Hodder 1990) a socio-ecological perspective is proposed that integrates and centralizes natural and human elements.

Reasoning from this perspective, many environmental elements influenced the shaping of regional identities or moral communities. Of importance is the notion that the affordances of the environment are based upon perception and that this mainly derives from hands-on, everyday tasks that require a practiced ability to respond to salient aspects of the environment (Ingold 2000, 166; see also Gibson 1979). The essence of dwelling in a landscape implies that people do not import ideas, plans or mental representations (Ingold 2000, 186), but that these come into existence because of their interaction with it. This urges us to seek out those aspects of dwelling that differ from other regions and that were characteristic for the studied area.

Since we are dealing with long-term cultural continuity both short-term and long-term developments and characteristics can be used to outline the recursive relationship between communities and their surroundings over time. Moreover, the former, at least in part, constitute the latter (see Foxhall 2000; Gerritsen 2008). In this way both the limited brief snapshots that high-quality (wetland) excavations sometimes provide as well as the more coarse-grained and murkier palimpsest evidence that we are usually confronted with, may be informative on the relationship of people and their environment (*e.g.* Layton 2008, 3, 5).

An interpretation of total phenomena

The perspective on communities and landscape offered here is firmly rooted in ethnography (*e.g.* De Coppet 1985; Küchler 1993; Politis 2007), where there has been an increasing appreciation of the non-western conceptualization of environment and its agency (Descola/Pálsson 1996, 3). Central is the notion that there is no perfect match between culture and environment and that behaviours cannot be sorted into those that are ecological, social or cultural (Kelly 1995, 36). This indicates the need for a contextualized, regional and historical perspective. Barton *et al.* (2004, 253) point out that '*spaceless, timeless, linear relationships that specified flows of matter and energy among organisms are giving way to a realization that ecosystem configuration and process is dynamic in time and space and contingent on the history of a system in a particular place*'. This 'historical ecology' focuses on the 'dialogue' between nature and culture and the relations existing between them (Balée 1998[a], 3). It emphasizes that all human activity takes place somewhere, embedded in a matrix, context, environment (Crumley 1998, ix) and landscape is foregrounded not as a composition of resources or the structure of terrain, but as a central concept, with which humans conjoin in a dialectic entity (Balée 1998[a], 9). This merges with the approach of an archaeology of inhabitation as proposed in Chapter 6.

By focusing on this interaction from a non-dualist perspective, the existence of local (or regional) systems characterized by specific sets of (perceived) human and non-human relations geared towards specific environments is implied (Descola 1996, 99). Instead of distinguishing between persons, culture, technology and environment, fields of significance, 'mental systems', or moral communities are identified (*cf.* Descola/ Pálsson 1996, 18; Latour 2005; Whittle 2003). Within such an intentional environment, person and environment embrace an irreducible system; the person is part of the environment and, consonantly, the environment is part of the person (Descola/Pálsson 1996, 18). The different composite elements should then be studied as 'total phenomena', as specific types of socio-cultural systems that historically have interacted in finite and comprehensible ways with parts of the biosphere (Balée 1998[b], 24). In this respect it can be stated that human communities and cultures over time interact with landscapes and regions, they grow into each other and from this interaction a certain regional identity is forged.

9.6.2 Wetland and wetland margin inhabitation

Working within this theoretical 'ethnographic' paradigm we should thus aim to come to terms with how the dynamics of the wetland and wetland margin landscape and environment attuned with the community characteristics we document archaeologically. For this it is important to understand how people perceived and dealt with landscape instability and how continuous (long-term and short-term) environmental flux is incorporated into group perception and social definition of the environment (Papagianni 2008, 39).

A modern-day ethnographic example is formed by the local perception of semi-sedentary people in Northern Greece of both long-term and abrupt landscape change due to tectonic activity (Papagianni, 2008, 40 (and references)). While this produced dramatic effects, such as cracks widening each year, areas sinking several feet and land slumping off into gullies, all of which affected grazing grounds and cultivation areas, people responded that the landscape 'had always been like that'. Change to local people did not appear anomalous, because stability and lack of movement was not something they associated with their landscape. People, animals, the ground etc. were all on the move and activities were simply relocated if land was lost or became useless. This stresses the important point that people were linked not to tectonic, but to historical processes (*ibid.*). These were dealt with by relocating, modifying and rearranging the set of strategies practiced, so ensuring continuity.

Wetland dynamics

The dynamics of the wetland environment must have formed a constantly changing element harbouring both slow or gradual, as well as sudden and unexpected qualities that were negotiated by its inhabitants (see Chapter 7). From a broader perspective comparable ethnographic and archaeological case-studies therefore exist. Nicholas (1998[b], 40-42) for instance mentions several regional examples of hunter-gatherer wetland use in North America and stresses that landscape use changes, but places remain constant. For Sweden Larsson (1998) points out ritual and territorial activities of societies as a potential reaction against the changeability of nature.

From a more interpretative perspective and against the background of an evolving character of wetland landscapes (Van de Noort 1998, 294), Van de Noort and O'Sullivan (2006, 63) stress the need for a more empathic perspective in understanding human-wetland relationships and an appreciation of the way in which the daily practical engagement of communities with the dynamics of these environments constructs and negotiates distinctive social identities (see also Coles/Coles 1992, 152). One of the most emblematic examples in this respect is formed by the gradual transgression of the North Sea after the last glacial, leading to the loss of land (such as Doggerland) in the North Sea basin. Between 8000 and 6000 cal BC sea-levels rose rapidly and the loss of land will have been considerable and noticeable (Van Gijssel/Van der Valk 2005; 60-61; Van de Noort 2011, 49-55; Verhart 2008, 159). Undoubtedly the inhabitants of this area had to deal with the submergence of their camping and hunting grounds. They had to adjust their mental maps, territories and mobility rounds, but over time these coastal dynamics also became an accepted part of living in the North sea coastal region (see fig. 9.1; also Leary 2009; Van de Noort 2011, 67). Comparable processes were likely experienced and dealt with by the later inhabitants of the LRA wetlands studied here. Thesiger (2007) in his 'Marsh Arabs' emblematically demonstrates how such wetland dynamics are confronted and at the same time form an intrinsic part of community identity and existence. Similar work has been done by Pétrequin (1984) in his *Gens de l'eau, gens de la terre*.

Fig. 9.1 Doggerland hunter-gatherers (c. 8000 cal BC) returning to their flooded camp (John Tomanio/National Geographic Stock; John Tomanio and Amanda Hobbs, NGM Staff; Art: Alexander Maleev; Sources: Simon Fitch, Vincent Gaffney, Benjamin Geary, University of Birmingham U.K.; published in NG December 2012, 132-133).

Delta dispositions

If we transpose this theoretical and ethnographic perspective to the wetlands and wetland margins, then several elements stand out. These include the rich ecological diversity, the importance of fish, waterfowl, beaver and otter, the lush forested environment, the waterways, the insular dry patches, the absence of stone, certain species of trees and animals etc. Within the wetlands these differ, often in arrangement, from other environments and locations. They play a role in how landscape is perceived and experienced, simply because they are directly visible and present. On the other hand they are at least partially symptomatic, rather than fundamental. For an increased understanding of past perception of the environment and its potential influence, it may be more profitable to focus on the more subliminal elements that underlie wetland constellations and influence mental processes and *habitus*. In other words the material and historical conditions that lead to a certain type of life or disposition and the 'rhythms' associated with dwelling in these wetland areas. If we study the wetlands from this phenomenological perspective, then it is especially the (potential) dynamic qualities, or the affordances of the wetland landscapes within different temporalities that may be defined as characteristic. These may include the (un)expected floodings, changing constellations of resources and routes, waterlogging, alternations between brackish and fresh and the drowning or surfacing of land. It is these aspects, shaped and governed by water, that created a distinctively dynamic, interactive and living landscape and may have significantly influenced and shaped community characteristics, identity and long-term moral networks over time.

Of essential importance here is that instead of a (Western) human-environment dichotomy, whereby natural processes are interpreted as outside of society and externally imposed, posing problems or difficulties that need to be overcome or controlled, these characteristics can be seen as indivisible to these landscapes (Ingold 2000; Leary 2009, 230; Van de Noort 2011, 30-35). Societies were accustomed to these aspects, learned how to deal with them and developed an intimate relationship with these landscapes (*e.g.* Sturt 2006, 136).

The specific aspects of living in and with the (dynamics of) the wetland environment, over time brought about a certain attunement, a wetland disposition that became part of the socio-ideological characteristics of these communities and that more or less differed from that of communities elsewhere. The strategies and dispositions that enabled them to deal with life in these parts should not be confined to physical adaptations, or local knowledge, (see examples in Chapter 8). They also involved ideology and other long-term mechanisms of passing on information between groups (see Leary 2009, 234). These aspects, in their combination, touch upon what shapes a moral community, group identity and *mentalité*. From this perspective, questions regarding the existence of a 'people of the wetlands' (see Van de Noort and O'Sullivan 2006, 67; see also Coles/Coles 1989) can be answered positively for the wetlands and wet margins of the LRA and validate a search for the 'total phenomenon' of wetland occupation, the fibre of life in these parts.

9.7 Future prospects

The integrated community-environment perspective forms the background of the theoretical approach adopted in this study. The central question to be answered from this context was twofold. It aimed at elucidating the long-term cultural and behavioural continuity witnessed from the perspective of the communities involved and sought to explain the gradual nature of the process of Neolithisation in relation to their characteristics. In answering these questions I have tried to analyse the available evidence from a perspective that foregrounds human-environment relationships, envisaging them as total phenomena from which a characteristic regional *mentalité* or moral community developed.

For the wetland and wetland margin communities its application may be motivated from two perspectives. On the one hand there is the landscape and environmental point-of-view, distinguishing wetlands as (gradually) diverging from uplands and endowed with dynamic, consistently changing qualities over time. On the other hand there is an historical motivation, rooted in the cultural succession and community continuity from the Late Mesolithic to the Vlaardingen culture, where both the short-term and long-term characteristics of inhabitation form part of the same fabric of community-environment relationships. From this perspective the character and internal dynamics of the wetland environment and the way communities interacted with it, led to the development of recognizable traits and traditions, in particular a sense of flexibility and pragmatism. These were then studied form a long-term perspective and interpreted as fundamental in the disposition of these communities in relation to the development of Neolithisation.

The future prospects of the approach offered in this study lie with the alternative perspective it offers. Rather than a novel interpretation of the period or transition to agriculture, it presents a vision. It offers an alternative framework for studying the indigenous communities of the wetland and wetland margins and provides a complementary perspective on the process of Neolithisation. While archaeological application for a phenomenological understanding of landscape, community and environment is limited due to the intrinsic limitations of the material record (however, see Bender *et al.* 2008; Zvelebil 2003[a,b]), it may be used alongside, or compared to other economic, functional, more factual approaches. Reappraising the less tangible aspects of the LRA wetland communities in this way and focusing on the way they inhabited and may have understood their landscapes, brings us closer to understanding environment and surroundings as active agents in the creation of local identities and *mentalité*, while simultaneously shaping a regionally specific set of practices, rituals, rules and traditions for living in and dealing with such an environment. This realization may help in understanding regional similarities and variations in behaviour and settlement systems. It may shed light on the composition of resources and the continued mixing of 'wild' and 'domestic' elements, or even concerning the way in which architecture and (the long-term) use of places are conjoined and regionally significant. Finally, it broadens our horizons regarding the perspectives we may have on the process of Neolithisation and its specific long and gradual trajectory in this area.

Notes

1 The existence and legitimacy of such an approach may be based on a wide range of ethnographic, ethnohistorical, philosophical and historical literature (see Chapter 7 and references; *e.g.* Casey 1996; Chadwick 2004; Coles and Coles 1989; Cooney 2000; Ingold 1993; Lefebvre 2004; Van de Noort/O'Sullivan 2006; Schama 1995; Thesiger 2007; Tilley 2004).

2 It should be taken into account that the information from wetland margin sites, especially for the period between 4500 and 3600 cal BC, is limited and that comparative upland information is largely lacking (see also Chapter 7).

3 In view of this the character of short- or medium-term activities at sites, which provide us with the most direct access to past perception and *habitus*, may essentially be informative on longer-term traits (Foxhall 2000, 484-485, 496), especially within settings where there is cultural continuity.

4 This existence of community agency may also be documented for topics such as housing, settlement structure as well as social practices such as burial (*e.g.* Amkreutz 2013[a,b]; Louwe Kooijmans 2009; Tringham 2000[b]).

5 Consistent community adaptability in view of these dynamics appears to be more convincing than stressing issues such as calamity, disaster and vulnerability (however, see Leary 2009).

6 A number of sites (*e.g.* Hazendonk, Hekelingen-III, Vlaardingen; see Chapter 8) serve as cautionary tales against interpreting the archaeological record as showing a straightforward development towards significantly sedentary communities.

Chapter 10 - Epilogue

Afterthoughts on Neolithisation: Zvelebil's model reconsidered

10.1 Introduction

This study has focused on the role and position of the communities involved in the process of Neolithisation in the Lower Rhine Area between *c.* 6000 and 2500 cal BC, with an emphasis on the wetlands and wetland margins. The transition to agriculture has therefore been studied indirectly from a theoretical framework aimed at elucidating the long-term characteristics of communities in relation to the landscape and environment they inhabited (see Chapters 6 and 9). In this concluding chapter the implications of the approach taken in this study will be briefly interpreted for the process of Neolithisation, from a general, modelled and theoretical perspective. This is done by offering an alternative interpretation of the well-known availability model (Zvelebil/Rowley-Conwy 1984; Zvelebil 1986[a,b]).

10.2 Revisiting the availability model: indigenous perspectives

The availability model (see fig. 3.7) was intended as a heuristic framework to document the transition to agriculture through three stages: availability, substitution and consolidation, defined by the relative contribution of domesticates and cultigens to the diet. The model was reviewed in Chapters 3 and 7. While it offers a broad outline of the process of Neolithisation, it also has its shortcomings. These are mainly manifested in its focus on subsistence. Despite the importance of an economic shift from a hunting and gathering way of life to food production, its large-scale use as a 'prime marker' (see Zvelebil/Lillie 2000) is problematic from the regional and indigenous perspective adopted here. Additionally, it has been questioned to what extent the contribution of domesticates (and cultigens) can be determined for an entire cultural unit instead of per site (*contra* Zvelebil 1998[a], 11; 1998[b]) and to what extent we may base our interpretations on presence/absence data (Raemaekers 1999, 13), rather than proportions (see Chapter 7).[1] Both aspects obscure the diversity existing between sites and the choices made by the communities involved.

Change towards a producing economy inspired many developments, yet the 'transition to agriculture' is not synonymous with the 'process of Neolithisation'. The latter includes other, technical, social and ideological developments (*e.g.* Thomas 1999; Whittle 2003), each with its own (geographically changing) temporality and nature (see Rowley-Conwy 2004). An enhanced understanding can only be gained by studying all elements within a cohesive landscape and environmental setting. In this respect continuity and development, tradition and innovation, acculturation and identity may or may not have operated independently; some things changed, while others stayed the same (see Chapter 9).

In the following an attempt is made to re-think Neolithisation along the lines of the availability-model, yet from a relational perspective focusing on community-based interaction and perception. The aim is to present an alternative (modular) approach to Neolithisation that may be used alongside the original availability-model, not in an opposing, but in a complementary manner. This is an approach 'from the perspective of a hunting stand, rather than from behind the plough' as argued originally by Zvelebil and Rowley-Conwy (1984, 104; Zvelebil 2001, 17). From this it follows that the general (Mesolithic) hunter-gatherer roots of communities in relation to their landscape and environment are foregrounded. To this end two theoretical perspectives will be introduced.

10.3 'Attitude': the context of a giving environment

The first perspective focuses on the *mentalité* or world-view of these communities. It concerns the ingredients of their 'moral community' (*cf.* Whittle 2003). This may help our understanding of the behaviour of indigenous populations in light of change.

While there are limitations to the generalization of ethnographic information (*e.g.* Testart 1988 and comments), certain common characteristics may be identified (Brinch Petersen/Meiklejohn 2007; Finlayson 2009; Panter-Brick *et al.* 2001, 2-10; Rowley-Conwy 2001). Crucial among them is the ideological perception of the environment.

10.3.1 The giving environment

Among (sub-)recent hunter-gatherers, including those that additionally, or temporarily practise some form of horticulture or pastoralism, culturally specific, yet comparable perspectives exist upon nature and their relationship with it (Descola 1992). The most characteristic of these is the idea of a 'giving environment' (see Bird-David 1990).[2] This perspective centres on the continuity between the social and the natural domain and may be termed 'animist'.[3] Nature and society are not separated by ontological boundaries but are perceived as part of one universe, a closed circuit featuring a constant circulation of substances, souls and identity (Descola 1992, 114-116). These important distinguishing traits do not stand alone. A similar division is witnessed among the Mbuti pygmies of Zaire and their Bantu-speaking farming neighbours, as well as other groups (*e.g.* Bird-David 1990; Politis 2007; Turnbull 1983). According to Bird-David (1990, 194) it is characteristic of hunter-gatherers in general that their views of the environment draw on primary kin relationships (also see Descola 1992, 126; Ingold 2000, 58-60). As such, our often dualistic view of nature and culture need not apply to the groups studied (Ingold 2000, 40; Johansson 2003, 109-138). Moreover, where Bird-David (1990[a,b], 1992) and others offer culture-sensitive interpretations regarding hunter-gatherer perceptions of the natural world, based on their relations in the human world, Ingold (2000, 42, 44) argues that interaction with nature is not grasped conceptually this way. Since hunter-gatherers cannot enter into interaction with the non-human environment as persons, they do so in a separate domain, where they figure as biological objects, rather than cultural subjects, as organisms rather than as persons. This forms a natural domain of organism-

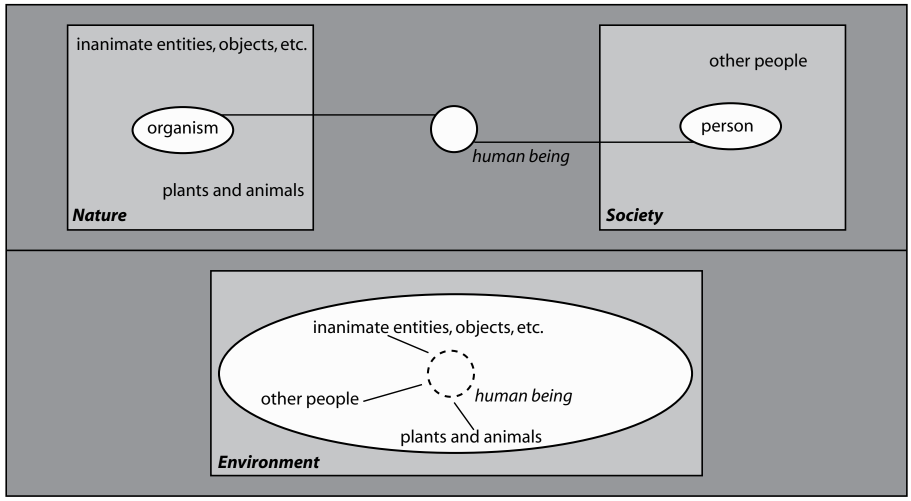


Fig. 10.1 Hunter-gatherer 'economies of knowledge' and interaction, adapted from Ingold (2000, fig. 3.2). The lower part represents the indigenous perspective.

environment interactions, rather than a social domain of personal relations (fig. 10.1). In it there is no distinction between a literal truth in interpersonal relations and a metaphorical truth among humans and non-humans; there is no radical break between social and ecological relations and the latter should rather be seen as a subset of the former (Ingold 2000, 60, 76).

10.3.2 Resilient modes of thought

In contrast to pristine 'affluent foragers', it is now clear that many hunter-gatherer groups shared a history of centuries or even millennia of contact and interaction with food-producing groups. In many cases this has led to hunter-gatherers pursuing (and in some cases later abandoning) food production activities (see Chapter 7; Appendix III; Finlayson 2009; Layton *et al.* 1991). An important question in this regard is to what extent there is a degree of reconciliation, of combining hunting and gathering activities with other subsistence strategies (see Bird-David 1992[b], 20-22).[4] The ideology of a 'giving environment' implies the non-distinctive way in which hunter-gatherers may approach and value new resources. Domesticated plants and animals are bound to be perceived within the same framework as the natural resources, plants and animals that were already used (see also Ingold 2000, Chapter 5). Many modern-day hunter-gatherers combine their activities with cultivation and stock-keeping, yet do so in a manner that permits continued hunting and gathering (Bird-David 1992[b], 37). New activities are thus re-organized to resemble the 'old' traditions and practices as much as possible (note some of the examples among the Nayaka, Cree and San Bushmen).[5] While it is easy to characterise this behaviour as opportunistic or as part of a 'foraging mentality' (see Bird-David 1992[b], 38; Kelly 1995), it may rather be representative of how these communities relate to the outside world, implying a close relationship with their environment, responding to it in a flexible manner and adapting to geographical and temporal differences and changes. Resources are used and added from the idea of nature providing. In addition to this 'ecological knowledge' (*e.g.* Ingold 2000), Bird-David (1992[b], 32) stresses that while our society revolves around different products and related activities (cultivation and stockherding are distinguished from each other), hunter-gatherer society is cognitively sensitive to resources. This forms a crucial point: the means of acquiring resources does not establish their nature. For instance (*ibid.*, 39-40), the Indian Nakaya hunter-gatherers do not distinguish between jackfruit they grow and jackfruit they collect in the wild. Similarly, according to the circumstances, they hunt and 'gather' animals. Along the same lines, if certain hunter-gatherer groups practice stock-keeping or cultivation, they do so to *procure* resources, rather than to *produce*. So while to us they appear to shift between subsistence activities, from their perspective, they simply obtain the resources afforded by their environment through whatever means suitable (*ibid.*; Ingold 2000, 59). Based on these perspectives a number of characteristics may be defined:

- Attitudes to land and resources are based upon longstanding relations and perception of the environment, rather than ownership. Communities relate to this, outside of any nature-culture division, but within the idea of a web of connections where social and economic relations merge (*e.g.* Barnard 2007; Bird-David 1992[b]; Descola 1994; Ingold 2000).
- Sharing and the absence of long-term hierarchical leadership form important values in society. This grants family groups and individuals a certain level of autonomy with respect to procuring resources, dealing with change and making use of opportunities (Raemaekers 1999, Chapter 5; see also Brinch Petersen/Meiklejohn 2007; Finlayson 2009; Rowley-Conwy 2001).
- There are shifts and variations in subsistence activities. Different social cohorts (individuals, families, communities) may mix and match different types of resource-acquiring activities, while sharing, exchange and mobility enable diverse combinations. This potentially leads to smaller and larger-scale variation at different time intervals, ranging from weeks to generations.
- Hunting and gathering continue to be important activities that apart from economical value may also have had distinct symbolical connotations (Amkreutz/Corbey 2008; Bird-David 1992[b], 41).

These elements can be used to conceptualise the transition from an indigenous perspective (*e.g.* Zvelebil 2003[b]). In this respect Barnard (2007, 14), comparing Mesolithic and Neolithic modes of thought from a social anthropological perspective, stresses that the impact of culture contact on (hunter-gatherer) modes of thought is regularly overestimated. The hunter-gatherer mode of thought is much slower to change than its mode of production, or rather procurement (Barnard 2007; Bird-David 1992[b], 40; Ingold 2000, 59). Therefore social relations, or relations of production, retain the structures of hunter-gatherer times, since these are deeply rooted in cultural understanding of sociality. The existence of nearby agro-pastoralists, may even make former hunter-gatherers more aware of their differences, perhaps even accentuating these (*ibid.*, 2007, 14-15; Hodder 1982).[6] Furthermore the survival of many characteristic elements of the hunter-gatherer mode of thought is possible due to the flexibility of these communities (Barnard 2007, 15; Chapter 9). By adhering to the characteristics described above, these communities long resisted becoming 'Neolithic'.

10.4 Interaction: a context of networks

A second perspective deals with the nature of contact, exchange and interaction and how communities function in networks in which commodities, innovation and ideas are implemented or re-interpreted. The ideas presented earlier indicate that while archaeologically, over time, communities may be grouped into substitution or consolidation phases, this does not necessarily imply any ideological transition. It then becomes important to document the consistency of modes of thought and behaviour in the light of (Neolithic) change.

In view of Neolithisation we are confronted with one state (indigenous communities, hunter-gatherer existence, procurement economy) developing into another (settled farming communities). Instead of focusing on the trajectory and ingredients of Neolithisation emphasis here lies on the interaction with and implementation of new elements. This may be grouped under the term 'acculturation'.[7] This means gaining insight into the culture-sensitive dynamics of interaction, necessitating a qualitative approach to the indigenous effects of acculturation and an analysis of processes of hybridization (see Barnard/Spencer 2002, 897 *et passim*). The question is patently not what changed, when or why, but, in line with the indigenous approach advocated here, *how* change was implemented, controlled, and interpreted.

10.4.1 Networks

To study the processes of interaction from an indigenous perspective, it is important to focus on the characteristics of local translation for making sense of the world. A useful methodology for interpreting the behaviour of past communities and their reaction to potential change is in terms of the networks in which these groups function. In sociology and (to some extent) anthropology, this method has been applied and developed and has become known as actor-network theory (Callon 1986; Latour 1993; 2005; Law 1992; see Hoogsteyns 2008 for an elaborate review).

Actor-network theory (ANT) approaches reality as a network consisting of actors, that may be animate or inanimate; people, objects and places may all participate in it (see Latour 1993; 2005; Strathern 1996). Both material aspects as well as semiotics (ideas or concepts) are included and interact in relation to each other. Within ANT, all are endowed with agency.[8] This enables them to influence and change the other participants in the network (Latour 2005, 71; Law 1992). Participants and relations are therefore subject to ongoing redefinition, ordering and interaction (*ibid.*, 218). New actors are constantly redefined or 'translated' (Callon 1986) and their eventual positioning in a new network takes place in an altered and differentiated form. New 'truths' arise.[9]

Networks and Neolithisation

ANT fits the approach to Neolithisation adopted in this study, because it implies an absence of (hierarchical) categorization between subject and objects, through a focus on actors (see Hoogsteyns 2008, 190). This involves the abandonment of *a priori* distinctions between the natural and the social (Callon 1986, 196-200).[10] This fits within the idea of a moral community that experiences its surroundings as embodied or animate (see Descola 1994) and applies to the environmental perception of past hunter-gatherer-farmers.

A network is defined and maintained by re-establishing the relations between the actors, by continuously ordering them. ANT is therefore anti-static and performative. It accentuates the ramifications of what takes place in interaction (Latour 2005, 200-202).[11] Furthermore, networks and actors are studied from a bottom-up perspective, meaning that Neolithisation is studied at the level of the pieces (actors) forming the mosaic (composition of networks), focusing on the communities and their developments within coherent regional contexts (*e.g.* Tringham 2000[a]; Whittle/Cummings 2007). It is this aspect that is of special importance; the local implication and translation of new actors and the way networks both change and are consolidated.

10.4.2 Network dynamics

Within ANT the studies of Callon (1986) and Latour (2004) have tried to phase the dynamics at play in a network when new actors are introduced. They focus on the processes of translation taking place (Callon 1986, 200-214; Law 1992), the moments at which new actors, their identity and implications are negotiated by the participants in the network. A first phase distinguished is one of amazement and problematization. A new actor arrives within the network. Its identity and implications are researched and other actors involved are identified. The existential rights of the new actor are questioned and acceptance depends on the redefinition of alliances and existing relationships between other participants. The second phase of 'interessement' (*cf.* Callon 1986) starts after the existential right of the new actor has been established and involves the negotiation of its essence and the place it may assume in a network. It is this phase that may be linked to how societies allow or prevent change and new *habitus* (see Bourdieu 1977; Sommer 2001). A third phase of 'enrollment' (*ibid.*) involves the incorporation of the new actor in the network within the parameters established by the previous negotiations. It involves a process of translation that seeks to redress the balance and find a way in which the new actor may settle among the existing structures without disrupting them (see Latour 2004, 109).[12] The role or essence of the actor may still change, but will equally affect already existing structures. In the end the actors involved accept the redefined roles and a new hierarchy is established. A final phase involves the redefinition of the network. The new actor is now accepted and no longer questioned. It is institutionalized, implying it has become a functioning participant. All existing actors in the network interact with it and vice versa.

This sequence aids the formulation of hypotheses and modeling concerning the character and implementation of Neolithic elements and the degree to which change was allowed for at a localized level, from an indigenous perspective. In the next paragraph this reasoning will be applied to communities in the process of Neolithisation.

10.5 Integration

Understanding the local communities involved in Neolithisation, both in relation to their perception of the environment as well as their place in the network, is important for providing an alternative perspective on the developments taking place. This requires regionalizing large-scale processes (see Harrison *et al.* 2004, 9) and focusing on processes of adaptation, rather than change. Latour (1993, 117;

2005, 190-195) uses the metaphor of a railroad, to indicate that even the longest networks are seen and interpreted as local at particular times and places. It is the new elements of the network that are framed by what already existed and that make it 'localized' and 'placed' (also see Strathern 1996, 523-529).[13] As argued earlier, novel elements will often be transposed according to the already existing constellation of relations of the indigenous groups. This stresses the resilience of the existing hunter-gatherer modes of thought and perception. Ethnographic work suggests that rather than a process of hybridisation (or creolisation), developments in acculturation may be best interpreted along the lines of adaptation, in particular if the introduction of new elements took place under the conditions and temporality set by the indigenous communities (*e.g.* Barnard 2007; Bird-David 1992[b]; Helms 1988; Turnbull 1983).[14]

Based on the perspectives presented above it can be hypothesized that as long as there is no direct necessity (*e.g.* resource stress, competition, violence, see Gregg 1988) to 'go over' to new (Neolithic) practices, products and ideas, 'translation' of new elements and aspects will take place along existing perception and cultural lines. While 'novelties' may be used to fix or ameliorate individual or group position (in an economic or social manner, *e.g.* Verhart 2000), aspects and elements of identity will for a long time remain as they were. Actual change, affecting all aspects of society, may have been very slow and controlled, since those aspects that were deemed intrinsically important and deeply rooted, the constituents of socio-cultural integrity of a hunting-gathering moral network, remained fixed and unchanged for a long time.

A complementary model of 'attunement'

The foregoing theoretical perspectives highlighted alternative factors that influence and shape the process of Neolithisation. In the following an attempt will be made to reconcile these ideas in a complementary model, based on the availability model, that studies Neolithisation from a perspective focusing on community, process and implementation. In this respect it is also a reconsideration of the original model by Zvelebil and Rowley-Conwy (1984; Zvelebil 1986[a,b]) as it matches the static stages with dynamic processes from an indigenous and interactive perspective.

At the core of the model (see fig. 10.2) a number of phases may be distinguished that provide a reference for the developments taking place during Neolithisation. They start from community perception and agency and form alternatives to the well-known phases of availability, substitution and consolidation in the original model. The perspective of this framework is deliberately divorced from either an economical orientation or evolutionary developments (see arguments above and in Chapter 7) and focuses on the character of implementation, on the processes taking place.

- A first phase may be termed '**acquaintance**'. This indicates an awareness of a potential new actor, from direct or indirect personal knowledge. This knowledge is derived from participation or observation. An initial stage within this first phase may be termed 'cognizance' which involves the condition of knowledge or familiarity gained through association or experience. Within this phase the actors in their network become aware of potential new actors and their viability is probed. Certain elements in the network may be in favour of introduction, others opposed to it.

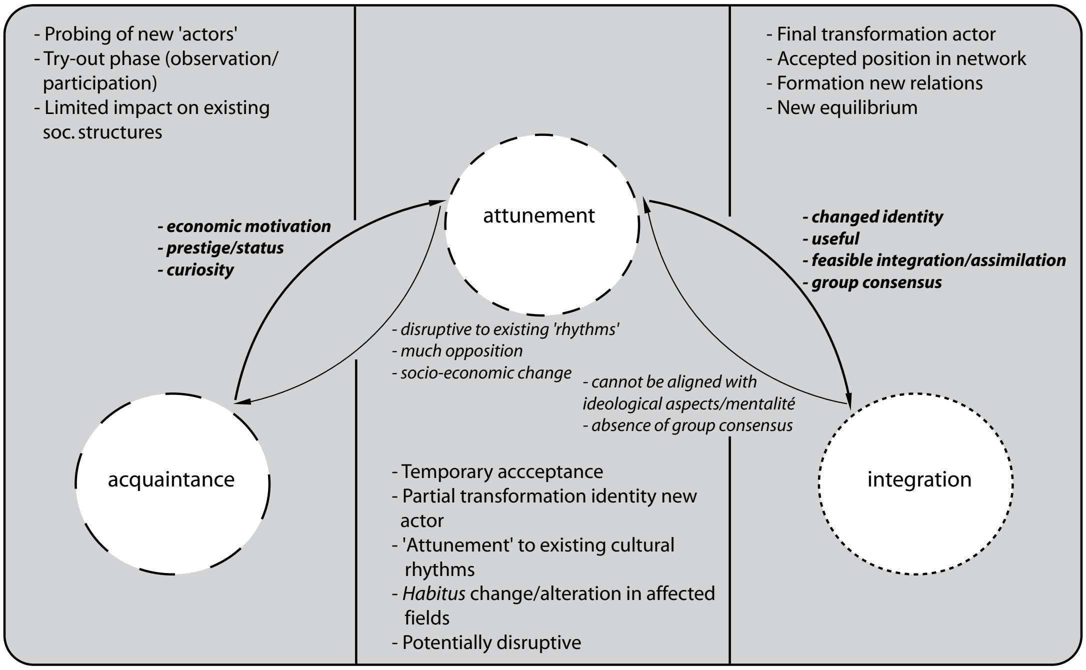


Fig. 10.2 Schematic illustration of a model of 'attunement' in which there is no dominant direction and an emphasis on implementation of Neolithic elements in existing structures.

- A second phase may be termed '**attunement**'. This involves the (temporary) acceptance of the new actor as a potential attribution to the network and its subsequent positioning within the established relations. This is a try-out phase which may see the temporary or definitive integration of new actors within existing cultural rhythms (*cf.* Lefebvre 2004). If implementation proves too disruptive to these rhythms, the new actor may again be excluded or its identity transformed.[15] Eventually this phase involves some form of *habitus*-change in fields affected by the introduction of a new actor (see Bourdieu 1977; Jacobs 1993). It is likely that within the small-scale non-hierarchical communities of the LRA, group consensus will have been the main factor in allowing for change (see also discussion in Raemaekers 1999, 190-192 and Tilley 1996), while acceptance would have depended strongly on the way in which the 'identity' of the new actor may be transformed to fit existing structures (*e.g.* Bird-David 1992[a,b]).
- A third and last phase is termed '**integration**'. It involves the unquestioning acceptance of the new actor in the network in its final transformation. This involves a change in the network, creating a new position and subsequently new relations, as well as a change in the actor, both due to the process of attunement in the previous phase. It is therefore a phase characterized by the acculturated local implementation of a new actor and the degree of continuity witnessed in the existing socio-cultural moral network.

The main premise in the last phases is that existing perception and *mentalité* will generally be the chief conservative elements in relation to the positioning of new elements. Furthermore from the perspective of the processes taking place there is no clean break between the different stages.[16]

10.6 Application and future use

The model is more than a semantic paraphrasing of the availability model. It may be employed to study different trajectories of attunement of Neolithic aspects and to form hypotheses as to their implementation. The three defined levels serve as a framework for establishing the degree to which new elements were incorporated into existing structures. The model's main purpose is to present an alternative perspective on the processes taking place.

Application involves a different point of view, arguing that instead of a necessary socio-symbolical change in the minds of the indigenous inhabitants of Europe to adopt a Neolithic way of life (*cf.* Hodder 1990), the opposite took place. Based on a wide array of ethnographic evidence it is more likely that in the absence of severe or direct demographic or economic pressure to 'go over', the hunter-gatherer mode-of-thought, their *mentalité* and its associated *habitus* were conservative and slow to change in comparison to their mode of production or procurement (see Barnard 2007).

The operative principle of the model suggests a practice aimed at translating, or attuning new elements so that their potential disruptive power to the existing traditions and rhythms is limited. Arguably there is discrepancy in the way certain new elements are adopted. Some aspects are integrated more quickly than others. The latter are usually of distinct socio-symbolic value. If we focus on those aspects that remain of a continued, largely Mesolithic character, these may particularly be found in such basic domains as food procurement, technology and mobility.

The model argues against the idea that the first use of domesticates involved a new conception of the relationship between human beings, their environment and time (Bradley 2004, 113). As such it questions whether the centre stage taken by domesticates and cultigens in analyses of the process of Neolithisation is appropriate, as hunter-gatherer communities within their ideology of a 'giving environment' may not have approached domesticates and cultigens as radically different from the resources they were already procuring. Instead it argues for an emphasis on how new material, economic and social elements were integrated. For instance, while growing crops and herding cattle may require new techniques, practices and rhythm, it is the scale and consistency of these that define their impact *in combination* with indigenous perception of them. This implies that new practices and resources were probably perceived according to existing ideological frameworks and re-organized to be integrated with existing practices and traditions (see Bird-David 1992[b]; Ingold 2000). As such the model abandons implicit connotations of (economic) development in favour of behavioural implementation of new ideas, products or technology from an indigenous perspective. Its emphasis lies with their 'attunement' within existing practices and ideology. The integration of domesticates and cultigens in the LRA wetlands may be envisaged along similar lines. This means that the introduction of agriculture may have brought about changes in an economic respect, but much less so on an ideological and social level.

Notes

1 A proper quantitative assessment is limited by methodological and taphonomic factors, while isotope and related studies may offer a contrasting point of view (see Smits *et al.* 2010).

2 Bird-David (1990, 190-194) stresses that among the South Indian Nayaka hunter-gatherers nature, the forest and the wild are perceived as family. The Nayaka see the forest as a parent giving food and themselves as siblings with whom one shares. Among their farming neighbours, the forest is perceived as potentially dangerous, and the relationship is seen as ancestral and reciprocal.

3 Animistic belief systems do not regard plants or animals in a taxonomic manner, but believe that all natural beings possess their own specific spiritual principles and that it is possible for humans to establish personal relations with these entities.

4 As argued in this study (see also Layton *et al.* 1991, 255), it is potentially more useful to study hunting, gathering, herding and cultivation as alternative strategies, which are singly, or in combination, appropriate to particular natural and social environments. This also underscores the problematic application of the term 'substitution' in the availability model. New resources are not expected to be dealt with from a perspective of eventual replacement, but as additional strategies, used in an integrative manner (see Chapter 7).

5 Activities are combined if opportunities allow to permit continued, if intermittent, hunting and gathering. An elaborate study of the Nayaka in India demonstrates that at times these groups received seedlings from their neighbours and subsequently invested considerable time and effort in preparing paddies, yet this investment was seen as a means to procure food on a one-off basis, not as the start of a cyclical (agricultural) investment. In this manner, individuals or groups may have cultivated at considerable intervals, possibly lasting decades (Bird-David 1992[b], 37).

6 A case-study of the Hai//om Bushmen demonstrates that, while working at least part of the year for Ovambo agro-pastoralists, growing their own crops and building their houses in the same style, these communities spend most of the year hunting and gathering, having little contact with their agricultural neighbours (see Barnard 2007).

7 Much debate has taken place as to what defines culture (Cohen 2004; Wagner 1981). It can take many forms, encompassing what people do, eat, think, make etc. Together these traits form distinguishable cultural complexes, whose members are culturally competent and knowledgeable when it comes to the rules, practices and *habitus* (*e.g.* Bourdieu 1977; Giddens 1984; Sommer 2001). These complexes, while not in the least original or pristine themselves, may enter into contact with each other, exchanging flows of objects, people and ideas. In the long run the effects of this may change or alter one or more of the interacting complexes (see Redfield *et al.* 1935); acculturation takes place. In this respect the context of acculturation is of crucial importance (Naerebout/Versluys 2006, 16).

8 This does not presuppose intentionality on the part of inanimate elements. Instead it indicates a focus on the multi-stranded heterogeneous relationships between humans and non-humans (places, objects, environment).

9 This process of translation is not necessarily dialectic in that it may take place over a prolonged period of time with actors that are not consciously involved in translating or changing other actors. In this sense it finds itself on a par with the mechanisms underlying the creation of new *habitus* (Bourdieu 1977; see Chapter 6).

10 It is important to stress that there are differences between the ANT approach of, amongst others, Latour and the phenomenologically rooted approach of Ingold (2000). Latour's emphases lie more on material culture studies, whereas Ingold focuses predominantly on ecological, biological and psychological case-studies (see Hoogsteyns 2008, 72-73; see also Ingold 2007). Both, however, propagate an abandonment of nature-culture oppositions and both share a number of common ideas that tie in with the ethnographically and perception-oriented approach of this study.

11 It is argued that interaction is never *isotopic*, what is happening in one place and at one moment is in fact connected to many other places, distant materials and remote actors. Nor is interaction *synchronic*. Actions in the present (or past present) are historically connected. Objects used, ideas spread, share histories and transformations (Latour 2005). As argued by Latour (2005, 201), time is folded. Related to this the interactions taking place are also historical and thus not homogenous. Finally, interaction is not *synoptic*. Not all participants in interaction are visible or possibly even known. This implies that both past participants or actors and, even more so, current archaeologists, cannot establish the complete set of actors making up a network. This is partly also the result of the fact that interactions are not homogenous (Latour 2005, 201), since the relays through which interaction takes place will not have the same material quality all along. The actors in the network are not static but develop, shift, are succeeded or disintegrate.

12 A parallel may be drawn with the work of Lefebvre (2004) where the introduction of new rhythms may have caused *arrhythmia* that demanded a (communal) reaction ranging from mild attunement to more intense restructuring in order to recreate a new state of harmony or *eurhythmia* (see Chapter 6).

13 One might argue that cultural hybrids (involving both natural as well as material and social elements; *cf.* Latour 1993, 10-11) exist that consist of specific constellations between people, objects, practices and the environment (actors in ANT) and that the composition of these constellations is negotiated and re-interpreted at the moment that the network is cut.

14 While there are many examples of adaptation (*e.g.* Barnard 2007; Gregg 1988; Kent 1989[a,b]) a useful case is provided by Turnbull's study of the Mbuti pygmies of the Ituri rainforest in Zaire (Turnbull 1983). Over many years these communities were confronted with, and interacted with, non-forager groups, ranging from Bantu-speaking farmers to Belgians. Until recently and despite all these influences they have preserved their identity of *bamiki bandura* (children of the forest; Turnbull 1983, 19, 156). This does not mean they have remained static or impervious; some elements were adopted (*e.g.* iron tools and spears), and they provided services and resources to their non-foraging neighbours. But a major motive in the character of their interaction and the degree of adaptation that took place was their intention to preserve their integrity of a forest way-of-life and preferably to keep others from interfering with it (*ibid.*, 21). To engage in interaction may thus very well involve a distinct (heightened) sense of separation and safeguarding of identity (Naerebout/Versluys 2006, 18). It should therefore be realized that when confronting change, indigenous groups may have chosen to adapt, perhaps not only according to what befitted their 'foraging mode of thought', but in view of (unavoidable) culture contact and interaction perhaps also to preserve such a mode of thought.

15 In line with the terminology utilised by Lefebvre (2004), it may be more correct to assume that instead of *arrhythmia*, the communities in question may rather have perceived the 'Neolithic rhythms involved' as *isorhythmia* that were different but similar and may have been brought into harmony, without disrupting the existing structure (see Chapter 6).

16 As argued previously it should be noted that in situations where some form of stress or pressure exists the implementation of new elements may have followed a much less gradual course, or even in the absence of group consensus (*e.g.* Gregg 1988).

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Dutch Summary - Samenvatting

Continue tradities. Een langetermijnperspectief op het neolithisatieproces van de gemeenschappen in het Benedenrijnse gebied (5500-2500 v. Chr.)

Introductie (hoofdstuk 1)

De overgang naar een landbouwend bestaan (neolithisatie) verliep langzamer en geleidelijker in een groot deel van het Benedenrijnse gebied, dan bij het overgrote deel van de West-Europese jager-verzamelaars. Dit proefschrift is de verslaglegging van een onderzoek naar de rol van de normen en waarden van de inheemse samenlevingen in dit proces. Chronologisch betreft dit met name de culturele opeenvolging van laatmesolithische groepen, de Swifterbant cultuur, de Hazendonk groep en de Vlaardingen cultuur (ca. 5500-2500 v. Chr.). Geografisch ligt het accent grotendeels op de wetlands en hun randgebieden tussen de Schelde en de Elbe. De afgelopen jaren zijn er binnen het kader van de 'Malta-archeologie' in dit gebied een aantal kwalitatief hoogwaardige vindplaatsen opgegraven die, tezamen met reeds eerder bekende vindplaatsen, een nieuw perspectief op deze periode van Neolithisatie mogelijk maken. Een cruciale vraag daarbij is in hoeverre gemeenschappen, zoals bijvoorbeeld de bewoners van het mesolithische jachtkamp te Polderweg (ca. 5500-4500 v. Chr.) en die van de sedentaire landbouwers te Schipluiden (ca. 3700-3400 v. Chr.), een fundamenteel ander bestaan leiden. Door andere zaken dan alleen de bestaanseconomie van de samenlevingen in beschouwing te nemen wordt beargumenteerd dat er veeleer sprake is van dezelfde continue traditie. Het onderzoek beoogt zo meer grip te krijgen op het karakter van Neolithisatie in het onderzoeksgebied, door middel van een langetermijnanalyse van de sociaal-ideologische aspecten van de inheemse gemeenschappen.

Het graduele verloop van Neolithisatie in het onderzoeksgebied kenmerkt zich door een geleidelijke incorporatie van Neolithische gebruiksvoorwerpen, gedomesticeerde dieren, gewassen en uiteindelijk het wonen in permanente nederzettingen. De nadruk van dit onderzoek ligt op het documenteren van de doorlopende culturele tradities van de oorspronkelijke jager-verzamelaargemeenschappen en de inpassing van Neolithische verworvenheden daarin. Omdat het proces van Neolithisatie in de natte gebieden verschilt van dat in andere landschappen is een zwaartepunt van dit onderzoek de invloed die het dynamische landschap heeft op de vorm van de culturele tradities van de samenlevingen die erin leven. Daarin kunnen een aantal onderzoeksthema's worden onderscheiden die licht werpen op de rol van de inheemse gemeenschappen, hun verbondenheid met landschap en hun traditionele waarden, ofwel *mentalité*:

- De mesolithische wortels van deze gemeenschappen. De diversiteit in het karakter van bewoning van natte en droge gebieden in het laat-mesolithicum vormt een divers substraat voor het karakter van de erop volgende neolithisatie.

- Landschap en omgeving. De dynamiek van het landschap, vooral in de natte gebieden, vormt niet alleen een natuurlijke achtergrond die ecologische grenzen stelt, maar is tevens een omgeving waarmee de er levende groepen relaties aangaan en die door perceptie gekleurd wordt.
- Neolithische axioma. Het debat over het Neolithicum en het proces van Neolithisatie wordt beïnvloed door de gebruikte terminologie. Een reflectie daarop en de modellen die erop zijn gebaseerd verduidelijken ook de rol van inheemse gemeenschappen.

Naast het 'inheemse' perspectief wordt tenslotte een terugkoppeling geboden op het Neolithisatieproces in het algemeen, door middel van een reflectie op het veel gebruikte 'beschikbaarheidsmodel'. Dit model maakt een onderscheid in drie fasen (beschikbaarheid, vervanging en consolidering), in de overgang naar een landbouwend bestaan en benadrukt met name de economische kant van het neolithisatieproces. Deze studie voegt daar een sociaal-ideologische dimensie aan toe.

Achtergrond

Dit onderzoek is een literatuurstudie binnen het 'Oogst van Malta' programma van de Nederlandse organisatie voor wetenschappelijk onderzoek (NWO), waarbij de resultaten van recente Malta-opgravingen worden gecombineerd met bestaande kennis. Daarbij wordt gebruik gemaakt van een uitgebreide verzameling van vindplaatsen (Appendix I), die op vergelijkende wijze worden bestudeerd teneinde inzicht te verschaffen in de langetermijngebruiken van de bewoners in relatie tot hun omgeving. De nadruk van het onderzoek ligt op het synthetiseren van kennis en het bieden van nieuwe perspectieven. Het is met name de nadruk op de eigenschappen, identiteit en rol van de inheemse gemeenschappen waardoor dit onderzoek een bijdrage levert aan een evenwichtiger begrip van Neolithisatie in dit gebied.

Archeologische context (hoofdstuk 2 en 3)

In hoofdstukken 2 en 3 wordt de stand van zaken van onze kennis over het proces van Neolithisatie en de wetenschappelijke onderzoeksgeschiedenis naar dit proces behandelt.

Neolithisatie

De overgang naar een landbouwend bestaan wordt beschouwd als één van de belangrijkste veranderingen in de ontwikkeling van de mensheid. In Europa is er geen overtuigend bewijs voor een onafhankelijke domesticatie en kunnen de wortels van de landbouw worden herleid tot het Nabije Oosten. Migratie en overname vormen de twee mechanismen waardoor landbouw zich verspreidde. Beide mechanismen kwamen naast elkaar en tegelijkertijd voor. Voor Noordwest-Europa vormt de Lineair Bandkeramische cultuur (LBK) die ontstaat in het noordwestelijk deel van de Hongaarse laagvlakte een belangrijk voorbeeld van migratie; althans voor de tweede fase van verspreiding die ook Zuid-Limburg bereikt. Het voorkomen en de verspreiding van vindplaatsen met zogenaamd

Limburg aardewerk of La Hoguette aardewerk en *Begleitkeramik* geeft de complexiteit van het proces weer en de potentiële rol die inheemse groepen, al dan niet met aardewerk, in deze vroege fase van het Neolithicum speelden.

De verspreiding van landbouwende samenlevingen vanuit het LBK- gebied naar het noorden en westen gebeurde geleidelijk. Aan de randen van de Noord Europese laagvlakte remt de aanvankelijk snelle verspreiding van het Neolithicum af. Hier lijkt geen sprake te zijn van migraties van groepen.

De polarisatie in het debat tussen migratie en overname is de laatste jaren afgenomen en heeft plaats gemaakt voor een meer gedifferentieerde benadering, waarbij een mozaïek van overgangssituaties bestaat en diverse temporele en regionale combinaties van de daarbij behorende mechanismen.

Afgezien van hoe, waar en wanneer landbouw zich verspreidde blijft de vraag waarom dat gebeurde cruciaal. Binnen de archeologie werd landbouw aanvankelijk als een superieure bestaanswijze gezien die, zo snel ze beschikbaar werd, door jager-verzamelaars overgenomen werd. De archeologische realiteit laat echter zien dat veel jager-verzamelaars lange tijd in de nabijheid van landbouwende samenlevingen leefden zonder zelf boer te worden. Tevens ontstonden er nieuwe ideeën over jager-verzamelaars die hun 'behoeftige' imago bijstelden. Daarop werden modellen ontwikkeld, die stelden dat landbouw veelal overgenomen werd onder invloed van ecologische factoren zoals bevolkingsdruk en voedselschaarste. Tegenwoordig wordt meer gekeken naar sociale en ideologische factoren, waarbij jager-verzamelaars een centrale rol spelen en de keuze maken om al dan niet landbouwtechnieken over te nemen om bijvoorbeeld hun prestige te verhogen.

Het is duidelijk dat beide benaderingen van belang zijn en elkaar niet uitsluiten. Desondanks is er de laatste jaren een wig gedreven, met name in de Angelsaksische literatuur, betreffende de voedselvoorziening en de economische kant van het proces en de sociale en ideologische veranderingen die daarmee gepaard gaan. Tevens is men vaak in toenemende mate afgedreven van de realiteit van de vaak weerbarstige archeologische feiten. Dit onderzoek poogt economische, ecologische en sociaal-ideologische benaderingen te combineren om tot een meer 'all-round' benadering van de overgang van jagen en verzamelen naar landbouw te komen.

Van belang daarbij is onderzoek op een geschikt schaalniveau, waarbij er een duidelijke terugkoppeling is naar de beschikbare archeologische gegevens. Dit betekent een 'bottom-up' benadering binnen een coherente geografische en culturele context en een introductie van nieuwe theorieën die de beperkingen en patronen in de beschikbare gegevens incorporeren. Dit laatste behelst ook een tafonomische waardering van het archeologisch archief in een bepaalde regio (zie hoofdstuk 4).

Het Benedenrijnse gebied

Het proces van Neolithisatie in het Benedenrijnse gebied omvat zoals hierboven omschreven twee trajecten. Enerzijds betreft dit de 'klassieke' neolithische opeenvolging die begint met de Bandkeramiek (vanaf ca. 5250 v. Chr.) en wordt gevolgd door de Rössen cultuur, de Michelsberg cultuur, de Stein groep en de enkelgraf- en klokbekercultuur. Ook de producenten van La Hoguette aardewerk en *Begleitkeramik* horen in deze traditie thuis. Vanaf 3400 v. Chr. kunnen we ook de Trechterbekercultuur in het noorden en oosten van Nederland en aangrenzend Duitsland in dit traject plaatsen. Dit proces speelt zich voornamelijk af op de

Pleistocene löss- en zandgronden. Het andere traject omvat het neolithisatieproces van de inheemse jager-verzamelaars en omvat het laat-mesolithicum, de Swifterbant cultuur, de Hazendonk groep en de Vlaardingencultuur. Dit traject ontwikkelt zich voornamelijk in de wetland gebieden tussen de Schelde en de Elbe en kan ruwweg tussen 5500 en 2500 v. Chr. geplaatst worden. Het neolithisatietraject van deze 'deltagemeenschappen' wordt geografisch en chronologisch 'geflankeerd' door de ontwikkelingen in het eerste traject dat grotendeels als volledig neolithisch omschreven kan worden. De ontwikkelingen in de culturen op de zand- en lössgronden hebben door contact, uitwisseling en inspiratie een belangrijke invloed op de ontwikkeling binnen de deltagemeenschappen. Daarin zijn verschillende stappen te onderscheiden:

1. De verspreiding van stenen werktuigen zoals dissels en *Breitkeilen* en de aanwezigheid van neolithische artefacten en zuidelijk vuursteen op mesolithische vindplaatsen duiden op vroege contacten en uitwisseling tussen beiden gemeenschappen.

2. Vanaf ca. 5000 v. Chr. zien we de ontwikkeling van een inheemse aardewerk traditie (Swifterbant aardewerk) met inheemse technieken, die haar inspiratie waarschijnlijk ontleent aan het zuidelijke (bandkeramische) Neolithicum.

3. Tussen 4700 en 4450 v. Chr. komen de eerste botten van gedomesticeerde dieren voor op vindplaatsen van de Swifterbant cultuur (Hardinxveld-Giessendam-De Bruin). Naar verloop van tijd worden ook de aanwijzingen voor het hebben en houden van vee overtuigender. De vroegste botanische resten van gedomesticeerde gewassen op deze vindplaatsen dateren tussen 4300 en 4100 v. Chr. Ze duiden op import dan wel kleinschalige verbouw van gedomesticeerde gewassen.

4. Rond 3600 v. Chr. vormt de site Schipluiden (Hazendonk groep) de eerste aanwijzing voor een volledig sedentair bestaan.

De interactie tussen de 'klassieke' en inheemse ontwikkelingen en het lange traject, maakt dat in het Benedenrijnse gebied het Neolithisatieproces als het ware in 'slow-motion' bestudeerd kan worden. Dat neemt niet weg dat er een aantal complicerende factoren zijn die genoemd moeten worden.

Een eerste betreft het verschil tussen de zogenaamde 'uplands' en 'wetlands'. Terwijl vindplaatsen in de eerste groep talrijker zijn, omdat ze dicht aan of op de oppervlakte liggen, contrasteert dit met de kwaliteit van de informatie. Op wetland vindplaatsen blijven organisch materiaal en ruimte-tijd gebonden patronen beter bewaard, terwijl upland vindplaatsen vaak als een palimpsest gekarakteriseerd kunnen worden. Parallel aan deze tafonomische verschillen speelt de vraag in hoeverre deze gebieden andere vereisten stelden aan hun bewoners en of die verschillen gradueel dan wel fundamenteel zijn.

Een tweede punt betreft de mate waarin de archeologie uit het Benedenrijnse gebied voor deze periode beoordeeld wordt op haar eigen karakter. Vaak zijn in het verleden parallellen getrokken met de rijke Scandinavische gegevens voor deze periode, zoals die van de Ertebølle cultuur. Het gebruik van het eerder genoemde beschikbaarheidsmodel, waarbij een fase van beschikbaarheid (met minder dan 5% huisdieren en cultuurgewassen), gevolgd wordt door een korte fase van vervanging (5-50% huisdieren en cultuurgewassen) en een fase van consolidatie (meer dan 50% huisdieren en cultuurgewassen), blijkt ook niet te stroken met de ontwikkeling in het onderzoeksgebied, waar juist een zeer langdurige vervangingsfase aantoonbaar aanwezig is. Het concept van complexe jager-verzamelaars, vaak gebezigd voor de Scandinavische groepen, lijkt ook weinig van toepassing te zijn op de Benedenrijnse situatie.

Een derde punt van aandacht betreft de gangbare wetenschappelijke terminologie. De concepten 'mesolithicum' en 'neolithicum' zijn beladen termen die veel zaken zoals een landbouwend bestaan, sedentisme en een andere ideologie impliceren. Binnen het 'neolithisch pakket' wordt voedselvoorziening daarnaast vaak als voornaamste kenmerk gedefinieerd. Hoewel de gebruikte terminologie een duidelijke (chronologische en inhoudelijke) functie heeft in het academische debat is het met name in de situatie van het Benedenrijnse bekken, waar inheemse groepen zowel typisch mesolithische als neolithische elementen combineren, van belang om de achterliggende connotaties te onderkennen.

Perspectieven

Vanwege de hierboven genoemde aspecten is het van belang een aantal uitgangspunten te definiëren waarop deze studie zich zal baseren:

1. Mesolithicum en neolithicum worden gebruikt als conceptuele termen. Ze worden inhoudelijk echter beschouwd als minder rigide categorieën en als uitersten op een glijdende schaal.
2. Economie wordt niet gezien als het enige criterium in het debat over Neolithisatie. Economische aspecten moeten worden herenigd met sociale, ideologische en materiële aspecten. Op die manier wordt de specifieke compositie van archeologische gegevens op een vindplaats in geografische, sociale en ecologische context het uitgangspunt. De rol van de bijdrage van huisdieren en cultuurgewassen kan dan ook niet voor een hele culturele eenheid bepaald worden, maar enkel per vindplaats. Proportie is daarbij een belangrijkere factor dan aanwezigheid of afwezigheid.
3. Er moet voldoende aandacht zijn voor de historiciteit van de bestudeerde situaties. In plaats van het zoeken naar algemene waarden in neolithisatie, duidt het bestaande mozaïek aan overgangssituaties erop dat er voldoende aandacht voor de aanwezige diversiteit dient te zijn.
4. Het is van belang het proces van neolithisatie te bestuderen aan de hand van een relevante geografische en culturele context. Dit impliceert dat de bewoning van een bepaald landschap een relatie tussen mensen en hun (perceptie van) omgeving tot stand brengt. Deze is van invloed op aspecten van identiteit, maar beïnvloedt potentieel ook hun omgang met nieuwe verworvenheden.

Waardering van de gegevens (hoofdstuk 4)

Hoofdstuk 4 betreft een analyse van de eigenschappen van de verschillende sites die de basis van deze studie vormen in relatie tot hun landschappelijke en omgevingscontext. Dit behelst vooral tafonomische, depositionele en post-depositionele processen. Naast de conservering van (organische) vondsten, van sporen en van tijd- en ruimte-gebonden patronen worden de verschillende historische en methodologische keuzes in ogenschouw genomen die bij opgravingen een rol spelen. Op deze manier wordt in kaart gebracht door welke filters ons beeld van deze vindplaatsen tot stand komt. Een ander punt van discussie vormt de vaak bekritiseerde waarde van een benadering op vindplaats-niveau, ten opzichte van een landschapsbenadering. Deze studie benadrukt het belang van een integratie van beide en de waarde van het concept 'site' als analytische onderzoekseenheid en komt tot een serie 'site templates'.

Uplands versus wetlands

De uitgebreide analyse van de verschillende vindplaatsen raakt aan de schijnbare dichotomie tussen de vaak talrijke upland vindplaatsen ten opzichte van de door afdekking of verstoring minder talrijke wetland-vindplaatsen. Deze laatste zijn daarentegen kwalitatief vaak superieur vanwege de organische conservering en hun inbedding, veelal in veen of klei, waardoor de archeologische neerslag van patronen van handelingen vaak stratigrafisch te onderscheiden is. Het is duidelijk dat enerzijds het maken van een onderscheid tussen deze twee typen vindplaatsen een contemporaine aangelegenheid is, aangezien de prehistorische bewoners niet op dezelfde wijze naar het landschap zullen hebben gekeken. Bovendien zullen wetland-vindplaatsen onderdeel hebben uitgemaakt van nederzettingssystemen waartoe ook plaatsen in andere gebieden behoorden. Het onderscheid tussen wetland en upland vindplaatsen is dus eerder gradueel dan fundamenteel. Wetland vindplaatsen zijn dus ten dele representatief voor de kwalitatief minder informatieve vindplaatsen elders.

Echter, de karakteristieke verschillen in conservering tussen wetland en upland vindplaatsen zijn uiteindelijk terug te voeren tot verschillende geogenetische milieus, en dus een ander landschap en een andere omgeving. Het leven in en bewonen van die omgevingen stelde waarschijnlijk verschillende eisen, die leidden tot andere strategieën en dus een deels verschillende manier van leven met andere accenten. Dergelijke wederkerige relaties tussen mensen en hun omgeving zijn etnografische vaak aangetoond. Wetlands moeten dus niet enkel als gradueel verschillend van upland vindplaatsen worden bestudeerd, maar ook worden geïnterpreteerd aan de hand van de specifieke kwaliteiten die het leven in een dergelijke omgeving met zich meebracht. In het bijzonder betreft dit de dynamiek van deze gebieden die duidelijk verschilt van typische upland situaties. Dit betreft niet enkel de pragmatische economische keuzes die een leven in deze natte gebieden met zich meebrengt, maar juist ook de wijze waarop een omgeving ervaren wordt en hoe dit de er levende gemeenschappen heeft gevormd.

Het laat-mesolithicum (hoofdstuk 5)

Om het Benedenrijnse proces van Neolithisatie beter te begrijpen is het van belang meer inzicht te verkrijgen in de laatmesolithische gemeenschappen van jager-verzamelaars die dit gebied bewoonden. Zij vormen de socio-culturele context waarbinnen de overgang naar een landbouwend bestaan zicht afspeelt. Het is daarbij van belang deze gemeenschappen niet te zien als een homogeen decor waartegen neolithisatie zich afspeelt. Integendeel, de diversiteit binnen de laatmesolithische gemeenschappen, in relatie tot de verschillende landschappen die ze bewoonden, vormde een heterogene voedingsbodem voor het proces van neolithisatie. In hoofdstuk 5 wordt deze diversiteit in kaart gebracht, voornamelijk gebaseerd op gegevens van opgegraven vindplaatsen en binnen een regionale setting. Het doel is om aan te tonen welke verschillen en overeenkomsten van betekenis zijn in het bepalen van de diversiteit in de laatmesolithische bewoning en op welke wijze dit van belang kan zijn voor een beter begrip van neolithisatie.

De vindplaatsen zijn bestudeerd aan de hand van verschillende variabelen. Deze omvatten site locatie keuze, positie en structuur van de vindplaats in het landschap en mate van investering in locaties. Ook is gekeken naar de technologische en typologische aspecten van de lithische vondstverzamelingen en de samenstelling naar vuursteensoort. De vindplaatsen zijn daarbij in regionale categorieën ingedeeld. Deze omvatten het zuidelijke en noordelijke dekzandlandschap, vindplaatsen in rivierdalen en vindplaatsen in of aan de randen van de wetlands.

Landschappelijke situering en locatiekeuze

De vindplaatsen binnen de regionale groepen zijn vergeleken met betrekking tot site locatie keuze, structuur van de nederzetting en mate van investering. Wat betreft site locatiekeuze en structuur straalt de relatief grote groep van vindplaatsen in het zuidelijke dekzandlandschap een grote mate van homogeniteit uit. Vindplaatsen liggen vaak op lage dekzandduinen en ruggen in de buurt van beekjes of vennen en vormen regelmatig uitgestrekte complexen. Er zijn bovendien weinig aanwijzingen voor een investering in de vorm van structuren of voorzieningen. Het zijn met name dezelfde locaties en condities die keer op keer opgezocht werden voor een relatief kortstondig verblijf. De setting, eerder dan de precieze plek was dus van belang. Het karakter van de site locatiekeuze voor het noordelijke dekzandlandschap is grotendeels vergelijkbaar. Hier zien we echter vaak iets meer bewijs voor investering in de vorm van kuilen, steenconfiguraties en soms uitgebreide haardkuil complexen. De karakteristiek van bewoning in het dekzandgebied verschilt van de locatiekeuze en structuur binnen de wetland en rivierdal groepen. Typische wetland vindplaatsen zoals de sites van Hardinxveld-Giessendam duiden op een structurele relatie tot plekken die gedurende een lange periode op dezelfde wijze werden benut. Tevens vormen verschillende sporen, vondsten en structuren (zoals bijvoorbeeld hutten, graven, een kano en diverse kuilen) duidelijke aanwijzingen voor investering. Deze vindplaatsen zijn daarmee als 'persistent places' te duiden. Andere vindplaatsen aan de randen van de wetlands en in rivierdalen, zoals de vindplaats Luik-Place St.-Lambert zijn hier ten dele mee te vergelijken. Hoewel er veel variatie is lijkt de wijze waarop de wetland locaties benut worden duidelijk te verschillen van het reguliere gebruik van vindplaatsen in de dekzandlandschappen, met name wat betreft bewoningsduur en investering.

Lithische informatie

De analyse van de lithische vondstassemblages ondersteunt deels het hierboven geschetste beeld, maar is minder afhankelijk van verschillen in conservering. Op de zuidelijke zandgronden is er een vrij homogeen spectrum aan werktuigen, met een belangrijk aandeel pijlpunten (met name trapezia). Daarnaast is zowel technologisch als typologisch de productie van klingen belangrijk. Zowel het aandeel formele werktuigen als de klingproductie duiden zo op een 'curated technology', een 'verzorgende technologie', die ondersteund wordt door het consistente gebruik van het betrouwbare Wommersom kwartsiet, met name in de productie van werktuigen. Dit spectrum contrasteert met de typische wetland vindplaatsen, als de sites bij Hardinxveld, waar juist sprake lijkt te zijn van een zogenaamde 'expedient technology', een 'toegepaste technologie', met een belangrijk aandeel van non-formele werktuigen zoals geretoucheerde afslagen. De andere sites bevinden zich veelal in een intermediaire positie. Het beeld wordt ondersteund door keuzes in de grondstofvoorziening. Het grootste aandeel in lithische grondstoffen op vrijwel alle vindplaatsen is afkomstig uit lokale voorkomens. In het zuidelijke dekzandlandschap speelt Wommersom kwartsiet een belangrijke rol en is mogelijk verkregen door 'embedded mobility' in combinatie met speciale expedities en uitwisseling. Het grondstofspectrum op de wetland vindplaatsen van Hardinxveld, waar geen lithisch materiaal in de omgeving voorkomt, duidt juist op een belangrijke rol voor logistieke mobiliteit vanuit en gericht op één locatie. Dit ruwe onderscheid werpt licht op het activiteitenspectrum en daarmee op site-functie en mobiliteit. In het algemeen wordt daarbij aangenomen dat een groter aandeel formele werktuigen en een 'curated technology' in combinatie met factoren zoals betrouwbaarheid, bulk en omvang van het materiaal etc. karakteristieker zijn voor groepen met een hogere mobiliteit. Non-formele werktuigen en een 'expedient technology' worden daarentegen in verband gebracht met een lagere mobiliteit en een langere verblijfsduur. Dit kan gekoppeld worden aan de door Binford geopperde 'forager' en 'collector' mobiliteitsstrategieën. Waarbij de eerste uitgaat van een regelmatige residentiële verplaatsing van groepen naar bronnen en de tweede van een grotere plaatvastheid en een verplaatsing van bronnen naar bewoners.

Diversiteit in het laat-mesolithicum

Wanneer de structurele en artefact-gerelateerde informatie wordt gecombineerd en gekoppeld aan de landschappelijke situatie, dan is er een vergelijking mogelijk tussen twee uitersten op een glijdende schaal. Vindplaatsen in de dekzandlandschappen bevinden zich in een relatief homogeen, bebost landschap, waar met name beken en vennen kleinschalige locaties van ecologische diversificatie en dus gunstige vestigingslocaties vormen. Het is te verwachten dat de beperkte omvang van de voedsel -en andere bronnen in deze locaties, gecombineerd met hun regeneratietijd, regelmatige verplaatsing noodzakelijk maakten. Dit wordt ondersteund door de focus op terrestrische bronnen die een mobiele (jacht-)strategie aannemelijk maken. Aangezien dezelfde locaties werden opgezocht kunnen op deze wijze uitgebreide vindplaatscomplexen ontstaan.

Het andere uiterste wordt gevormd door vindplaatsen in het wetland landschap van de delta en in mindere mate vindplaatsen in rivierdalen. Vanwege de voedselrijkdom in deze gebieden, door het ruim(er) voorhanden zijn van aquatische en verwante bronnen, is er een ruime buffer voor langduriger bewoning door grotere groepen. De ecologisch heterogene omgeving varieert, maar biedt doorgaans diverse aantrekkelijke combinaties van bronnen die zich het best middels een 'collector type' strategie laten exploiteren. Het karakter van de bewoning van deze vindplaatsen wordt dan ook gekenmerkt door een lagere mobiliteit, potentieel grotere groepsomvang, en investering in plekken. Dit plaatsgerichte karakter wordt onderbouwd door onder meer de duidelijk seizoenmatige bewoning op een vindplaats als Hardinxveld-Giessendam-Polderweg.

De mesolithische factor

De geschetste contrasten verhouden zich als uitersten op een glijdende schaal. Bovendien heeft etnografisch onderzoek aangetoond dat jager-verzamelaars verschillende strategieën complementair gebruiken. Enerzijds moeten we er dus vanuit gaan dat er combinaties zijn geweest waarbij vindplaatsen in verschillende omgevingen gebruikt werden. Anderzijds zijn de contrasten in voedselvoorziening, technologie, typologie, grondstofvoorziening, mobiliteit, en de investering en het gebruik van plaatsen meer dan slechts gradueel verschillend. Dit rechtvaardigt de aanname dat er nederzettingssystemen zullen zijn geweest die voor een groot deel waren gericht op de exploitatie van aquatische bronnen en systemen met een meer terrestrische oriëntatie. Hoewel dit combinaties niet in de weg staat, leidt het wel tot gemeenschappen die economisch en socio-cultureel van elkaar verschillen. Er is dus sprake van diversiteit in het laat-mesolithicum.

Deze diversiteit zal een belangrijke factor zal geweest zijn in het regionale verloop van neolithisatie. Daarbij kan worden verondersteld dat met name voor de gemeenschappen in de wetland gebieden, er minder economische aanleiding was om over te gaan op een agrarisch bestaan. Verder is het zo dat deze natte gebieden waarschijnlijk weinig geschikt waren voor de verbouw van gewassen zoals deze bijvoorbeeld in de Bandkeramiek plaatsvond. Tenslotte bevonden deze groepen zich op een ruime afstand van volledig neolithische groepen, waardoor overdracht van kennis mogelijk minder intensief was. Het initiatief in de wetlands zal voornamelijk bij de inheemse groepen hebben gelegen, in tegenstelling tot in gebieden met weinig aquatische bronnen en mogelijke conflicten over voedselvoorziening en andere benodigdheden, waar een overgang sneller plaatsvond. In de wetlands vond dus een grotendeels intern gecontroleerd proces plaats, waarbij belangrijke aspecten en waarden van de betrokken laatmesolithische samenlevingen lang onveranderd bleven. De culturele continuïteit en het langetermijnkarakter van de gemeenschappen in deze wetland gebieden, maakt dat de manier waarop de veranderingen die plaatshadden, vanuit een inheems perspectief bestudeerd kunnen worden. De wederkerige relatie met de wetland-omgeving vormt daarin een belangrijke factor.

Theoretisch kader (hoofdstuk 6 en 7)

De diversiteit in het laat-mesolithicum vormt een belangrijke uitgangsbasis voor een verdere studie van het neolithisatieproces. Daarbij ligt de nadruk op de culturele continuïteit zoals die bestaat in de wetlands van het Benedenrijnse gebied en die naast het laat-mesolithicum de Swifterbant cultuur, de Hazendonk groep en de Vlaardingen cultuur omvat. Neolithisatie zal worden benaderd vanuit het perspectief van de inheemse gemeenschappen en de manier waarop zij omgaan met nieuwe verworvenheden. Dat is minder een focus op verandering en overgang en meer op stabiliteit en identiteit.

Een eerste stap is om de betrokken gemeenschappen niet anders te bestuderen vanwege de incorporatie van neolithische aspecten in hun bestaan. Dat betekent juist geen economische benadering, maar een benadering die uitgaat van een sterke continuïteit tussen natuur en cultuur. Dit perspectief is bovendien diachroon en gericht op de langdurige relatie tussen gemeenschappen, het landschap en de ecologische omgeving. Van belang daarbij zijn met name de alledaagse praktijken en routines. Deze vormen de korte en middellange patronen die de basis voor langduriger trends en tradities zijn. Op deze manier kan context gebonden gedrag, of 'habitus', bestudeerd worden voor de lange termijn en kan geduid worden in hoeverre de 'agency', de handelingsbevoegdheid en intentie, binnen deze inheemse groepen de structuur van opeenvolgende culturen beïnvloedde. Van belang daarbij is dat deze mechanismen van continuïteit en verandering ingebed worden in de bredere set van factoren die van invloed zijn op de sociale structuur. Daartoe kan het 'dwelling perspective', het 'residerend perspectief worden geïntroduceerd. Deze archeologie van ' inhabitation', of 'inwoning' probeert de dynamiek van gemeenschappen te begrijpen aan de hand van de structurele, structurerende en historische condities die ze bewonen. Dat betekent een bijzondere aandacht voor de interactieve relatie tussen gemeenschappen en hun natuurlijk omgeving en de (wederkerige) netwerken die daarbinnen ontstaan. Binnen deze netwerken vormen de gemeenschappen slechts één van de elementen en vormen de handelingen en routines de essentie die continuïteit waarborgt. De aandacht voor neolithische aspecten richt zich vervolgens met name op de wijze waarop deze daarin geïntegreerd worden.

Leven in een wetland omgeving

Binnen dit theoretische kader is de rol van de omgeving, met name de perceptie ervan door gemeenschappen, van belang als structurerend element van deze samenlevingen. De omgeving omvat diverse geologische, geografische en ecologische aspecten die van invloed zijn op landgebruik, levensonderhoud, mobiliteit en nederzettingssysteem. Binnen deze fenomenologische benadering worden gemeenschappen en hun omgeving als een eenheid gezien en bestudeerd als 'totale fenomenen'.

Indien we dit perspectief hanteren voor een studie van de gemeenschappen in en om de delta van het Benedenrijnse gebied, dan is het duidelijk dat de wetlands vanuit economisch en materieel perspectief als rijke gebieden kunnen worden omschreven. Kijken we echter naar de beleving van die landschappen, dan spelen andere aspecten een rol. De wetlands kunnen dan gekarakteriseerd worden als een relatief dynamisch landschap. Processen zoals onverwachte overstromingen, het verdrinken van landschappen, veengroei, veranderende composities van (voedsel)bronnen en routes, verdwijnend en verschijnend land, toename van afstanden tot het vasteland en veranderingen in brak- en zoetwatercondities hoorden allen bij dit dynamische spectrum. Hoewel de onderliggende geologische en ecologische processen zich afspelen op de lange termijn zijn hun gevolgen wel degelijk waarneembaar binnen generaties en kunnen zelfs binnen een mensenleven waargenomen worden en verwachte dan wel onverwachte gevolgen hebben gehad.

Dit zal van invloed zijn geweest op de mate waarin op bepaalde bronnen vertrouwd kon worden en dus op aspecten van planning en anticipatie, territorialiteit en mobiliteit. Het wetland-landschap als medium daarin zal een waargenomen factor van belang zijn geweest.

Het is van belang op te merken dat mensen langdurig leefden in deze landschappen met hun cyclische als ook onverwachte veranderingen en eigenschappen, terwijl dat de structuur van hun leven niet domineerde of veranderde. Waarschijnlijk bood hun manier van bewoning van deze gebieden mechanismen om op een flexibele manier met deze dynamiek om te gaan. Dat roept vragen op over de manier van verwevenheid van gemeenschappen, plaatsen, en het landschap en op welke wijze de wetland omgeving een structurerende, actieve invloed had op het karakter en de identiteit van de er levende gemeenschappen. Voor een beter begrip van de rol van deze gemeenschappen in het proces van Neolithisatie is die wederkerige relatie met hun omgeving cruciaal.

Voedselvoorziening, nederzettingssystemen en geïntegreerde strategieën (hoofdstuk 7 en 8)

De relatie tussen mensen en hun omgeving was intensief en wederkerig. Hoewel de omgeving grenzenstellend was, hadden de er levende gemeenschappen daarbinnen keuzevrijheid. Deze was primair verbonden aan sociale conventie, 'habitus' en traditie, die op hun beurt werden beinvloed door het leven in een wetland omgeving. Binnen de gestelde grenzen zijn het dus de keuzes van gemeenschappen die bepalen hoe er met de omgeving werd omgegaan en hoe continuïteit werd gewaarborgd. Deze continuïteit ontstaat dus uit de wisselwerking tussen mens en omgeving en de gemaakte keuzes werpen een licht op de sociale identiteit van en ontwikkelingen in deze kleinschalige gemeenschappen. Het kiezen voor veranderingen of aanpassingen in strategie, zoals die in een proces van neolithisatie voorkomen, kan er dus op gericht zijn om een bestaande wijze van leven te consolideren. Een dergelijke houding past binnen de adaptieve attitude van deze gemeenschappen. Deze vloeit voort uit het gegeven dat zij op een flexibele manier met de realiteit en ritmes van een dynamische wetland omgeving om moesten gaan.

In hoofdstuk 7 en 8 zijn binnen deze kaders verschillende aspecten van het bestaan van wetland gemeenschappen onder de loep genomen, waaronder voedselvoorziening, mobiliteit en landgebruik. Deze zijn daarna gecombineerd in een alternatieve benadering van zowel het nederzettingssysteem als Neolithisatie.

Voedselvoorziening, seizoenaliteit en mobiliteit

Het voedselrijke karakter van de wetlands noopte niet tot een snelle overgang op andere manieren van voedselverkrijging, zoals de verbouw van gewassen of veeteelt. Deze vormden eerder een aanvulling op de reeds bestaande breed-spectrum economie, terwijl jagen, verzamelen en vissen daar eveneens belangrijke onderdelen van bleven uitmaken.

De samenstelling van het voedselpakket op individuele sites is het best af te lezen aan de faunaresten. Deze vormen allereerst veelal een reflectie van de directe omgeving (bijvoorbeeld veel vis, vogels, otters en bevers in het veenmoerasgebied). Hoewel het aandeel gedomesticeerde dieren in de faunacompositie toeneemt door de tijd, vormen ze pas een dominante bijdrage op vindplaatsen in de kuststreek (en hypothetisch de randen van de wetlands) vanaf de Hazendonk groep. Een meer gevarieerd spectrum, met een belangrijk percentage wild zien we echter ook nog op een aantal sites uit de latere Vlaardingen cultuur. Het aandeel van akkerbouw is moeilijk in te schatten, aangezien de bewijzen het vaak niet toelaten een eenduidig onderscheid te maken tussen import en lokale verbouw. Er zijn een aantal aanwijzingen voor lokale verbouw voor de Swifterbant sites en in ieder geval voor de kustlocaties van de Hazendonk groep. Lokale verbouw zal echter vaak kleinschalig zijn geweest, wat betekent dat gecultiveerde gewassen vooral een aanvulling op het al verzamelde plantaardige voedsel vormden. Het is dus duidelijk dat de potentiële implicaties van een overgang op deze neolithische wijze van voedselvoorziening beperkt bleven. Gedomesticeerde dieren en gewassen werden geleidelijk aan de bestaande mix toegevoegd en veranderingen betroffen nooit alle cultureel contemporaine vindplaatsen in dezelfde mate. Als zodanig blijft er een duidelijke keuzevrijheid bestaan binnen de marges van het specifieke wetlandlandschap waarbinnen sites gelegen zijn.

Wat seizoenaliteit en mobiliteit betreft zijn er duidelijke aanwijzingen voor een continuïteit in de oriëntatie op de wetlandgebieden. Hoewel bepaalde activiteiten seizoensgebonden zijn, zijn er geen aanwijzingen voor momenten in het jaar waarop de wetlands niet residentieel bewoond werden. Tevens zijn er geen archeologische aanwijzingen dat de wetlands naar verloop van tijd vooral extractief gebruikt werden. Naast het verschijnen van sedentaire nederzettingen in het kustgebied binnen de Hazendonkgroep, blijft er sprake van een residentiële bewoning van de wetlands en een belangrijk aandeel van wilde bronnen in de voedselvoorziening. Sedentaire nederzettingen vormen een nieuw element in het nederzettingssysteem, maar slechts als aanvulling van een reeks bestaande opties. Naast de logistieke mobiliteit vanuit verschillende plekken, blijft residentiële mobiliteit een factor van belang. Er is dus sprake van een sterke continuïteit in de manier waarop het wetland landschap wordt benut. Dat betreft ook de verkrijging van bijvoorbeeld grondstoffen. Mesolithische routines en netwerken bleven veelal intact.

Er kan geconcludeerd worden dat er sprake is van continuïteit in hoe gemeenschappen gebruik maakten van het wetland-landschap. Deze komt tot uitdrukking in de constante range van praktijken en strategieën die in gebruik blijft. Plekken werden langdurig gebruikt en jagen, vissen en verzamelen bleven een kernonderdeel van het levensonderhoud uitmaken. Akkerbouw en veeteelt werden daaraan toegevoegd. Tegelijkertijd was er geen volledige overgang naar een sedentair bestaan en bleven (delen van) gemeenschappen residentieel mobiel. De kern van dit gedrag en deze culturele waarden in de inwoning van het dynamische wetland landschap bleef gedurende drie millennia stabiel.

Tegelijkertijd is er binnen het karakter van deze continuïteit een duidelijke rol weggelegd voor een flexibele attitude. Het gebruik van sites is constant, bepaalde plekken werden langdurig gebruikt, maar de aard van het gebruik kon seizoenaal wisselen en ook veranderen op de lange termijn. Tegelijkertijd is er een breed spectrum aan 'procurement strategies', of 'verkrijgingsstrategieën' in gebruik en blijft een typisch mesolithische 'traditie' zoals residentiële mobiliteit van belang. De gemeenschappelijke keuzes waren niet altijd geoptimaliseerd, waardoor de waargenomen flexibiliteit als kernwaarde van de er levende samenlevingen was, in plaats van slechts een reactie op de omgeving. Deze werd gekarakteriseerd door een responsieve capaciteit om in te spelen op veranderende omstandigheden: een soort pragmatisme.

Geïntegreerde strategieën

Binnen het perspectief van de op gemeenschapsniveau gedocumenteerde continuïteit en de erbij behorende flexibiliteit, lijkt er sprake van een intra-culturele agency die vooral op het regionale niveau van het nederzettingssysteem een rol speelde. Dit blijkt uit de contemporaine diversiteit aan keuzes in de voedselvoorziening en bewoning van vindplaatsen met dezelfde culturele achtergrond, zowel in ecologisch verschillende gebieden, als op naburige sites met een vergelijkbare ecologische context. Dit duidt op autonome keuzes op het niveau van die individuele gemeenschappen met betrekking tot voedselvoorziening, mobiliteit en incorporatie van neolithische elementen.

Binnen dit systeem werden gedomesticeerde dieren en gewassen aan het bestaande brede spectrum van voedselbronnen toegevoegd. Deze 'extended broad spectrum economy', of 'uitgebreide breed spectrum economie', legt het accent bij de economische en praktische toevoeging van deze nieuwe elementen. Andere aspecten, zoals mobiliteit, uitwisseling en groepssamenstelling vormen echter ook onderdeel van de reeks van keuzes die gemeenschappen maakten. Niet alleen de samenstelling van de mix van geexploiteerde voedselbronnen, maar de organisatie en operationalisatie van die exploitatie was dus belangrijk. De actieve transformatie van het repertoire aan keuzes in adaptieve combinaties wordt daardoor gedefinieerd is typisch voor deze gemeenschappen en wordt hier gedefinieerd als 'integrative strategies', 'geïntegreerde strategieën'.

Dit perspectief gaat ervan uit dat hoewel het gebruik van een repertoire aan keuzes groeide uit de langetermijnrelatie tussen gemeenschappen en de wetland omgeving, de flexibiliteit die eraan ten grondslag ligt uiteindelijk deel uitmaakt van de culturele waarden van de gemeenschappen als zodanig. Vanuit die optiek moet de toevoeging van neolithische elementen (domesticaten, technologie, sedentisme) gezien worden als een uitbreiding van de bestaande range zonder dat er direct sprake was van een disruptie van het bestaande leven. Het belang dat werd gehecht aan een voortbestaan van bestaande praktijken en de waarneembare continuïteit wordt onderbouwd door diverse etnografische case-studies (zie Appendix III). Deze tonen aan dat inheemse groepen op velerlei wijze wilde en gedomesticeerde bronnen combineren. Het incorporeren van elementen van een neolitische (producerende) bestaanswijze lijkt dus lang niet altijd de verstrekkende gevolgen te hebben gehad die wij er vanuit ons perspectief op neolithisatie vaak aan verbinden.

Een nieuw perspectief op nederzettingssystemen

Vanuit bovenstaande visie is opnieuw gekeken naar de beschikbare gegevens voor mobiliteit en het gebruik van vindplaatsen in de wetlands. De uitkomsten zijn gemodelleerd in de vorm van potentiële nederzettingssystemen. Hoewel de beperkte hoeveelheid aan beschikbare informatie verhindert daadwerkelijke nederzettingssystemen vast te leggen zijn de bredere trends wel waarneembaar.

Tijdens het laat-mesolithicum en de vroege Swifterbant periode is er sprake van voornamelijk logistiek mobiele systemen in de wetlands en wellicht volledig residentieel mobiele systemen in de dekzand gebieden. Vindplaatsen in de delta (zoals Hardinxveld-Giessendam en mogelijk Maaspoort) wijzen op structurele exploitatie van de wetlands en worden gekenmerkt door investering en een zekere permanentie in gebruik. Dit logistieke systeem van seizoensexploitatie in combinatie met extractie kampementen lijkt gedurende de midden Swifterbant periode standaard te worden. Mobiliteit wordt daarbij gekoppeld aan het hebben van vee en de import, of kleinschalige verbouw van gecultiveerde gewassen. Dit neemt niet weg dat bijvoorbeeld bij incorporatie van upland vindplaatsen er ten dele een hogere mate van residentiële mobiliteit kan zijn. Voor de Late Swifterbant periode en de Hazendonk groep werden twee soorten nederzettingssysteem onderscheiden. Enerzijds een voortzetting van seizoensbewoning in combinatie met logistieke mobiliteit. Daarnaast en in samenhang daarmee een groep van vindplaatsen (tot nu toe vooral in het kustgebied van Delfland gedocumenteerd) die duiden op sedentaire bewoning en een belangrijke rol voor akkerbouw en veeteelt. Voor de erop volgende Vlaardingen cultuur lijkt er met name in de kustgebieden sprake van continuïteit wat betreft permanente bewoning, akkerbouw en veeteelt, terwijl er in het zoetwatergetijdegebied en in de veenmoerassen sprake is van niet permanent bewoonde plekken en logistieke mobiliteit.

Een belangrijke vraag is in hoeverre het verschijnen van sedentaire nederzettingen en een belangrijke rol voor akkerbouw en veeteelt een centrale rol dient te spelen in de interpretatie van de nederzettingssystemen. Indien daarvan uit wordt gegaan, dan is de structuur van de nederzettingssystemen in de Hazendonk groep en de Vlaardingen cultuur hiërarchisch, waarbij een centrale rol is weggelegd voor permanente nederzettingen aan de kust (en potentieel aan de randen van het wetland gebied). Locatiekeuze is dan primair georiënteerd op de mogelijkheden voor een landbouwend bestaan en vindplaatsen met een alternatief karakter staan in een ondergeschikt verband. Vanuit een perspectief dat zich richt op de economische aspecten van neolithisatie en de overgang naar een landbouwend bestaan vormt een dergelijk subordinaat systeem een logische stap. Deze benadering legt het accent bij een primaat voor een landbouwend bestaan, zonder dat daarmee vastgesteld is of landbouw ook calorisch de belangrijkste bijdrage levert, of dat locatiekeuze voor een sedentaire site inderdaad gebaseerd is op agrarisch potentieel. De tweede benadering, die hier gepropageerd wordt, is pragmatischer. Een aantal opties en keuzes bestaan hier naast en in verband met elkaar. Dit kan sedentaire agrarische sites en subsidiaire locaties, als ook logistiek mobiele systemen met residentiële mobiliteit omvatten. Contact, interactie, mobiliteit en groepssamenstelling vormen daarbinnen de factoren die de bestaande manier van leven en wonen consolideren. Daarbij kan worden gesteld dat de verschillende wetland landschappen (kustzone, getijdengebied, zoetwatermoeras en rivierengebied) gedurende de gehele periode bewoond bleven. Alternatieve keuzes in de manier van wonen en voedselvoorziening wijzen op een mate van keuzevrijheid op gemeenschapsniveau, ook binnen dezelfde ecologische context. Dit wordt ondersteund door bijvoorbeeld verschillen in grondstofvoorziening die duiden op verschillen in achterland en netwerken. Het is onwaarschijnlijk dat het brede spectrum aan diverse keuzes binnen één soort nederzettingssysteem te vatten zou zijn. Er lijkt eerder sprake van een continuïteit in de flexibele mechanismen om deze gebieden te bewonen. Het daaraan verbonden socio-culturele karakter van de gemeenschappen vormt een belangrijke factor in ons begrip van het proces van neolithisatie in dit gebied.

Neolithisatie in het Benedenrijnse gebied: een lange of korte transitie? (hoofdstuk 8)

Het karakter van de gemeenschappen zoals hierboven besproken bepaalt hun positie in het proces van neolithisatie. Het is duidelijk dat dit met name samenhangt met het perspectief dat in het onderzoek wordt gekozen. Bovendien valt het bepalen van een kunstmatige grens om de overgang van mesolithicum naar neolithicum te duiden niet per definitie samen met het bestuderen van een proces van neolithisatie.

Gebaseerd op het eerder besproken beschikbaarheidsmodel kan de overgang naar een landbouwend bestaan in het Benedenrijnse gebied gekenschetst worden als relatief kort. Een aandeel van 50% of meer gedomesticeerde dieren en duidelijke aanwijzingen voor inheemse akkerbouw zijn aantoonbaar aanwezig op een aantal vindplaatsen rond het midden van het vierde millennium v. Chr. Dit wordt ondersteund door het gegeven dat de samenstelling van de faunaresten op de vindplaatsen meer verschilt per gebied dan door de tijd. Bovendien zijn er duidelijke aanwijzingen voor sedentisme. Deze kenschets past goed in de consolidatiefase van het besproken model. Op basis daarvan is gepleit voor een korte transitiefase die voltooid werd tijdens de Hazendonk groep en, in afwezigheid van oudere Swifterbant vindplaatsen langs de kust, mogelijk al daarvoor (zie Raemaekers 2003).

Binnen de geïntegreerde relatie tussen gemeenschappen en hun leefomgeving die hier uiteen gezet is, is het echter de vraag of een dergelijke korte overgang bestaan heeft. De argumenten voor het bestaan ervan berusten voornamelijk op een aantal typisch 'neolithische' premissen. De voornaamste betreft het belang dat wordt gehecht aan de verhouding tussen wilde en gedomesticeerde dieren in de faunaresten. Afgezien van het vaak moeilijk te maken onderscheid tussen wilde en tamme varkens wordt het spectrum verdeeld in een wilde en een tamme component die de bestaande diversiteit in keuzes en accenten tussen verschillende sites homogeniseert. Bovendien wordt er geen aandacht besteed aan het calorisch belang van gedomesticeerde dieren in het dieet, de bijdrage van vis en vogels, de gevolgen van het slachten buiten de nederzetting en de verschillende tafonomische gevolgen voor bepaalde delen van het karkas. Markant is bijvoorbeeld het gegeven dat het isotopensignaal voor de bewoners van Schipluiden, ondanks een voorname rol voor gedomesticeerde dieren in de samenstelling van de faunaresten, duidelijk wijst op het belang van aquatische bronnen. Los van deze argumenten is een aanvullend probleem het belang dat er aan deze benadering wordt gegeven binnen het beschikbaarheidsmodel. Het (begin van het) eind van neolithisatie in een bepaald gebied wordt bepaald door het aandeel van meer dan 50% domesticaten in de faunaresten van één site. Deze bepaalt vervolgens zowel de site functie als de aard van het nederzettingssysteem. Sites uit de Hazendonk groep met een duidelijk aandeel van gedomesticeerde dieren bepalen zo dus ook de positie van bijvoorbeeld latere Vlaardingen vindplaatsen met een duidelijk wild spectrum. Indien een Neolithische 'signatuur' in het nederzettingssysteem centraal wordt gesteld is het verleidelijk een lineaire ontwikkeling te zien.

Argumentatie voor een lange transitie

De keus voor een lange of korte overgang naar een landbouwend bestaan is duidelijk verbonden aan de nadruk die men legt op sommige aspecten van de voedselvoorziening en het nederzettingssysteem, als ook de combinatie daartussen. Indien men echter binnen de hier gekozen benadering de nadruk legt bij het gedrag en de strategieën van de inheemse wetland gemeenschappen, dan ontstaat er een beeld waaruit vooral continuïteit spreekt en een incorporatie van nieuwe kennis, praktijken en producten die niet tot abrupte veranderingen leidde. In dat opzicht wordt de periode eerder gekenmerkt door de manier waarop verschillende bronnen inter- en intraregionaal gebruikt en gecombineerd werden, in plaats van door het aandeel gedomesticeerde dieren en gewassen. Indien deze eigenschappen centraal gesteld worden en beschouwd als de uitkomst van de langetermijnrelatie tussen gemeenschappen en hun leefomgeving, ontstaat een beeld waarin er sprake is van een (zeer) lange, geleidelijke transitie. Daarbij zijn twee aspecten van belang. Het eerste is dat het verschijnen van 'neolithische' elementen (objecten, praktijken, gedomesticeerde dieren en gecultiveerde gewassen) weliswaar een stadium in ontwikkeling en contact markeert, maar ons geen kennis verschaft over de impact op de bestaanswijze van de betrokken gemeenschappen. In het geval van de hier bestudeerde gemeenschappen werden deze nieuwe verworvenheden veeleer toegevoegd aan een bestaand spectrum en geïntegreerd in een set van gekende strategieën. Daarbij is er eerder sprake van continuïteit, dan van verandering. Ten tweede, indien het gebruik van gedomesticeerde dieren en gecultiveerde gewassen begrepen kan worden als een toevoeging aan de breed-spectrum economie, dan is het logisch om de nadruk bij de continuïteit van dit systeem te leggen, in plaats van bij de toevoeging zelf. Het belang van een voortdurende diversiteit in keuzes, ook op vindplaatsen met eenzelfde ecologische achtergrond, de continue en mogelijk symbolische bijdrage van wilde voedselbronnen en het voortbestaan en belang van (residentiële) mobiliteit als een essentieel onderdeel van het nederzettingssysteem ondersteunen dit.

Op basis van deze benadering en de gedocumenteerde continuïteit in een groot deel van de aspecten van het bestaan van de inheemse gemeenschappen is te beweren dat het proces van neolithisatie niet ten einde was voor het begin van de vroege bronstijd. Dit betekent tevens dat neolithische verworvenheden veel minder verandering initieerden (of zelfs afdwongen), maar werden ingepast in de reeds bestaande ritmes van de inheemse gemeenschappen. Dit wordt ondersteund door de genoemde continuïteit in typisch mesolithische aspecten van het bestaan (technologisch, economisch en qua nederzettingssysteem). Deze getuigt van een voortdurende waardering voor de tradities en 'ritmes' uit het verleden. Een dergelijke argumentatie betreffende de implicaties en het verloop van neolithisatie blijkt ook voor andere delen van Centraal- en Noordwest Europa aangetoond te kunnen worden.

Mens-omgevingsrelaties in de wetlands: 'total phenomena' (hoofdstuk 9)

In hoofdstuk 9 worden de verschillende onderdelen in een synthese gepresenteerd. De gemene deler wordt gevormd door de centrale positie van de relatie tussen mensen en hun leefomgeving in deze studie, waarbij deze relatie reëel is, ervaren wordt, een sociale rol speelt en een factor is in de vorming van een regionale identiteit of gemeenschapszin. Het idee van een dergelijke 'moral community', or morele gemeenschap gaat uit van een geïntegreerd bestaan van natuurlijke en menselijke ('cultuurlijke') aspecten en de belangrijke rol die de perceptie van gemeenschappen daarin speelt. Een dergelijke benadering wordt ondersteund door de etnografie waaruit blijkt dat er geen duidelijke scheidslijnen zijn tussen ecologische, sociale of culturele aspecten van samenlevingen. Een historisch-ecologische invalshoek stelt deze gebiedsgebonden relatie tussen mensen en hun omgeving centraal. Voor een beter begrip van de menselijke inwoning van zo een gebied en de manier waarop daaruit een morele gemeenschap ontstaat is het van belang de verschillende onderdelen gecombineerd als 'total phenomena' te bestuderen. Binnen een dergelijke benadering komt naar voren dat de inheemse bewoners van de wetlands de dynamiek van en veranderingen in hun omgeving zeer waarschijnlijk niet als ontwrichtend of verstorend hebben ervaren. Integendeel, de bestaande dynamiek met de gevolgen die deze kon hebben, waarvan sommigen ongetwijfeld nadelig waren, werd waarschijnlijk eerder ervaren als een natuurlijk aspect behorend bij de omgeving. Het omgaan met veranderingen vormde een integraal onderdeel van de gemeenschappen die er woonden en was een belangrijke factor in hun flexibele, pragmatische attitude. Een dergelijke relatie met de wijdere leefomgeving kan ook etnografisch onderbouwd worden, onder meer in het bekende werk van Thesiger (2007/(1964)) bij de Marsh Arabs. Van belang voor een beter begrip is dat we de westerse dichotomie tussen mens en omgeving loslaten. Dit is geen ecologisch deterministische benadering, maar een benadering die tracht om niet enkel een praktisch inspelen op de omgeving te duiden, maar vooral hoe omgeving op een meer indirecte manier en op de lange duur van invloed kan zijn op het karakter, de *mentalité* van de er levende gemeenschappen. Vanuit die optiek en binnen de benadering van 'total phenomena', kunnen we spreken van wetlandmensen, 'people of the wetlands'.

In toekomstig onderzoek kan een dergelijke benadering licht werpen op andere aspecten van het bewonen van een landschap. Hoewel de archeologische realiteit onze beeldvorming aangaande de fenomenologische aspecten van het leven in een omgeving beperkt, biedt een dergelijke benadering wel een kader om regionale keuzes en tradities te herkennen en te interpreteren.

Epiloog: terug naar het beschikbaarheidsmodel (hoofdstuk 10)

In het laatste hoofdstuk wordt vanuit de in deze studie gekozen benadering opnieuw gekeken naar het beschikbaarheidsmodel. In plaats van een economisch perspectief en een homogene definitie per periode ligt de nadruk bij de implementatie van neolithisatie en de rol van de inheemse gemeenschappen. Dit betekent dat de jager-verzamelaars waarden van de lokale bewoners en hun relatie met de wetland omgeving voorop staan. Twee theoretische perspectieven zijn daarbij van belang.

Jager-verzamelaar mentaliteit

Het eerste onderstreept etnografisch aangetoonde universele waarden bij jager-verzamelaar samenlevingen en hun perceptie van de omgeving. Daarbij blijkt de omgeving vaak als een gevende omgeving, 'a giving environment' gezien te worden waarmee men sociale relaties aangaat. Dit perspectief gaat ervan uit dat er geen fundamentele grenzen tussen de sociale en de natuurlijke omgeving zijn en dat er dus sprake is van evenwaardige relaties tussen mensen en hun omgeving. Jager-verzamelaars maken dat onderscheid tussen natuur en cultuur dus niet. Dat betekent dat jager-verzamelaars ook nieuwe voedselbronnen zoals gedomesticeerde dieren en gewassen binnen deze kaders hebben ervaren. In plaats van hier een onderscheid te maken naar een ander soort voedselbron, werd deze aan het natuurlijke spectrum, waar zij zelf ook deel van uitmaakten toegevoegd. Hun doel is dan ook niet zozeer productie, maar het verkrijgen van voedsel en andere benodigdheden, ongeacht de manier waarop dat gebeurde. Bepaalde basale waarden binnen deze gemeenschappen blijven van belang. Deze omvatten onder meer de langdurige relatie met en perceptie van de omgeving; het delen van voedsel; de afwezigheid van hiërarchisch leiderschap en de autonomie eigen keuzes te maken binnen de lokale gemeenschap; de diversiteit in het gebruik van (voedsel)bronnen en de bijbehorende strategieën; het symbolische belang van de jacht en het verzamelen.

Aangezien deze elementen tot de kern van het jager-verzamelaarbestaan behoren is het aannemelijk dat zij lang van waarde bleven. Antropologisch onderzoek heeft aangetoond dat de 'mesolithische' manier van denken namelijk veel minder aan verandering onderhevig was dan de manier waarop men in zijn levensonderhoud voorzag. De ideologie en structuur van het denken van jager-verzamelaars kan dus nog zeer lang het handelen hebben beïnvloed, ook al omvat dat elementen die juist niet typisch zijn voor jager-verzamelaars, zoals akkerbouw, veeteelt en sedentisme. De nabijheid van boerensamenlevingen kan in deze zin juist ook een stimulans vormen dit element van identiteit versterken.

Netwerken

Een tweede punt betreft de wijze van contact en interactie tussen en binnen samenlevingen. Van belang daarbij is een benadering die onder de loep neemt hoe nieuwe elementen in een gemeenschap geïmplementeerd worden. Een waardevolle bijdrage vanuit de sociologie daaraan is in de afgelopen jaren geleverd door de zogenaamde Actor Network Theory (ANT). Deze benadering gaat uit van een netwerk waar zowel mensen, plaatsen als objecten onderdeel vanuit maken. Al die verschillende actoren beïnvloeden en veranderen elkaar. Nieuw actoren worden als het ware herbepaald of vertaald zodat ze in het netwerk passen. Vanwege het feit dat er geen verschil wordt gemaakt tussen subject en object en de focus ligt bij de actoren, past deze benadering ook binnen een perspectief dat uitgaat van het niet aanwezig zijn van een duidelijk onderscheid tussen een natuurlijke en een 'cultuurlijke' wereld.

Binnen ANT zijn drie fasen te onderscheiden die een actor doorloopt, alvorens in het netwerk te worden opgenomen. Na een eerste fase van verbazing en problematisering, waarbij de andere deelnemers in het netwerk bepalen in hoeverre een implementatie succesvol kan zijn, volgt een fase waarbij de nieuwe actor als het ware een plaats verkrijgt in het netwerk. Dat houdt in dat andere actoren eveneens delen van het netwerk moeten herdefiniëren, herijken en kan eveneens inhouden dat de nieuwe actor niet geschikt wordt bevonden. Een derde fase betreft het moment waarop de nieuwe actor definitief een plaats in het netwerk heeft verworven. Andere actoren accepteren deze positie en de balans is hersteld.

Hoewel deze modellering abstract is kan zij van nut zijn voor een beter begrip van neolithisatie vanuit het hier gebezigde perspectief. Nieuwe elementen, in dit geval de neolithische verworvenheden, kunnen dan gezien worden als actoren in een netwerk. Dit netwerk wordt voor een belangrijk deel bepaald door het belang van met name de ideologische aspecten van het jager-verzamelaar bestaan. In de afwezigheid van druk of stress die een overgang op een andere levenswijze noodzakelijk maakt, is het dus vooral de vertaling van neolithische aspecten naar wat aanvaardbaar is en de mate van inpassing in de bestaande normen en waarden die bepaald of en hoe elementen worden overgenomen.

Een model van aanpassing en afstemming

Op basis van bovenstaand perspectief kan een complementair model voor het proces van neolithisatie voorgesteld worden naar analogie met het beschikbaarheidsmodel. Dit model van aanpassing of afstemming 'attunement model' bevat drie fasen.

Een eerste fase betreft kennismaking, of 'acquaintance', waarbij men zich bewust is van het bestaan van een nieuwe actor uit direct of indirect contact. Er wordt geëxperimenteerd. Elementen binnen het netwerk kunnen voor of tegen zijn. Een tweede fase betreft afstemming of aanpassing 'attunement'. Dit betreft de (tijdelijke) acceptatie van een nieuwe actor in zijn rol als nieuw, aanvullend element in het netwerk. Dit is een try-out fase waarin bepaald wordt in hoeverre de nieuwe actor geïntegreerd kan worden in bestaande waarden en ritmes. Indien deze te zeer verstoord worden vindt opname geen doorgang. Uiteindelijk zal dit ook leiden tot een zekere mate van 'habitus' verandering in bepaalde velden die door de nieuwe actor beïnvloedt worden. Groepsconcensus lijkt voor de hier bestudeerde gemeenschappen een belangrijk mechanisme in deze. Een derde en laatste fase betreft 'integratie'. Dit is de onvoorwaardelijke acceptatie van de nieuwe actor in het bestaande netwerk. Zowel het netwerk als de actor hebben in meer of mindere mate aanpassingen ondergaan die opname in het netwerk mogelijk hebben gemaakt zonder verstrekkende sociale of ideologische veranderingen.

Met betrekking tot het proces in de LRA zullen neolithische elementen de stadia in het model in tijd en ruimte op verschillende wijze hebben doorlopen, afhankelijk van de keuzes van de betrokken gemeenschappen. Van belang is dat in plaats van een lange substitutiefase in het beschikbaarheidsmodel, waarbij gemeenschappen in een of overgangsfase zijn, zij binnen dit model juist gekenmerkt worden door de wijze waarop ze vorm geven aan de fase van 'integratie'.

Het model als zodanig is een semantische parafrasering van het beschikbaarheidsmodel. Het doel is een alternatief perspectief te bieden op de processen die plaatshebben, met een belangrijke rol voor de bestaande inheemse waarden die wortelen in het mesolithicum. In de kern betreft het een proces waarbij nieuwe elementen aangepast worden aan bestaande culturele waarden en sociale ritmes in een samenleving, zodat hun verstorende invloed beperkt wordt. De consolidatie van de inheemse ideologie en identiteit is daarbij van groot belang. Tevens beargumenteert het model dat er niet per definitie sprake is van een nieuwe conceptualisering van de relatie tussen mens, omgeving en tijd met de introductie van 'neolithische kennis', producten en praktijen en dat ook vreemde nieuwe elementen ingepast kunnen worden in bestaande sociale en ideologische structuren. De veranderingen die we archeologisch waarnemen vormen op die manier slechts een deel van het verhaal en mogelijk niet eens het meest fundamentele deel ervan.

Acknowledgements

On September 5, 1977, about half a year before I was born, NASA launched its space probe Voyager 1. Some 36 years later, on September 12, 2013 it was announced that the vessel had left our Solar System. It had become the first man-made object to enter interstellar space on August 25, 2012, as I was nearing the completion of the manuscript of this thesis. Voyager's mission was and is one of scientific discovery, to investigate the outer reaches of our solar system and its planets, as well as the first exploration of what lies beyond. Many parallels with archaeology as well as this research and even myself can be drawn, but in general our contemporaneous voyages have been about exploring, research, and gathering and gaining knowledge, moving both in space and time. While Voyager has entered new territory on its mission, so have I.

On a different level it is evident that a mission like that of Voyager 1, as well as writing a PhD thesis, is never an individual undertaking. Success is dependent on many things and persons that directly or indirectly, professionally or personally contribute to, facilitate, shape and stimulate the achievement of the set goal. As such I want to express my sincere thanks to everyone at 'ground control'.

First I would like to thank the members of our NWO research project 'From Hardinxveld to Noordhoorn - From Forager to Farmer': Bart Vanmontfort, Leo Verhart, Welmoed Out, Liesbeth Smits and my supervisors, Leendert Louwe Kooijmans and David Fontijn, for providing an academic environment, discussion and encouragement during this journey. The Faculty of Archaeology at Leiden University served as the familiar and ideal base-camp where I grew up to be an archaeologist, both within as well as far beyond its walls. Many people there provided and continue to provide excellent and inspiring companionship, be it around coffee machines, behind computers or in a muddy trench. I would like to mention in particular Wil Roebroeks, Corrie Bakels, Raymond Corbey, Alexander Verpoorte, Milco Wansleeben, Menno Hoogland, Joanne Mol, Hans Kamermans, Annelou van Gijn, Claudia Regoor, Jaap Hoff, Corinne Hofman, Roswitha Manning and Harry Fokkens. Among and in addition to the Faculty staff a number of people provided me with advice, information, comments and discussion or just helped to keep spirits up during the writing of this thesis, for which I am very grateful. I would like to mention Fred Brounen, Marjorie de Grooth, Piet van de Velde, Gerrit van der Kooij, Peter Akkermans, Jean-Pierre de Warrimont, Daan Raemaekers, Marcel Niekus, Inger Woltinge, Paulien de Roever, Els Koeneman, Jos Deeben, Hans Peeters, Claudia Regoor, Karen Jeneson, Lucas Petit, Wout Arentzen, Jan Glimmerveen, Hans Postma, Martijn Eickhoff and Corrie Bakels. Pierre van der Sloot I thank for the use of the lithic data from Liège-Place St.-Lambert. In particular I would also like to thank a number of people who in addition to this took the time and effort to read parts of the manuscript and provide me with their invaluable feedback along the way: Hylke de Jong, Bjørn Smit, Stijn Arnoldussen, Welmoed Out, Alistair Bright, Erik van Rossenberg, Alexander Verpoorte, David Fontijn, Leendert Louwe Kooijmans, Leo Verhart, Annelou van Gijn, Pieter ter Keurs, Bart Vanmontfort and John Barrett. A very big thank you is due to Gerrit Dusseldorp who ceaselessly and optimistically read and commented upon large parts of this work, whether here or in South Africa and who generally stood by me all the way. Thanks buddy!

Before a manuscript becomes a printed book many things happen to it. For the production or finishing of the many illustrations I thank Medy Oberendorff and Joanne Porck (Faculty of Archaeology) and Walter Laan and colleagues (Archol). Milco Wansleeben I thank for turning some of the raw data into understandable images. For checking the English text I wish to express my thanks to native speakers Alistair Bright, Hylke de Jong and Sasja van der Vaart. For the layout, design and production I thank Corné van Woerdekom and Karsten Wentink of Sidestone Press. I am also grateful to the 'Stichting Rijksmuseum van Oudheden' and the 'Stichting Nederlands Museum voor Anthropologie en Praehistorie' for their financial contribution.

Of course the actual experience of becoming an archaeologist as well as the good times shared with non-archaeological interaction is with those I started out with in Leiden in 1998 and that (I) joined along the way both within and outside my studies. With unintentional omissions I would like to mention Ivo van Wijk, Richard Jansen, Alistair Bright, Dennis Bruggink, Philip Bes, Margriet Stronkhorst, Liesbeth Schuurman, Roos van Oosten, Emile Eimermann, Iris Briels, Yannick Henk, Phil Glaubermann, Claartje Schamp, Erik van Rossenberg, Stijn Arnoldussen, Alice Samson, Zeno Wijtten, Daan Isendoorn, Hylke de Jong, Mirjam Bruineberg, Dianne van de Zande, Tatjana Ivleva, Sasja van der Vaart, Lucas Meurkens, Tom Hamburg, Quentin Bourgeois, Dimitri de Loecker, Eugene Ball, Leon van Hooff, Geeske Langejans, Laura Crowley, the Limburgian Society of Intellectuals in Exile (LGIB), huize Albert and many others. Special thanks go to the PhD lunch and coffee crew who had to endure my endless banter: Gerrit Dusseldorp, Eva Kaptijn, Arne Wossink and Welmoed Out.

While I believe you never really leave the Faculty of Archaeology, I found a new 'home' across the Rapenburg in 2008. At the Rijksmuseum van Oudheden, the National Museum of Antiquities, I was appointed as curator of the Prehistory department. In my application I wrote that I had nearly completed my PhD thesis. Unfortunately that status clung to me a bit longer than I had anticipated. I am therefore very grateful for the trust and support I received from the Museum, both professionally and personally. Although many have expressed their support and provided a listening ear I would particularly like to thank Wim Weijland, Pieter ter Keurs and Annemarieke Willemsen as well as my fellow curators. I wish to say that I find it a privilege to work in an institute with such a proud history, but at least as important, with such good colleagues and friends. I hope to continue to do so for a long time.

Finally I wish to thank my parents Roswitha and Lei Amkreutz and my brother Ruud for the great start I had growing up in St.-Geertruid, where de vuursjteenmijn, de Sjoen Grub and de Kaap are just a dirt road away. They always stimulated me to follow my dreams, which, given this context, eventually and unavoidably led to becoming an archaeologist. I also wish to thank them for their patience, for dealing with or ignoring my moods and for keeping my spirits up over the past years. In particular I also wish to thank Frederike Burghout for that, and even more so for showing me there is more to life than finishing a book.

Let us briefly return to Voyager 1. The power to operate its scientific instruments will run out approximately in 2015, but not so its mission. Voyager 1 will for a long time be the only man-made object to travel farthest from its place of origin, into unknown space. What is peculiar is that apart from it being a message in itself, it also carries one. It harbours a gold-plated audio-visual disc containing greetings from Earth in many languages and music, as well as the sounds of animals such as whales. The disc is intended as a means of communication, a 'postcard' from Earth in case of an encounter with intelligent life. Instructions as to how to play the record and a needle are also included, in case no phonograph is available.

While we may consider Voyager's disc outdated already I feel it actually is not. Our drive for exploration is born out of curiosity, both for ourselves as well as others. As a result, we try to create a link, to reach out, and this may be both across space and time. As archaeologists we in particular do the same. We marvel at the finds we discover on the field or in our trenches, exactly because we appreciate them as 'postcards' from the past and we do our utmost best to decipher their message using both science and facts as well as experience and imagination. In a sense, making these connections across space and time is perhaps endemic to our human condition. While unlike Voyager's golden disc, most of the material witnesses we find were never intended to be found, I bet the thought must have occurred to our ancestors. I just hope that for the communities I studied this thesis to some extent does them justice.

Luc Amkreutz
Leiden 8 October 2013

't is een kwestie van geduld, rustig wachten op de dag'
Rowwen Hèze -Limburg- (1990)

Met dank aan/Many thanks to:

S·N·M·A·P

Rijksmuseum van Oudheden

Curriculum Vitae

Luc Winand Sophia Wilhelm Amkreutz was born on March 20, 1978 in Heerlen (Limburg, the Netherlands). During his youth in St.-Geertruid he was exposed to the well-known geology and archaeology from the area, in particular the Neolithic flint mines, from an early age.

He attended the Jeanne d'Arc college in Maastricht and graduated in 1997 (VWO). After obtaining a propaedeutic diploma in Dutch law at Maastricht University he moved to Leiden to study archaeology. He specialized in the Prehistory of Northwest Europe and graduated (*cum laude*) in 2004. His MA thesis dealt with the discovery, analysis and interpretation of *Linearbandkeramik* sites on the lower Meuse terrace. During his studies he participated in numerous excavations and surveys in the Netherlands and abroad (Belgium, France, Jordan and the Caribbean).

Between 2004 and 2008 he worked as a PhD student in the Leiden University research group 'From Hardinxveld to Noordhoorn – From Forager to Farmer', directed by Prof. dr. L.P. Louwe Kooijmans (NWO Malta Harvest programme). This dissertation is one of its results.

From 2008 onwards he has been working at the Rijksmuseum van Oudheden (National Museum of Antiquities) in Leiden as curator of the Prehistory of the Netherlands. He was involved in the new permanent exhibition 'Archaeology of the Netherlands' which opened in 2011. He also was part of the NWO Odyssey research programme 'The LBK revisited: 'forgotten' research into the bandkeramik occupation of the Low Countries'. While maintaining a broad scope on Prehistory in general, his research interests focus on Stone Age archaeology and the Mesolithic and Neolithic in particular.

PERSISTENT TRADITIONS

The adoption of agriculture is one of the major developments in human history. Archaeological studies have demonstrated that the trajectories of Neolithisation in Northwest Europe were diverse. This book presents a study into the archaeology of the communities involved in the process of Neolithisation in the Lower Rhine Area (5500-2500 cal BC). It elucidates the role played by the indigenous communities in relation to their environmental context and in view of the changes that becoming Neolithic brought about.

This work brings together a comprehensive array of excavated archaeological sites in the Lower Rhine Area. Their analysis shows that the succession of Late Mesolithic, Swifterbant culture, Hazendonk group and Vlaardingen culture societies represents a continuous long-term tradition of inhabitation of the wetlands and wetland margins of this area, forming a culturally continuous record of communities in the transition to agriculture.

After demonstrating the diversity of the Mesolithic, the subsequent developments regarding Neolithisation are studied from an indigenous perspective. Foregrounding the relationship between local communities and the dynamic wetland landscape, the study shows that the archaeological evidence of regional inhabitation points to long-term flexible behaviour and pragmatic decisions being made concerning livelihood, food economy and mobility. This disposition also influenced how the novel elements of Neolithisation were incorporated. Animal husbandry, crop cultivation and sedentism were an addition to the existing broad spectrum economy but were incorporated within a set of integrative strategies.

For the interpretation of Neolithisation this study offers a complementary approach to existing research. Instead of arguing for a short transition based on the economic importance of domesticates and cultigens at sites, this study emphasises the persistent traditions of the communities involved. New elements, instead of bringing about radical changes, are shown to be attuned to existing hunter-gatherer practices. By documenting indications of the *mentalité* of the inhabitants of the wetlands, it is demonstrated that their mindset remained essentially 'Mesolithic' for millennia.

Luc Amkreutz was a member of the NWO (Malta Harvest) archaeological research project 'From Hardinxveld to Noordhoorn – From Forager to Farmer' between 2004 and 2008. He is currently the curator of the Prehistory collections of the National Museum of Antiquities. His research interests include the Mesolithic and Neolithic archaeology of Northwest Europe, ethnoarchaeology and archaeological theory.

Sidestone Press

ISBN: 978-90-8890-203-1

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