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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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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

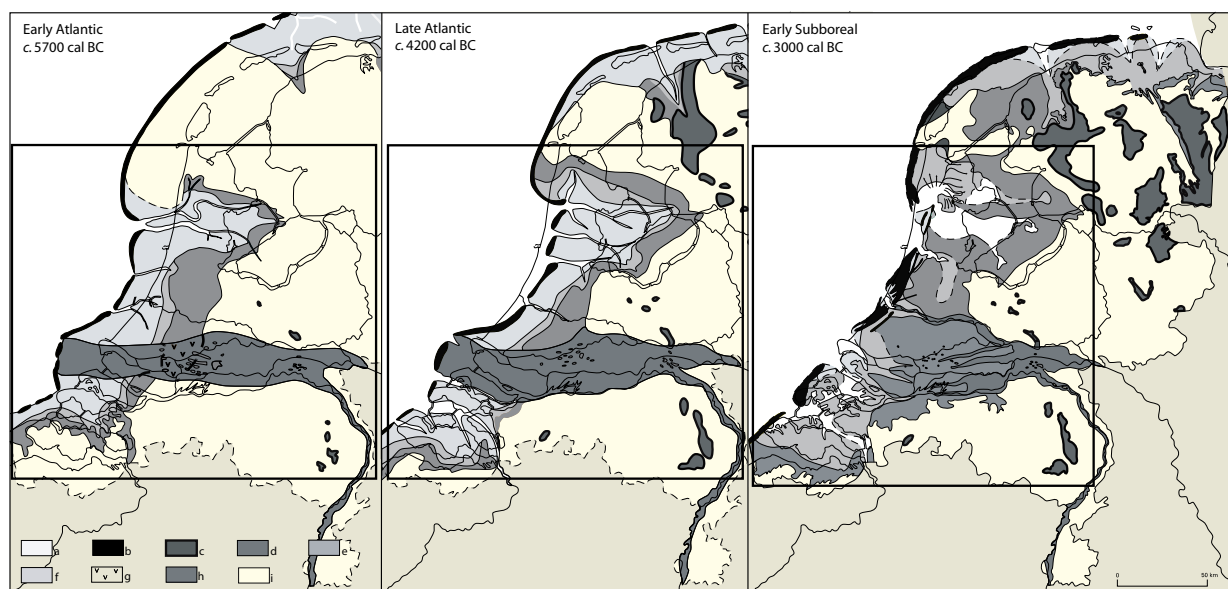
area are important aspects that set it apart from upland environments such as the coversand areas.

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 Braudel 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 Hude 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)

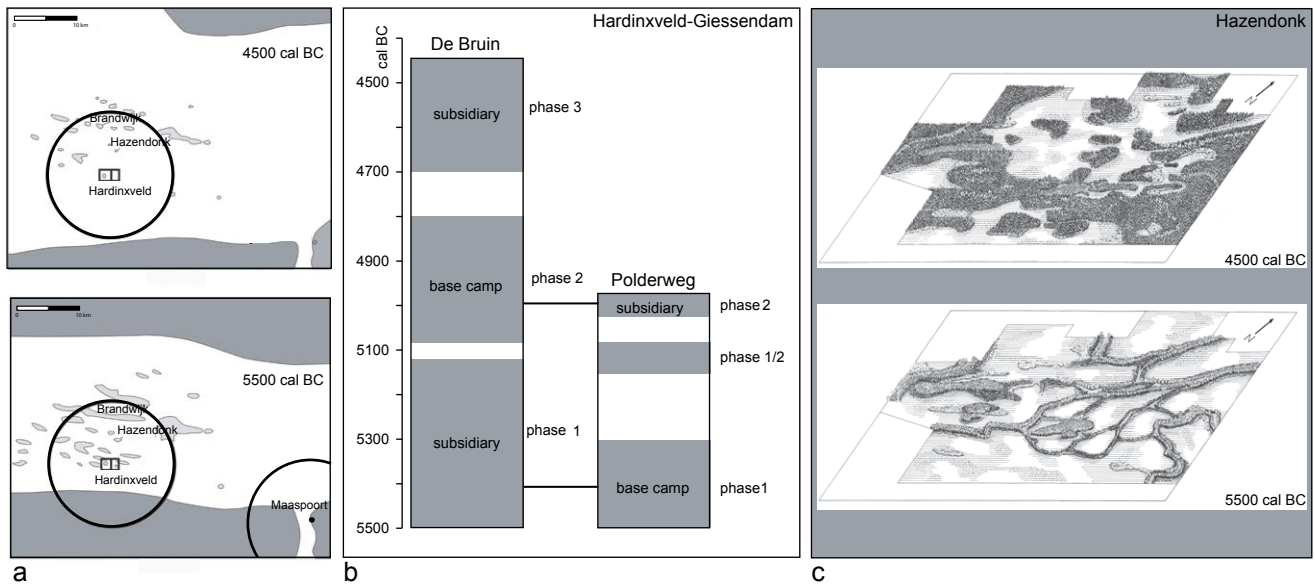
Developments comparable to those at the Hardinxveld dunes took place at sites such as the Hazendonk and Brandwijk (see fig. 7.2). At the Hazendonk the changing wetland landscape and long-term marsh conditions affected the use of the location, although occupation phases and landscape change do not always 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*; 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 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).



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-landscape (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-Kraaienbergh; 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.

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).

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 interwovenness. 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

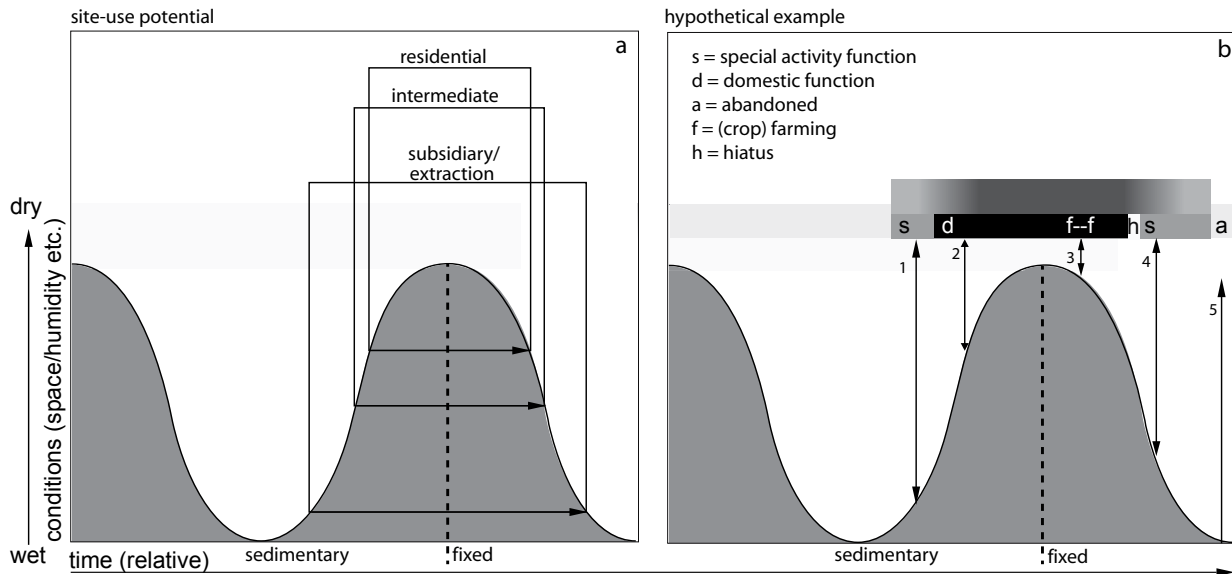
It has been pointed out above that the relationship between people and the land was intensive, encompassed many aspects of society and was of a recursive nature. Continuity and stability in these landscapes, necessary for a reliable and structured transition to agriculture and the adoption of new techniques, 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; Moll/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 exploitation and settlement system. Arrow 5 indicates that the options have become very limited shortly after the site is abandoned.



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 Vlaarding 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

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.

lies with changes in practice, rhythm and routine (*cf. supra*). Unquestionably, 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 Vlaarding 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. Furthermore, 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

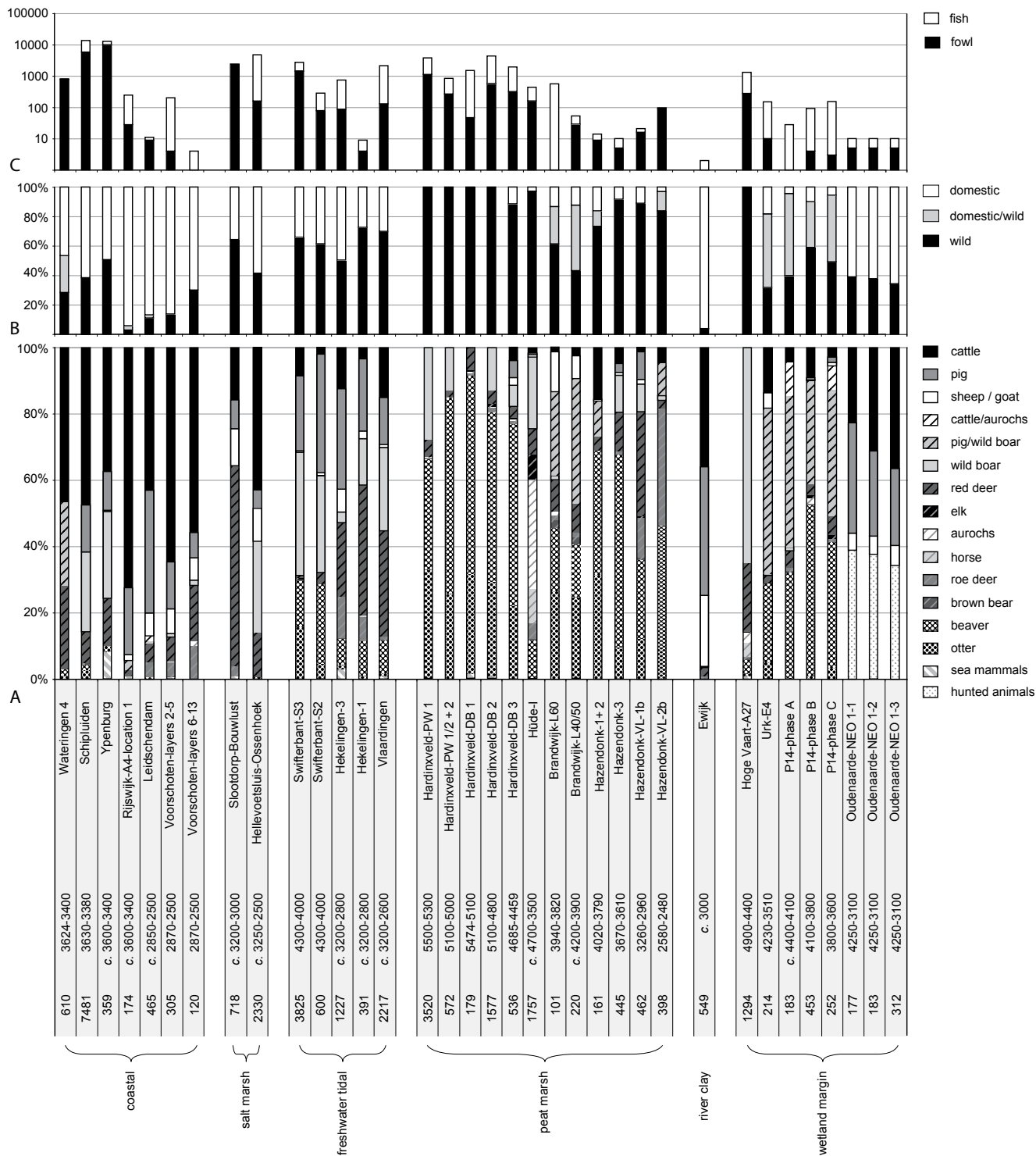


Fig. 7.4a Composition of the mammal faunal assemblage (A) per site according to geographical region and in general chronological order. Sections B: wild-domestic ratio and unspecified identifications of pig/wild boar and cattle/aurochs. Section C: fish and bird remains.

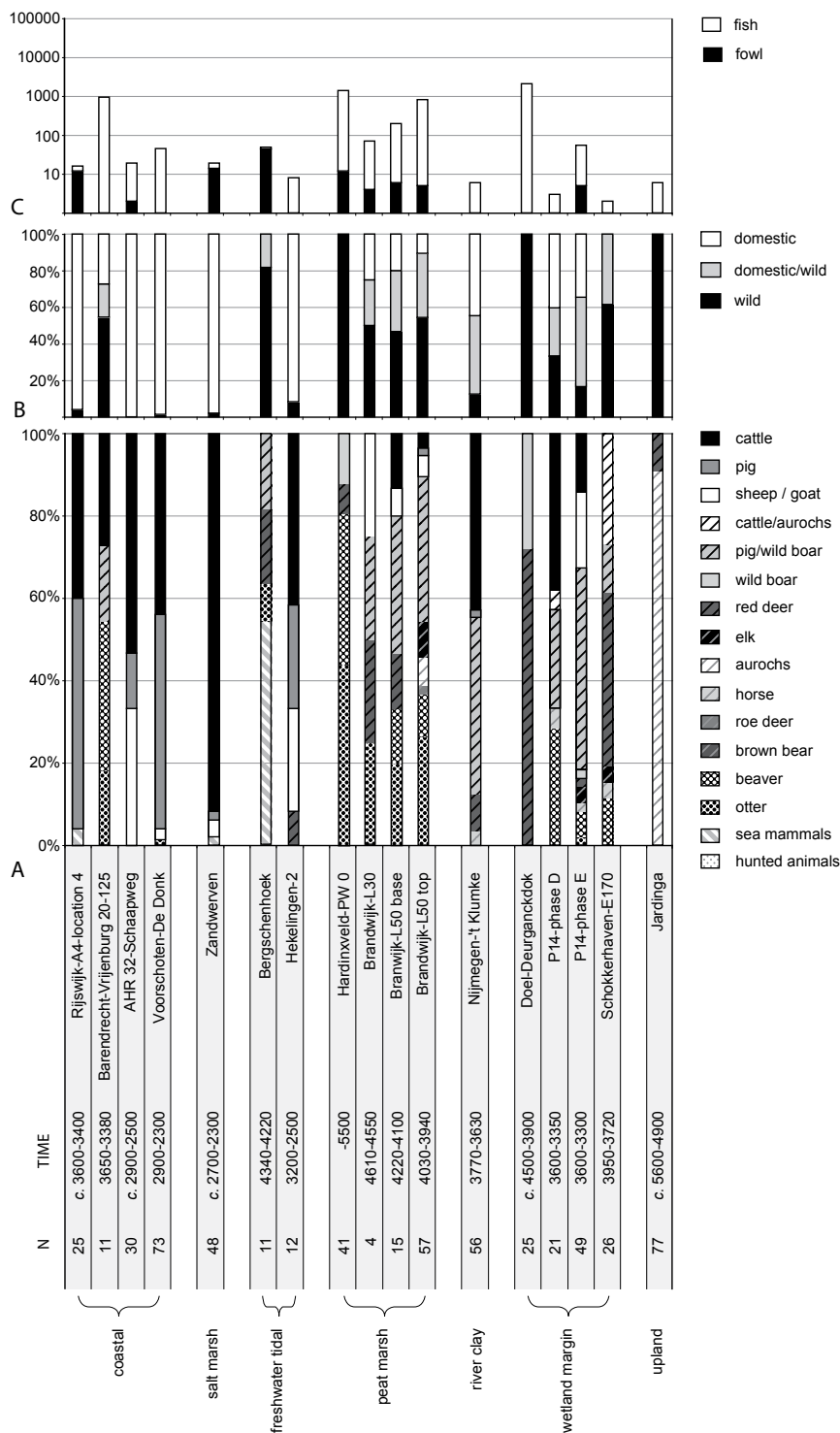


Figure 7.4b Sites with low counts ($N \leq 100$).

has been documented among the substantial faunal remains of phase 3 (c. 4850-4500 cal BC). Similarly the lake margin site of Hude 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 beach 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 occupation.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 Sloodorp-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 ¹⁵N 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 Hude 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 Vlaardingens 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 m² (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 m² to 4000 m² (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 inundation 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 ¹⁵N 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 5th 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 arid 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 threshing 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).

[illegible]

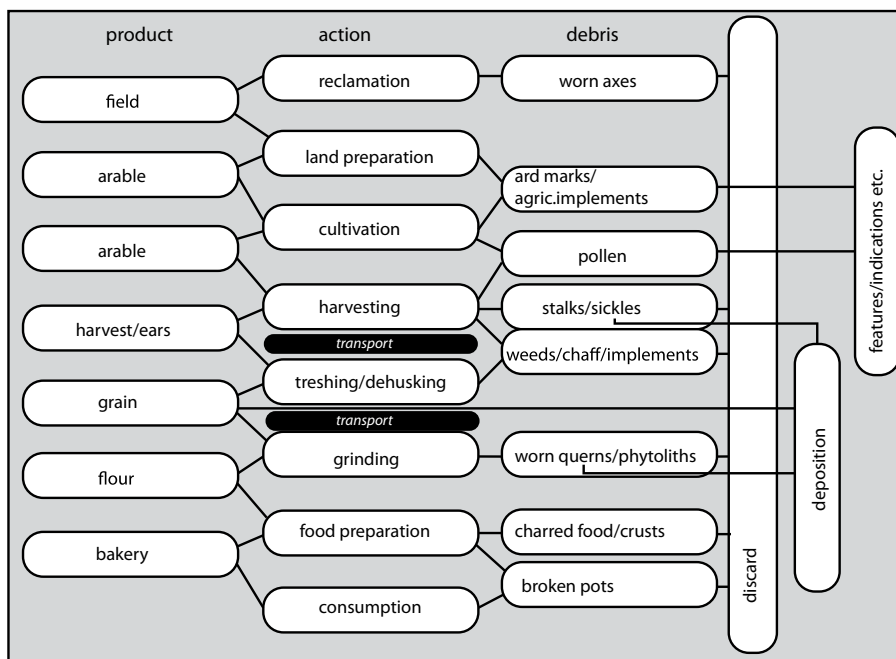


Fig. 7.5 Factors influencing the interpretation of evidence for crop cultivation and consumption of cereals, and related archaeological evidence.

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). Sickles 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 sickles have 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 sickles 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 sickles 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 Vlaarding occupation and similar features were documented at the Vlaarding 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 m² and 1000 m², 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 Hùde 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 5th 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 ards 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.* Hùde 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	
<i>Hdx-Polderweg 1</i>			e	m	-/+	-/+	+	+	+	Louwe Kooijmans 2001 ^a
Swifterbant Culture										
<i>Hdx-Polderweg 2</i>			e	m	-/+	+	+		+	Louwe Kooijmans 2001 ^a
<i>Hdx-De Bruin 2</i>	F-A	e,l	O-Ja	F-A	+	+	+	+		Louwe Kooijmans 2001 ^b
<i>Hdx-De Bruin 3</i>	e			l	+					Louwe Kooijmans 2001 ^b
<i>Rotterdam-CS</i>					+					Guiran/Brinkkemper 2007
<i>Hoge Vaart-A27 (wl)</i>										Laarman 2001
<i>Urk-E4 (wl)</i>					+					Oversteegen in: Peter/Peeters 2001
<i>Brandwijk</i>					+	+	+			Raemaekers 1999; Robeerst 1995
<i>Doel-Deurganckdok</i>		l		e	+				+	Bastiaens et al. 2005; Van Neer et al. 2005
<i>Swifterbant-S-3</i>					+	+	+			Zeiler 1997
<i>Bergschenhoek</i>					+	+				Louwe Kooijmans 1987
<i>Hazendonk-1-2</i>		l	l		+		+			Zeiler 1997
<i>P14-ABC (wl)</i>					+	+	+	+		Gehasse 1995
<i>P14-DE (wl)</i>					+	+	+	+		Gehasse 1995
<i>Hüde-I</i>		l	e							Kampffmeyer 1992; Raemaekers 1999
<i>Oudenaarde-Donk (wl)</i>					+	+		+		Blanquaert 1987; Vanmontfort 2004
Hazendonk group										
<i>Nijmegen-Klumke (wl)</i>	F-A			F-A			+			Zeiler in: Ball/Van den Broeke 2007
<i>Hazendonk-3</i>					+	+	+			Zeiler 1997
<i>Wateringen-4 (c)</i>					+	+	+	+		Raemaekers et al. 1997; Louwe Kooijmans 2006
<i>Schipluiden (c)</i>					+	+	+	+	+	Louwe Kooijmans 2006 ^a
<i>Ypenburg (c)</i>					+	+	+			De Vries 2004; 2008
<i>Rijswijk-A4 (c)</i>					+	+				Laarman in: De Vries 2004
TRB										
<i>Slootdorp-Bouwlust</i>					+	+	+	+		Hogestijn/Drenth 2000/2001
Vlaardingen Culture										
<i>Hazendonk-VL1-2</i>		l	l		+	+	+			Zeiler 1997
<i>Hekelingen-III</i>	My-J	My-J			+	+	+	+		Prummel 1987
<i>Hekelingen-I</i>						+				Clason 1967
<i>Hellevoetsluis-OH (c)</i>					+	+	+	+	+	Goossens 2009; 2010
<i>Vlaardingen</i>					+	+	+			Van Beek 1990
<i>Leidschendam (c)</i>										Glasbergen et al. 1967
<i>Voorschoten-Boschgeest (c)</i>										Glasbergen et al. 1967
<i>Voorschoten-De Donk (c)</i>	M-N	M-N	N-M	N-M			+			Deckers 1991
<i>Zandwerven (c)</i>										Van Regteren Altena et al. 1962/1963
<i>Ewijk (wl)</i>										Clason 1990
Season <div></div> inferred period of occupation <div></div> positive seasonal absence <div></div> non-specific or conflicting seasonal indicators <div></div> seasonal evidence <div></div> e=early <div></div> m=mid <div></div> l=late										Evidence <div></div> +=positive evidence <div></div> -=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 widgeon 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 Hùde 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.

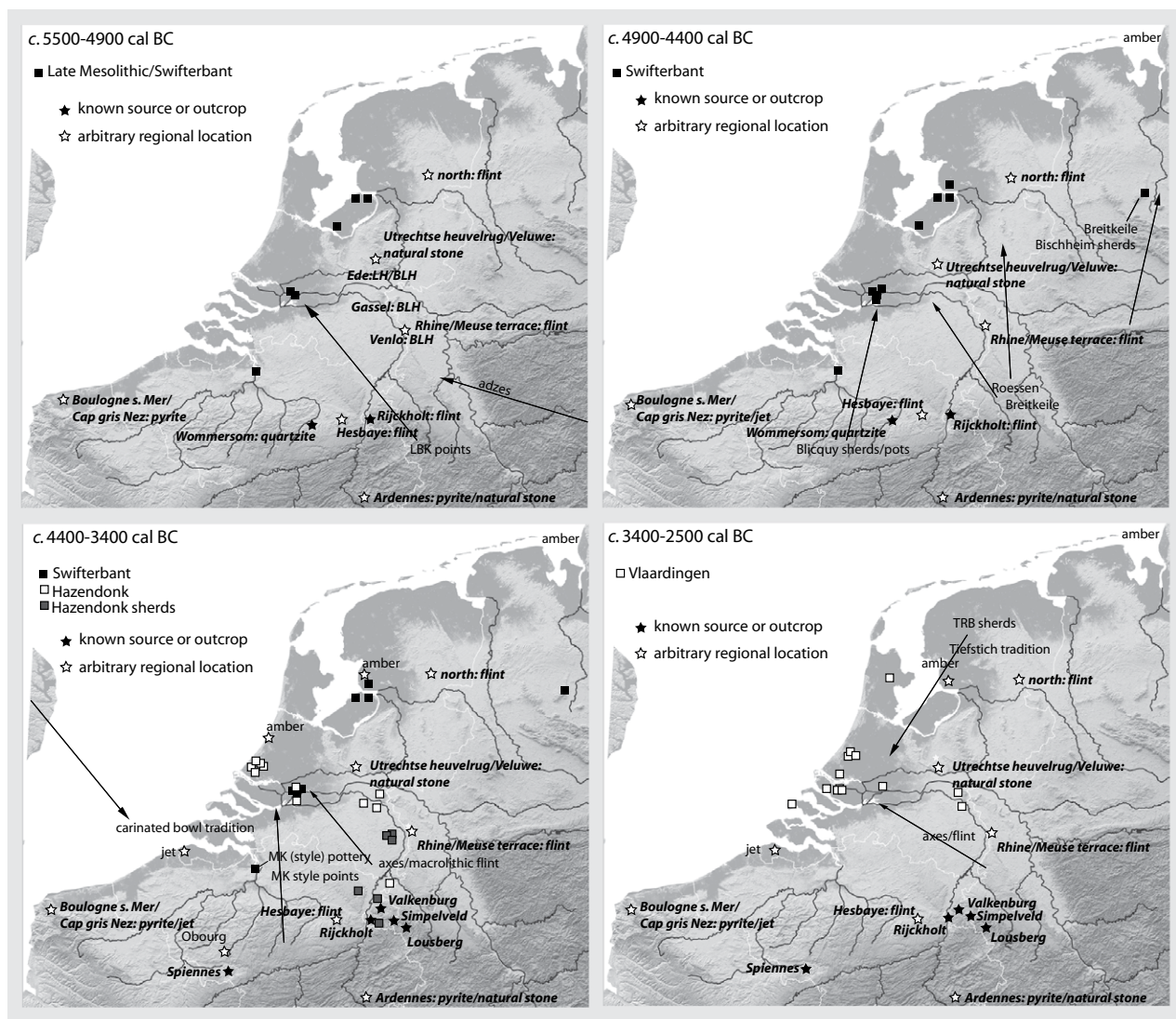
7.3.5 A note on non-food raw material procurement

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.



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. 7.7 Maps showing the most important raw material sources and routes of interaction of objects and ideas within a span of c. three millennia.

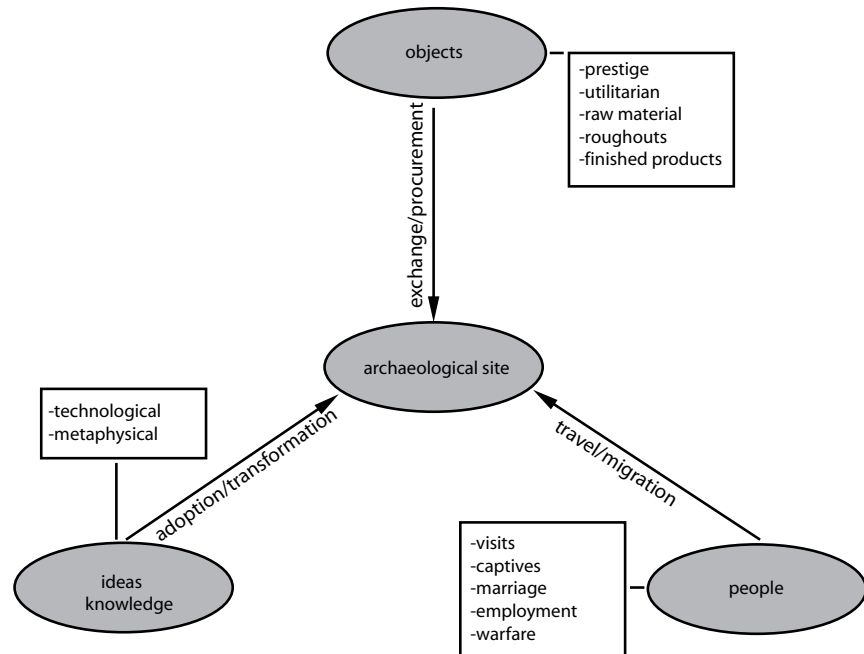


Fig. 7.8 Scheme of hypothetical correlates for interaction and exchange in combination with several specifications (after Amkreutz *et al.* 2009).

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 Húde 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 Húde 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 than 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-Westfalen 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 into 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 Rijkholt type flint and grey Hesbaye (Lightgrey Belgian) type flint. The presence of a heavy Rijkholt 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 discussed in Chapter 8.

	rolled/ (Meuse-egg)	terrace	Limburg/ Rijckholt	Hesbaye	Spiennes	Belgium	N. France/ Boulogne	northern	regional	'exotic'	references
<i>Haamstede-Brabers</i>	+					+			90.6%	9.4%	Verhart 1992
<i>Leidschendam</i>	+							+			Van Gijn 1989
<i>Voorschoten-De Donk</i>	+					+					Van Veen 1989
<i>Voorschoten-Boschgeest</i>	+							+			Verhart 1992
<i>Zandwerven</i>								+			Van Regteren-Altena/Bakker 1961
<i>Hekelingen-3</i>	+				+	+	+		0%	100%	Van Gijn 1989; Verhart 1983
<i>Hekelingen-1</i>				+		+			0%	100%	Modderman 1953
<i>Hellevoetsluis</i>	+	+	+	+	+	+	+			74,1%	Goossens 2009; 2010
<i>Vlaardingen</i>	+					+			70-80%	20-30%	Raemaekers 1999
<i>Hazendonk</i>		+	+	+					70-80%	20-30%	Raemaekers 1999
<i>Ewijk</i>				+					20.3%	79.7%	Asmussen/Moree 1987

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.

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.

7.3.5.4 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 2001⁶; 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.

Ethnography 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 exclusively) in different and complementary geographical areas, as well as in time. This latter aspect both incorporates short-term or yearly switches between beneficial 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 than 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 questionable 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 substitution. 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 substitution?

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 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 an 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^a; 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 intrinsic 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 archaeological 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 beneficial 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 residually 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 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 occasionally 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 subsistence 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; 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 m² in phase 1 and diminished to two smaller tops measuring 600 and 800 m² 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 ¹⁴C 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 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 Vlaardingse 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^{ab}). 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/Peters 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-Oldemepelerdiep (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 jadeite 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).

