Sowing the seed ? : human impact and plant subsistence in Dutch wetlands during the Late Mesolithic and Early and Middle Neolithic (5500-3400 cal BC)

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3. Coastal region

3.1 Geology and palaeogeography of the coastal region

3.1.1 Introduction

This paragraph, primarily based on Mol (2006), summarises the geology and palaeogeography of the sites Ypenburg, Wateringen 4, Schipluiden, Sion and Rijswijk-A4. Together these sites span an area at the inland side of a seaward prograding beach barrier system, occupied between *c.* 3860 and 3380 BC. Pleistocene deposits occur at relative large depths in this area and had been buried by metres of sediments in the first part of the Holocene (until *c.* 4000 BC). The Holocene subsurface of the region consists of fluvial deposits, tidal-flat deposits, tidal channel deposits, lagoon deposits and estuarine deposits consisting of sand, clay and peat. The coast was characterised by erosion during the first part of the Holocene. As a result, Mesolithic sites west of the study area may have been eroded. The oldest preserved beach deposits are those occupying a most easterly position and are dated to *c.* 4350 BC (Cleveringa 2000). Their preservation marks a switch from transgressive coastal formation into progradational beach barrier formation. This switch is related to the decreased rise of the sea level (globally) on the one hand, and plenty of available sediment at a shallow depth in the coastal zone on the other hand (Beets and Van der Spek 2000). During the Middle Holocene, a beach barrier system formed by *c.* 4000 BC protected the region from direct marine influence (Mol and Louwe Kooijmans in prep.; Van der Valk 2006). Isolated low coastal dunes developed on top of the beach barriers (*c.* 4000-3800 BC), which gradually healed to form larger barrier complexes. Behind the beach barriers, former tidal flats and tidal channels transformed into sandy beach plains. During storms, the sea incidentally flooded these plains, resulting in wash-over deposits. Low dunes developed on top of the wash-over deposits and beach plains. While relative sea-level rise continued at slowed-down rates, westward progradation, healing and closure of the barrier system transformed the area into a protected lagoon. In that situation, freshwater peat started to form in the study area at *c.* 3640-3340 BC, indicative of the gradual rise of the local ground water table.

Figure 3.1 shows a palaeogeographical map from the region at *c.* 4100 and 3500 BC. The reconstruction of the beach barrier is hypothetical since it was probably not closed completely, at least at 4100 BC. Occupation occurred on isolated dunes in the former beach plain, mostly oriented in NE-SW direction, which formed 5 to 10% of the landscape. They were relatively flat and stood *c.* 1-2 metres above the surrounding flats. There are also dunes that were used but not occupied. During the early part of the fourth millennium BC, a tidal channel was present that ran in west-east direction north of Ypenburg. Consequently, tidal influence is more expressed in the northern part of the region. South of the region, the river Meuse had an estuary, resulting in prevalent brackish conditions in the south. In eastern direction, freshwater lagoonal marshes were present (Van der Woude 1983). As a result, a variety of ecotopes was present in and near the region.

3.1.2 Ypenburg

The palaeogeography of Ypenburg was first reconstructed in detail by Cleveringa (2000). The subsurface at Ypenburg consists of channel deposits, wash-over deposits, beach ridge deposits (sand), beach plain deposits (sand) and marsh deposits (peat). Ypenburg is located on a series of dunes that were formed on beach ridges and the beach plain from 4000 BC onwards. The largest dune measures *c.* 750 x 100 metres, while others have a length of *c.* 250 metres. The height of the top of the largest dune was 2 metres above the former high water level. A tidal channel dissecting the beach plain became inactive before or during occupation (3900-3700 BC). The distance to the coast was *c.* 2.5 km. The surrounding landscape was a moist to wet salt marsh (lagoon fringe) where marine influence occurred during initial occupation. The salt marsh and dunes became less influenced by the sea through time.

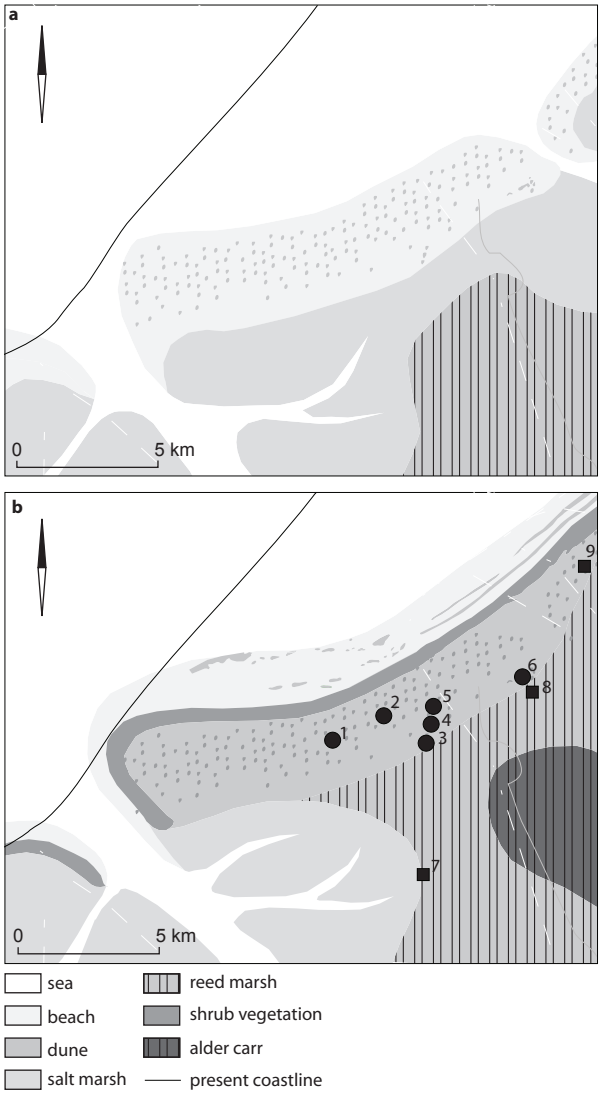

Figure 3.1 The coastal region, palaeogeographical reconstruction for a) 4100 BC and b) 3500 BC (after Louwe Kooijmans in press). The Meuse estuary is shown in the lower part of the figure. 1 = Wateringen 4, 2 = Wateringse Veld, 3 = Schipluiden, 4 = Sion, 5 = Rijswijk-A4, 6 = Ypenburg, 7 = Schipluiden-Zuidkade, 8 = Ypenburg-Postenkade, 9 = Nootdorp-Driemanspolder.

3.1.3 Wateringen 4

The subsurface at Wateringen consists of back-barrier deposits (sand and clay, deposited behind the beach barriers). The site was located on a relatively small dune. A second dune with a smaller surface, located next to the site, did not reveal indications of occupation during a coring campaign, and further information on this dune is not available. Peat growth started at *c.* 3650 BC. Erosion of unknown scale disturbed the eastern side of the dune at *c.* 3350 BC (Raemaekers *et al.* 1997, 146). The site was located in the southern part of the region where the beach barriers formed a less closed continuum than in the northern part of the region. The reconstruction of the natural vegetation however shows that this southern location did not result in a stronger marine influence during occupation than at other sites.

3.1.4 Schipluiden (AHR-39)

The subsurface at Schipluiden consists of sandy beach plain deposits representing the first phase of coastal progradation, tidal back-barrier deposits (silty clay with sand), and wash-over deposits. Dunes developed on top of the back-barrier and wash-over deposits after 4000 BC. During occupation, the dune was located *c.* 2.5 km away from the coast. During phase 1, clay was deposited on tidal flats and in tidal channels around the dune. The environment consisted of a salt marsh with both brackish and fresh water influxes. The size of the dune was *c.* 0.5 ha, and the height of the dune was *c.* 1.5 metres. During phase 2a, there was no sedimentation of clay or peat. During phase 2b, a reed marsh developed. The height of the dune was *c.* 0.8 metres. During phase 3, peat growth continued. The size of the dune had decreased to 100 x 30 metres, and the height was *c.* 0.4 metres. Much of the top of the dune has been eroded. Some preserved parts showed that a podsolic soil developed on top of the dune before the period of occupation.

3.1.5 Sion (AHR-42)

The geology and palaeogeography of Sion is comparable with Schipluiden, since the site was located on a dune 400 metres to the northeast of the site Schipluiden. The site Rijswijk-A4 is located to the northeast of Sion, and one of the four locations at Rijswijk-A4 may be located on the same dune as Sion.

3.1.6 Rijswijk-A4

The sediments of Rijswijk-A4 were studied by Van der Valk (1992, 1996). The subsurface at the four locations of Rijswijk-A4 consists of tidal or estuarine deposits (sand) and beach plain deposits (sand and clay) including wash-over deposits. Dunes developed on top of the beach plain before 3638-3341 BC. The site includes various sub-sites that are presumably located on two dunes, with the tops at 3.45 and *c.* 4.20 m -NAP.

3.1.7 Wateringse Veld

Wateringse Veld represents four dunes of which the geology is comparable with Ypenburg and Rijswijk-A4. On top of back-barrier deposits, a beach-ridge environment developed. The dunes, measure 30-40 metres in width, formed at the highest ridges of a beach. The beach-ridge and dunes were covered with peat and clay. Prospective research indicated that Wateringse Veld was not occupied (Bakker and Burnier 1997), but presence of some charcoal suggests that people used the dunes in some other way (see paragraph 3.10.4.4). Archaeobotanical data of Wateringse Veld are not available.

3.2 Nootdorp-Driemanspolder

Nootdorp-Driemanspolder is a non-archaeological location from which a pollen diagram is available. The site is located 5 km to the northeast of Ypenburg (coordinates 89.675/454.575). The data of Nootdorp were kindly made available by Alterra, the organisation that was responsible for the archive of K. Koelbloed, former employee of the Stichting voor Bodemkartering. The pollen analysis was performed in 1956 by three persons (K. Koelbloed, JMK and CvdW), possibly with the aim to date the diagram and to obtain an impression of the development of the landscape, but probably not with the aim to reconstruct the vegetation in detail.[1] In order to enable comparison with other diagrams from the coastal region, the diagram has been recalculated based on a total pollen sum, resulting in a pollen sum varying between 171 and 541 pollen grains. The depth of the diagram corresponds with 7.00 to 5.40 m -NAP, assuming that the depth given in the pollen diagram is the depth below surface (which is 4.7 m -NAP).

The diagram has been dated but the available sources give contradictive information. The manuscript of the Stichting voor Bodemkartering mentions that two samples were selected for dating, collected at 1.15-0.95 and 2.00-1.90 m below surface. The manuscript refers to GrN-1119: 5600 ± 70 BP (4600-4330 BC), sampled at 6.00-5.50 m -NAP, which may correspond with 1.15-0.95 m below surface, although the depth ranges do not correspond with each other. The official publication from the responsible institute in Groningen (De Vries and Waterbolk 1958) moreover gives another date: GrN-1119: 5360 ± 70 BP (4340-4040 BC). Calibration of both dates gives different results, but it nevertheless seems probable that the upper part of the diagram dates to the period before the known Middle Neolithic occupation in the region.

Figure 3.2 shows the pollen diagram of Nootdorp. The diagram mainly shows stable, continuous curves, suggesting continuity in the sedimentation and the development of the vegetation. The lower half of the diagram shows evidence of a local presence of Poaceae, Chenopodiaceae and Asteraceae tubuliflorae, suggesting the presence of tidal flats and salt marshes. A single grain of Cerealia-type is present, but this has little meaning without an archaeological context, more dates, or further indications of human impact on the vegetation. The diagram furthermore suggests that much of the material may represent non-local pollen. In the upper part of the diagram comparable indicators of the presence of tidal flats and salt marshes can be observed as in the lower part, now combined with increased values of *Artemisia* sp.

1 It is unknown to the author whether the diagram has been published before.

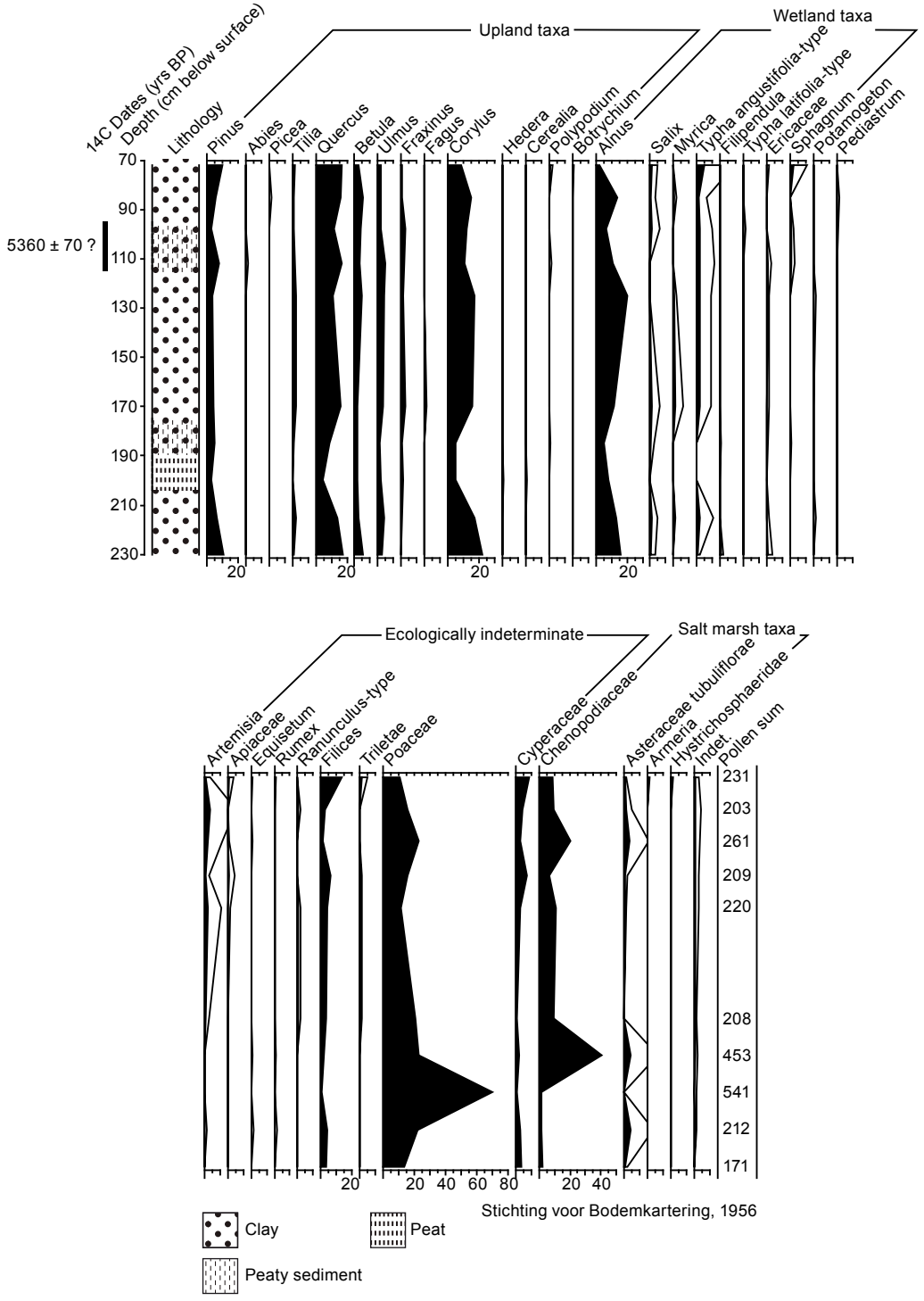

Figure 3.2 Nootdorp-Driemanspolder, pollen diagram based on a total pollen sum, exaggeration 5 x (Stichting voor Bodemkartering)

3.3 Schipluiden-Zuidkade

Schipluiden-Zuidkade (coordinates 81.960/443.441) is a non-archaeological location, 5 km south of the archaeological site Schipluiden, from which a dated pollen diagram is available. The data originate from the State Geological Survey and are published in Hartman (1968), where the location is called Schipluiden. This publication includes only the part of the diagram of Hartman that corresponds with the period before and during the Middle Neolithic occupation in the coastal region. For comparison with other diagrams from the region, the diagram was recalculated based on a total pollen sum, varying between *c.* 100 and 1200 pollen grains. Table 3.1 shows the lithostratigraphy of the core. Table 3.2 shows the relevant dates, corresponding with the Atlantic and Sub-Boreal. Figure 3.3 shows the pollen diagram. Hartman discusses that the major part of the pollen diagram as published here unto 5.25 m -NAP mainly represents non-local pollen rain, transported by river water. Furthermore, he argues that a hiatus may be present at 7.25 m -NAP (Hartman 1968, 35). Taxa that may represent the local vegetation are Chenopodiaceae, Asteraceae tubuliflorae and Poaceae in the middle part of the diagram, and Cyperaceae, Apiaceae, Rubiaceae and Polypodiaceae in the upper part of the diagram. The diagram therefore probably reflects the local development of salt marsh vegetation into sedge peat vegetation. Various herbs may represent local vegetation as well. *Alnus* sp., *Salix* sp. and *Typha latifolia* may represent extra-local vegetation. Human impact, if present, would be expected in the upper half of the diagram that corresponds with the Middle Neolithic occupation in the region. It is hardly possible to reconstruct human impact due to the assumed absence of local woodland vegetation, while the visible changes in the curves of herbs cannot be related to human activity with certainty.

depth (m -NAP)	sediment
4.80-4.50	Phragmites peat
5.15-4.80	amorphous peat with much charcoal
5.95-5.20	clay with marine diatoms
6.45-5.95	peat
6.55-6.45	clayey peat
7.15-6.55	brown clay
7.25-7.15	gyttja
7.60-7.25	peat with much charcoal
8.50-7.60	clay

Table 3.1 Schipluiden-Zuidkade, lithostratigraphy (Hartman 1968).

depth (m -NAP)	age (yrs BP)	age (yrs cal BC, 2σ)	dated material
5.05-5.04	4430 ± 60 BP	3340 BC (95.4%) 2910 BC	amorphous peat
5.60-5.59	4785 ± 60 BP	3670 BC (78.4%) 3490 BC 3460 BC (17%) 3370 BC	clay
6.40-6.39	5050 ± 45 BP	3960 BC (95.4%) 3710 BC	peat
7.50-7.49	6020 ± 70 BP	5210 BC (2.8%) 5160 BC 5080 BC (92.6%) 4720 BC	peat

Table 3.2 Schipluiden-Zuidkade, ^{14}C dates (Hartman 1968).

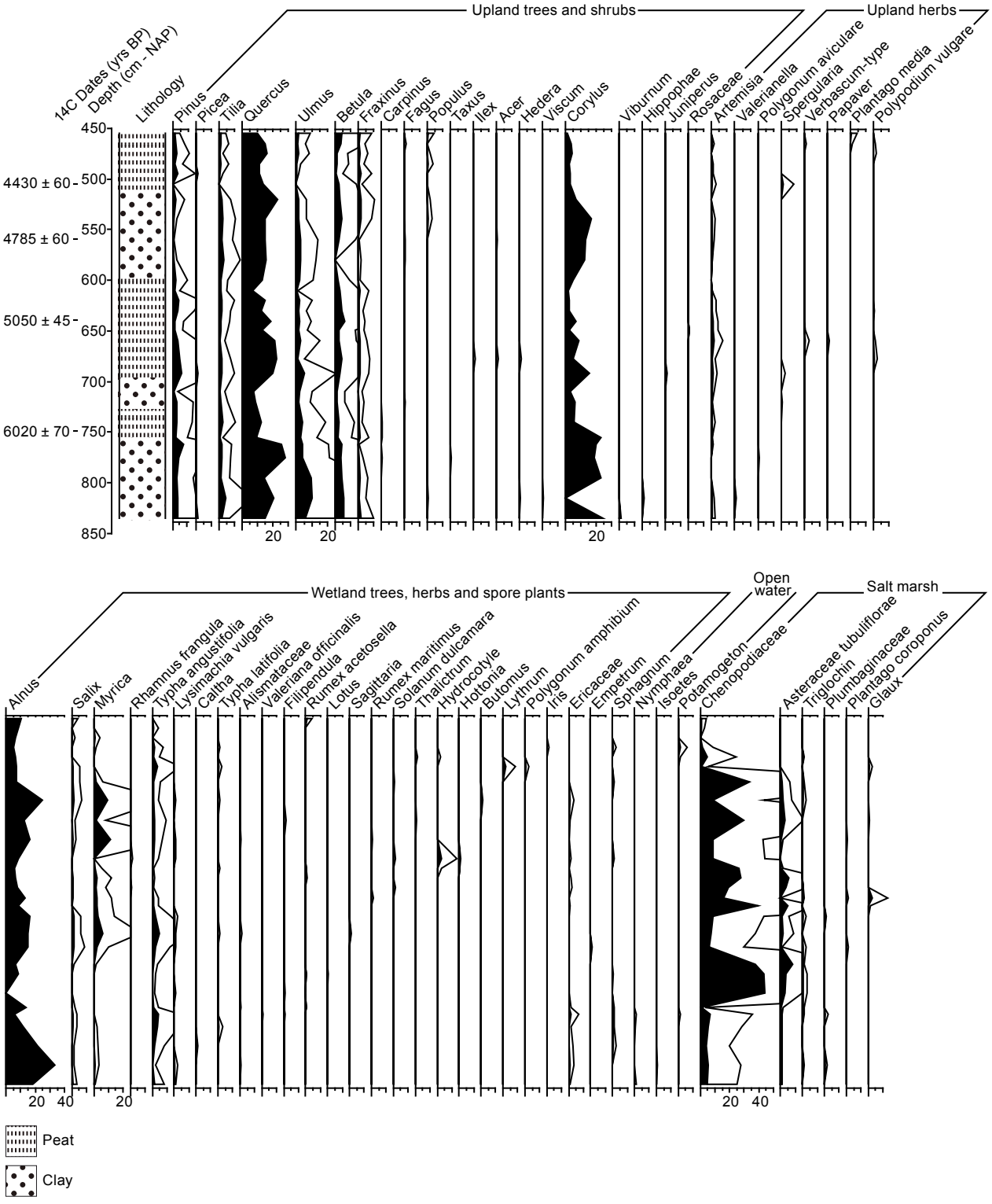

Figure 3.3 part 1.

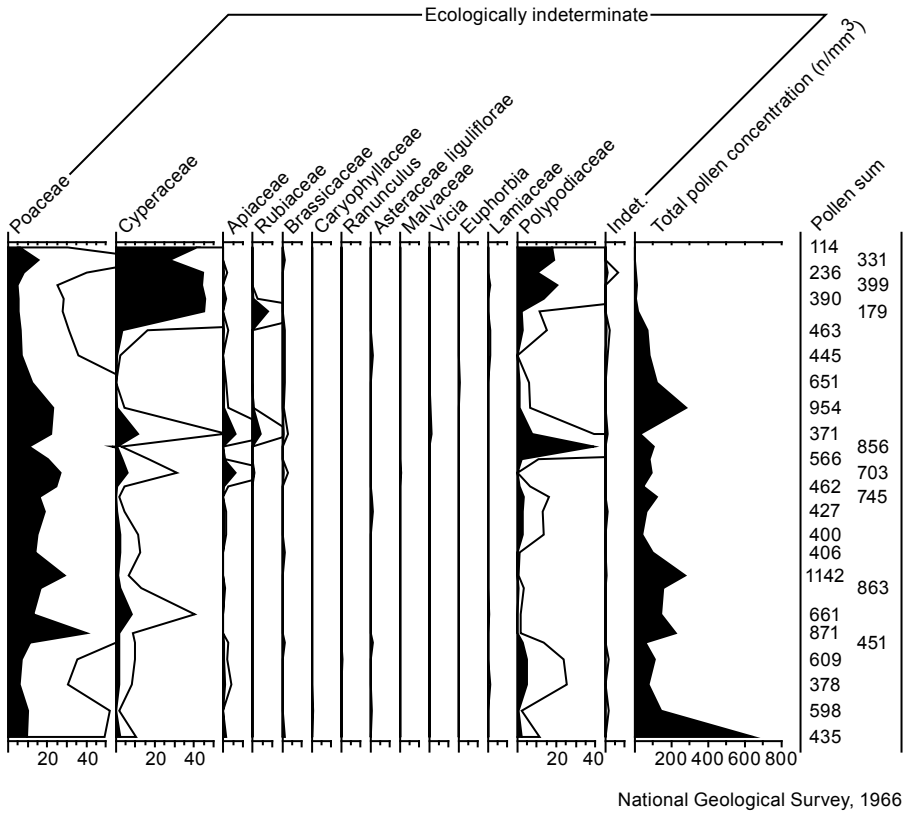

Figure 3.3 Schipluiden-Zuidkade, pollen diagram based on a total pollen sum, exaggeration 5 x (based on Hartman 1968), part 2.

3.4 Ypenburg-Postenkade

Ypenburg-Postenkade referes to the location of a pollen core (coordinates 85.400/450.750) that was sampled directly south of the dune where the site Rijswijk-Ypenburg is located. The discussion of the data is based on the diagram presented in Kooistra (2004). Samples were collected with pollen boxes at 4.53-2.78 m -NAP, and subjected to pollen and macroremains analysis. The pollen sum consisted of 600 pollen grains based on a total pollen sum excluding taxa of water plants and non-pollen palynomorphs. The resulting diagram dates to the period between *c.* 3350-1200 BC. Only the three lowest spectra (4.44, 4.37 and 4.36 m -NAP), dating to the period before 3350-2900 BC (GrN-25885: 4420 ± 90 BP), possibly correspond with the Middle Neolithic occupation in the region. The sediment of the spectra consisted of clay and clayey peat. The arboreal pollen percentage of 20-25% indicates an open landscape where woodland was scarce or absent. The herb pollen indicates the presence of salt marshes and eutrophic marshes. The sample at 4.36 m -NAP contained pollen of Cerealia-type, *Urtica dioica*, *Artemisia* sp. and *Plantago lanceolata*, which can be considered as anthropogenic indicators. The presence of these taxa may relate to Middle Neolithic occupation, but this is not demonstrated due to their scarce presence and absence of further archaeological indicators in the core. The spectra above those that potentially correspond with the Middle Neolithic occupation in the region represent reed marsh vegetation with reed, sedges and ferns. These younger spectra do not show explicit evidence of human impact (Kooistra 2004).

3.5 Rijswijk-Ypenburg

3.5.1 Archaeology

The discussion of the site of Ypenburg only includes preliminary results since only general results were published at the time of this research (Koot and Van der Have 2001).[2] The site (coordinates 85.400/450.800) was excavated on a large scale, covering several hectares. The site was occupied in the period 3860-3435 BC, corresponding with the Hazendonk group. Two main occupation phases have been distinguished, 3/C and 11/K. There were several other phases, including an early phase 2/B. Important features are four two-aisled houses (maximal 4.5 x 10 metres), unlined wells and a cemetrey with men, women and children. The preliminary results indicate that the site functioned as a year-round occupied settlement during some occupation phases. See the final site report (Koot *et al.* 2008) for further information.

Preliminary results on botanical macroremains were published in Van Haaster (2001) and Koot and Van der Have (2001). Hazenberg Archaeology and BIAX *Consult* kindly gave access to unpublished information on pollen, macroremains, coprolites, tubers, processed carbonised plant remains, wood and charcoal that is part of the final site report. The text below is based on Van Beurden (2008a, b), Kooistra (2008b), Kooistra and Hänninen (2008), Kubiak-Martens (2008), and Van Waijjen (2008), all published in Koot *et al.* (2008).

3.5.2 Pollen analysis

The pollen analysis comprised one sample of phase 2/B that took place just before phase 3/C, three samples from phase 3/C and three samples from phase 11/K. All samples were collected from a single section at the edge of the dune.[3] The analysis was based on a total pollen sum that varied between 400 and 1400 pollen grains, usually reaching a value of max. 650 pollen grains. The sample of phase 2/B indicates the local presence of freshwater marsh vegetation without alder, and the extra-local presence of salt marsh vegetation or influxes of brackish water. The samples of phase 3/C are characterised by an increase in taxa that tolerate brackish conditions, although freshwater taxa were still present in the extra-local vegetation. During phase 11/K, the importance of taxa that tolerate brackish conditions decreased, while the importance of *Alnus* sp. and Poaceae increased, indicating that the environment became less affected by marine influence and became a freshwater environment instead. In the last spectrum, *Dryopteris*-type increases strongly. Reconstruction of the vegetation on the dune is difficult for all phases. Pollen of dune shrub vegetation is present in small quantities (*Acer campestre*-type, *Hippophae rhamnoides* and *Juniperus communis*) and probably represents the dune vegetation (Van Beurden 2008b).

Indications of human impact in the pollen diagram are minimal because of the character of the natural vegetation and because of the small number of samples. The location of the sample point may play a role as well. The importance of shrubs decreased at the end of phases 3/C, which may be related to human impact or may be a statistical result from the increased percentages of Cyperaceae that were present in the local vegetation. The most direct indications of human impact are the presence of pollen grains of Cerealia-type in all phases and the presence of grains of *Hordeum*-type in phase 3/C. Taxa indicative of ruderal, disturbed terrain show relatively high values at the end of phase 3/C and in 11/K, corresponding with the presence of Cerealia-type pollen (Van Beurden 2008b).

Analysed coprolites are interpreted as coprolites from carnivores such as dog, fox and cat. A coprolite from phase 3/C was relatively rich in pollen of *Corylus* sp. and *Alnus* sp., which suggests the presence of these taxa in the surroundings of the site (Van Waijjen 2008).

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2 The data on Ypenburg presented in this chapter are nevertheless more detailed than in the chapters on gathered food plants and weeds since this chapter was finished in a later stage. The results by Koot and colleagues were published when the research for this study on the Dutch Late Mesolithic and Early and Middle Neolithic wetland sites was finished but not published.

3 The location of the pollen core was not known to the author during the writing of this study since the site report was not published yet.

3.5.3 Macroremains analysis

The analysis of macroremains is based on 21 samples of varying volumes[4] sieved on a 0.5 mm sieve and *c.* 3000 samples of 5 litres sieved on a 2 mm sieve. Some of the 21 samples were selected because of the context (refuse layers, hearths and pits), diversity, richness, and presence of food plants. The selection comprised both rich and poor samples (Kooistra 2001). The resulting assemblage contained taxa of dune shrub vegetation, some herbs indicative of shade, taxa indicative of dry to moist, disturbed terrain, and taxa of freshwater marshes and salt marshes. Taxa of open water were only scarcely found in unlined wells. Taxa of salt marsh vegetation were interestingly found in unlined wells as well. The numbers of samples of the various occupation phases do not allow analysis of changes through time (Van Beurden 2008a).

Carbonised finds of probable food plants included *Corylus avellana*, *Prunus spinosa* and *Rosa* sp. Another potential food plant of which seeds were found in a carbonised state is *Asparagus officinalis* (although it may have been the shoots that were consumed). Waterlogged finds of probable food plants included *Malus sylvestris*, *Pyrus communis* ssp. *pyraster*, *Crataegus monogyna*, *Sambucus nigra*, *Prunus padus*, *Berberis vulgaris*, *Rubus caesius*, *Rubus fruticosus*, *Rubus idaeus* and *Physalis alkekengi*. Other edible taxa may have been consumed as well. The group of probable food plants from Ypenburg contains some taxa that are not usually found at comparable sites, such as *Pyrus communis* ssp. *pyraster*, *Berberis vulgaris*, *Physalis alkekengi and Asparagus officinalis* (Van Beurden 2008a). Contextual indications of use are available for *Ruppia maritima*, since carbonised fruits of this species were found in a hearth (Van Beurden 2008a).

Analysis of carbonised tubers and carbonised processed food remains resulted in identifications of probable food plants as well. Analysis of carbonised parenchyma resulted in identification of *Allium* sp. (possibly *A. scorodoprasum* or *A. vineale*), *Typha* sp. (possibly *T. angustifolia*) and Pteridophyta (ferns). These plant remains are indeed known as human food sources and are also know from other excavations in Northwestern Europe (see chapter 9). Analysis of carbonised processed plant remains collected from pottery sherds resulted in identification of the epidermis of emmer wheat present in a sample, together with stem or leaf remains from plants, animal meat or fat, and fats from plants (Kubiak-Martens 2008).

Remains of crop plants found at Ypenburg are carbonised grains of emmer wheat (*Triticum dicoccon*) and naked barley (*Hordeum vulgare* var. *nudum*), and carbonised chaff of emmer wheat. There were some grains that showed some similarity with einkorn (*Triticum monococcum*) that were interpreted as grains from the top of emmer ears (Van Beurden 2008a, 316). There were additionally some grains that showed some similarity with hulled barley (*Hordeum vulgare* var. *vulgare*) that were interpreted as deformed grains of naked barley. Emmer chaff was found in five samples only. The low frequency of chaff and absence of chaff of naked barley is probably caused by the recovery methodology, since the majority of samples were sieved on a 2 mm sieve. The ratio of the two cereals, based on the number of grains, suggests general dominance of emmer wheat, but the validity of this conclusion is limited since many cereal grains could not be identified up to genus level and the ratio may have shifted through time. Identified stem remains of Poaceae may represent stems of cereals (Van Beurden 2008a).

The site revealed a varied list of indicators of disturbed and ruderal terrain, possibly representing arable weeds (Van Beurden 2008a; see also paragraph 3.10.4.3). Taxa that were found in a carbonised state are *cf. Bromus* sp., *Chenopodium album*, *Galium aparine*, *Malva neglecta*, *Persicaria lapathifolia*, *Rumex* sp., *Stellaria media*, *Vicia* sp. and *Vicia sativa*. Two samples rich in emmer chaff remains did not contain any carbonised macroremains of potential weeds. Chenopodiaceae, *cf. Bromus* sp., *cf. Galium* sp. and *Malva neglecta* were each found in a sample with few cereal remains without mixture of other taxa, which suggests

4 The samples published in Van Haaster (2001) had a volume varying between 1 and 5 litres.

that these taxa may represent arable weeds. The earlier archaeobotanical report also mentions a find of a single waterlogged grain of *cf. Avena* sp., interpreted as a possible find of *A. fatua*, a weed in cereal fields (Van Haaster 2001). Other finds of *Avena* sp. at the sites studied only includes pollen identifications at Urk-E4 (Van Smeerdijk 2001).

3.5.4 Wood and charcoal analysis

The wood remains, collected from the refuse layers, features and residues from the 2 mm sieve, were grouped into wood with no or scarce traces of working (N = 243) and artefacts (N = 15). Most of the presented wood corresponds with the occupation phases. The wood contained 65 unidentified remains.

Table 3.3 shows the taxa identified in the assemblages of unworked and worked waterlogged wood, and charcoal. The unworked wood assemblage was dominated by *Alnus* sp., followed by *Pinus* sp., *Quercus* sp., *Salix* sp. and *Fraxinus excelsior*. This frequency appears to be constant through time. Phase 11/K contained only wood of *Alnus* sp., *Salix* sp. and *Cornus* sp.; the small number of taxa is probably related to the small number of wood remains found from this phase. The presence of *Pinus* wood is remarkable in view of the absence of this species at other sites in the region and the absence of macroremains.

taxon / category	unworked wood	worked wood	charcoal	taxon / category	unworked wood	worked wood	charcoal
Acer sp.	+	-	+	Prunus padus/spinosa	+	-	-
Alnus sp.	+	+	+	Prunus spinosa	-	-	+
Betula sp.	-	-	+	Prunus-type	-	-	+
Cornus sp.	+	+	+	Quercus sp.	+	+	+
Corylus avellana	+	-	+	Rhamnus cathartica	+	+	+
Euonymus europaeus	-	-	+	Rhamnus frangula	-	-	+
Fraxinus excelsior	+	+	+	Salix sp.	+	+	+
Ilex aquifolium	-	-	+	Sorbus sp.	-	-	+
Juniperus communis	+	+	+	Taxus baccata	+	-	+
Ligustrum sp.	-	-	cf. +	Ulmus sp.	-	-	+
Pinus sp.	+	-	+	Viburnum opulus	+	-	+
Pomoideae	+	-	+	Viscum sp.	-	-	cf. +
Prunus avium/padus	-	-	+				

+ = present - = not present

Table 3.3 Ypenburg, unworked wood, worked wood, and charcoal (Kooistra 2008b; Kooistra and Hänninen 2008).

One piece of *Pinus* wood is dated to 8460-8249 BC (9110 ± 50 BP). In addition, artefacts of *Pinus* wood are absent despite frequent presence of unworked *Pinus* wood at the site, which may be related to the poor quality of the old wood. It is therefore suggested that the wood of *Pinus* sp. represents reworked material from the Boreal (Kooistra and Hänninen 2008). Parallels are known from several Dutch Neolithic sites (see chapters 6 and 7), but not from other sites in the coastal region.

The 15 artefacts comprised posts, possible planks, pointed roundwood, hafts, wickerwork and an unidentified artefact. Posts and possible posts were made of *Alnus* sp., *Quercus* sp., *Salix* sp. and *Fraxinus excelsior*. Two planks were made of *Alnus* sp. Pointed roundwood was made of *Juniperus communis*, *F. excelsior*, *Alnus* sp. and *Rhamnus cathartica*. Hafts were made of *Quercus* sp. and *Salix* sp. The haft of *Quercus* sp. was short (14 cm in total) and is interpreted as a possible haft of a sickle. The wickerwork was made of *Cornus* sp. (*C. sanguinea*). It is tentatively interpreted as a preparation for a fish trap (Kooistra 2008b), which corresponds with other selective use of red dogwood for fish traps (Out 2008b). The excavation also revealed two pieces of rope. All taxa that were used for artefacts were relatively common in the wood and charcoal assemblage (Kooistra 2008b; Kooistra and Hänninen 2008).

Charcoal (N = 1553) from the occupation phases 3/C (*c.* 66%) and 11/K (*c.* 33%) was collected from sieve residue samples of the 2 mm sieve and from features. The charcoal assemblage of phase 3/C was dominated by *Alnus* sp., *Quercus* sp. and *Fraxinus excelsior*. Identification of the charcoal from one of the two hearths that were both dated to phase 3/C resulted in four identifications only: *Salix* sp., *Alnus* sp./*Betula* sp., *Alnus* sp. and *Pinus* sp. Analysis of the second hearth showed use of *Quercus* sp., *Corylus avellana* and *Alnus* sp. These results do not indicate selection of fuel based on the qualities of the wood (Kooistra and Hänninen 2008). The assemblage of phase 11/K contained relatively more *Quercus* sp., *Alnus* sp., *Salix* sp., *Corylus avellana* and *Sorbus aucuparia* than the assemblage of phase 3/C. Specific contexts at Ypenburg resulted in identification of *Quercus* sp., *Salix* sp. and *cf.* Pomoideae. These contexts may represent selective use of wood based on the quality of the wood, but the contexts are not understood which makes interpretation difficult. The charcoal indicates use of primarily fresh and dry wood for fuel, and additionally of moist wood and brushwood affected by fungi (Kooistra and Hänninen 2008).

3.5.5 Discussion

The natural vegetation on the dune at Ypenburg probably consisted of scarce dune shrub vegetation, while the marshes that surrounded the dune developed from freshwater marshes to salt marshes and finally into freshwater marshes again during occupation. The analysis of waterlogged wood and charcoal revealed an unexpected large variety of taxa. The data indicate that the exploitation area of the site included dune shrub vegetation, alder carr and deciduous woodland vegetation. Kooistra and Hänninen (2008) conclude that especially the finds of *Acer* sp., *Fraxinus excelsior*, *Ilex aquifolium*, *Quercus* sp., *Taxus baccata* and *Ulmus* sp. indicate the presence of moist eutrophic woodland with changing water tables. The precise location of such vegetation in the region is not known.[5]

The macroremains assemblage from Ypenburg contains four taxa that are unique for the sites of the Hazendonk group in the coastal region as well as for other Late Mesolithic and Early and Middle Neolithic Dutch wetland sites: *Asparagus officinalis*, *Pyrus communis* ssp. *pyraster*, *Physalis alkekengi* and *Berberis vulgaris*. There is a chance that research methods play a role here, since the macroremains samples were sieved with water from a nearby ditch and since the samples were stored uncovered in open air for an unknown period. The analysts were however aware of these sources of possible contamination, and the four unique taxa in the macroremains assemblage are not taxa that were found in large numbers in the sieving water, and are not

5 Palaeogeographical reconstructions do not give detailed information since part of the region was destroyed by erosive channel activity.

transported by wind through the air either. An alternative explanation for their presence is that the large number of samples investigated plays a role (3000 samples of 5 litres sieved on a 2 mm sieve). Finally, the large number of new taxa may possibly be related to the site function and agency (human choice). There are no indicators of the import of taxa since they could all have been part of the natural vegetation in the coastal region.

Local crop cultivation may have occurred at Ypenburg since the size of the dune (7.5 hectare) would have enabled local cultivation and since the environment in the exploitation area was probably suitable for arable farming, at least at those locations that were hardly affected by flooding during the major part of the year. The botanical finds of crop plants included pollen and macroremains of emmer wheat and naked barley. Chaff remains of emmer were found, but there is no information on the presence or absence of chaff remains of naked barley. There are indications of burning of the vegetation at the dune and disturbance of the soil (Kooistra *et al*. 2002), which are possibly related to arable farming (further discussed in paragraph 3.10.4.4 and chapter 11). Use-wear analysis demonstrated the presence of flint with cereal gloss running in a longitudinal direction, which forms a major argument in favour of local arable farming (Van Gijn *et al*. 2006, 154). The wooden artefacts show the presence of a possible sickle haft. The available data overall provide positive indicators in favour of arable farming. More archaeological interpretations of the site on site function, mobility system, *etc*. are however necessary in order to make a final conclusion.

3.6 Schipluiden

3.6.1 Archaeology

The coastal dune site of Schipluiden-Harnaschpolder (coordinates 81.620/448.320) was almost fully excavated in 2003 by Archol B.V. in cooperation with Leiden University. The results are published in Louwe Kooijmans and Jongste (2006). The Holocene stratigraphy on the slopes of the dune allowed the distinction of stratigraphical units that could be dated. The settlement history was divided into four phases: phase 1 at *c*. 3630-3550 BC, phases 2a and 2b at *c*. 3550-3490 BC and phase 3 at *c*. 3490-3380 BC. The find assemblage of phase 1 is relatively small while the assemblage of phase 2 is rich. The pottery and the ^{14}C dates indicate that occupants at Schipluiden were part of the Hazendonk group.

The features comprise a large number of unlined wells, concentrated at the northern slope, pits, hearth pits, some burials, a deposition pit, ditches, fences, and clusters of many postholes interpreted as four or five house sites or yards. The finds comprise flint, stone, pottery, ornaments and organic remains. The concentration of the posts and the distribution patterns of the stratified archaeological remains indicate the continuous presence of four households or farmyards, certainly from phase 2a, and possibly already from phase 1 onwards. The fences were present around the site from phase 2b onwards. The average group size of these four households is estimated at 25 persons (Louwe Kooijmans 2006b).

The pottery is characteristic of the Hazendonk group (Raemaekers and Rooke 2006). The flint assemblage consisted of a large component of rolled pebbles and a small component of high quality imported material. The source of the rolled pebbles is expected to be located relatively close to the site (at the Belgian or Dutch coast). The imported flint indicates that the contact area of the site was in a southern and southeastern direction. Use-wear analysis of the flint resulted in indications of various activities including wood working, plant processing and cereal harvesting. In contrast to other Dutch Mesolithic and Neolithic sites there are no indications of tools that were used transversely for the processing of siliceous plant, indicating a change in techniques or a change in subsistence. Phytolith analysis of the querns indicated cereal processing. Use-wear analysis of bone and antler was indicative of plant processing (sewing), wood working and hide working (Van Gijn *et al.* 2006; Van Gijn and Houkes 2006).

The extended broad-spectrum economy of the site at Schipluiden was based on animal husbandry, crop cultivation, hunting, fishing, fowling and gathering. The ratio of domestic, terrestrial (wild) and aquatic protein food sources is estimated at 2:1:3 respectively. The site is considered to be occupied by complete households continuously and year-round at least from phase 2a onwards, based on the presence of houses, the skeletal remains of men, children and possibly a female, the local production of pottery, the broad range of artefacts and the wide diversity of materials, the production and repair of artefacts, the broad range of activities as indicated by the use-wear analysis, the diversity of food sources, the indications of seasonality and the composition of the wood assemblage (Louwe Kooijmans 2006b). The zoological and botanical data support the archaeological arguments for permanency (Kubiak-Martens 2006a; Zeiler 2006a, b).

The animal bone assemblage was dominated by cattle, wild boar and red deer. The importance of cattle slightly decreased through time while the importance of hunted mammals increased. The domestic animals present at the site are dog, cattle and pig, while sheep and goat were absent. There are no indications of the use of dairy products (Boon 2006; Brinkhuizen 2006; Zeiler 2006a, b).

3.6.2 Diatom and pollen analysis

The results of the diatom analysis are based on De Wolf and Cleveringa (2006). Diatoms indicate that at the start of occupation the site was located in a dynamic estuarine environment, representing the transition from saline to freshwater conditions. Freshwater conditions prevailed during the later occupation phases. The flooding frequency decreased through time from regular high tides into irregular floods during spring tides and storms, into highly irregular floods (De Wolf and Cleveringa 2006).

The discussion of the pollen analysis is based on Bakels (2006). Three sections were sampled with sample boxes at the northwestern and southeastern edges of the dune. The sections were combined with samples from four unlined wells located at the northwestern side of the dune and from eight coprolites. The analysis is based on a volume of 1 cm^3 and based on a total pollen sum. The pollen sum of the sections varied between 869 and 2486 pollen grains. The number of spectra counted per section varies between four and eight. The coprolites and half of the wells were poor in pollen.

The pollen analysis indicates the transition from salt marsh present all around the site into reed marsh vegetation during occupation, followed by sedge marsh vegetation. Taxa that initially dominate the pollen assemblage are Chenopodiaceae, Asteraceae, and a variety of taxa that possibly represent salt marsh taxa. Later Poaceae and afterwards Cyperaceae dominate in combination with taxa of eutrophic freshwater marshes. The results of the three sections are very similar. There is evidence of the absence of woodland vegetation on the dune since the percentage of pollen of trees is very low and since the percentage decreases at the transition from clay to peat, which indicates that the pollen found in the clay represent secondary transported pollen. Dune shrub vegetation was possibly present at the site, since the diagrams occasionally contain pollen of *Prunus avium/spinosa*, *Cornus sanguinea*, *Viburnum opulus* and *Hippophae rhamnoides* (all taxa that produce little pollen that is not spread over large distances). The shrub pollen is best represented in the stratigraphical units that correspond with occupation phase 1. The unlined wells, dating to phase 1-2a, do not however contain pollen of shrubs, which may be related to their specific location or with the low pollen sum of the well samples.

The pollen diagrams from the sections theoretically provide information on human impact since they correspond with occupation phases 1, 2a/2b/3 and the period after occupation. The low number of analysed spectra and the open vegetation however hamper a detailed analysis of human impact on the vegetation. The fact that shrub pollen is mostly found in the sediments from phase 1 indicates that occupation resulted in a decreased presence of shrub vegetation. Pollen identifications of possible anthropogenic indicators are Cerealia-type, *Plantago lanceolata*, *Plantago media*, *Artemisia* sp., *Polygonum aviculare* and Chenopodiaceae.

3.6.3 Macroremains analysis

The discussion of the macroremains is based on Kubiak-Martens (2006a). For analysis of botanical macroremains three types of samples were collected: 5-litre samples from features, (wells, pits, hearths and postholes), 5-litre interval samples collected every six metres, remains collected from the 4 mm sieves, and handpicked remains (N = 500). After assessment of the samples, 60 samples of the first two types of samples with a volume of 0.5 litres were analysed after sieving on a 0.25 mm sieve. The samples mainly represent stratigraphical units and wells, and additionally other features. The samples from pits, hearths and postholes could not be attributed to a single phase.

Although the aim of the sampling program and the analysis was to obtain data of similar contexts from all occupation phases, the data set is influenced by taphonomy and preservation. The interval samples collected from units from the early phases (1/2a) mainly contained waterlogged remains, while in contrast similar samples from phases 2 and 3 contained mainly carbonised remains. The samples from most features also contained mainly carbonised remains, except from samples from wells that contained mainly waterlogged remains. Remains from phases 1/2a were mainly retrieved from the northwestern side of the dune while remains of later phases were mainly retrieved from the southeastern side of the dune. Comparative analysis of the remains through time and space is therefore possible on a restricted scale only.

The macroremains indicate the presence of a variety of biotopes in the local and extra-local surroundings of the site: high salt marshes, eutrophic freshwater marshes that may have been somewhat brackish, dry grasslands, moist eutrophic grasslands, terrain rich in nitrate, disturbed and/or trodden terrain, shrubs, alder carr and woodland. There are a few taxa indicative of open water. The variation of taxa and their ecological range within single samples is generally very high. It appears that most interval samples and samples from features do not represent assemblages deposited during a single deposition process but represent settlement refuse instead.

The general presence of salt marsh taxa in the macroremains assemblage can be explained in various ways. Kubiak-Martens (2006a, 319, 329) argues that these macroremains entered the site together with animal dung after the grazing of domestic animals on the marshes, as gathered animal fodder, and together with the cereals, *i.e.* as arable weeds (further discussed in paragraph 3.10.4.3). Natural deposition processes should however be taken into consideration as well. Tidal flats and salt marshes were present around the dune during phase 1 and possibly during phase 2a. Macroremains of salt marsh taxa may have been deposited with the drift litter during all phases. This drift litter may have been used as fuel or may have been added to the fire for other reasons (see paragraph 5.5.3), resulting in carbonisation. Furthermore, for Wateringen 4 it has been suggested that the presence of *Suaeda maritima*, a salt marsh species, may be related to import of clay to the site (Raemaekers *et al.* 1997), and this could explain presence of salt marsh taxa at Schipluiden as well.

The taxa that are found in a carbonised state at Schipluiden are provided in Kubiak-Martens (2006a) and in the regional synthesis below (paragraph 3.10.3.2). The list of taxa is long and contains taxa of all distinguished ecological groups. The potential food plants most frequently found in carbonised and waterlogged state are *Prunus spinosa* and *Malus sylvestris*. One of the wells contained a concentration of waterlogged fruits of *Prunus spinosa*, supporting intentional collection by people. It is argued that *Prunus spinosa* and *Malus sylvestris* were present on the dune (Kubiak-Martens 2006a), although the taxa are probably overrepresented due to intentional gathering from other locations. The distribution of the macroremains of *Prunus spinosa* strongly corresponds with the distribution of other find categories, which indicates that the distribution of *Prunus spinosa* is indeed related to human activities (*cf.* Kubiak 2006a, 329).

Interestingly, the botanical macroremains contained carbonised remains of tubers of *Beta vulgaris* ssp. *maritima* (sea beet), *Allium* sp. (onion/leek) and *Bolboschoenus maritimus* (sea club-rush). Food crusts from pottery were analysed as well, containing fruits of *Atriplex* sp./*Suaeda* sp. (Kubiak-Martens 2006b).

The presence of the woodland taxa *Carex elongata*, *Moehringia trinervia*, *Stachys cf. sylvatica*, *Carex remota*, *Circaea lutetiana* and *Fallopia dumetorum* all indicate the presence of somewhat shaded terrain (not necessary completely shaded). The frequency of most of these taxa is ≤ 3.5% in a waterlogged state, they do not occur in a carbonised state and they mainly occur in samples form phases 1, 1/2a and 2 (not phases 2b and 3). Their waterlogged state indicates that the taxa may indeed represent the natural vegetation at the dune, while their low frequency and decreasing presence supports the results of the pollen that the dune was very open and that it became more open through time. In addition to shrub vegetation, the houses and possible other structures may have created some shady patches at the dune. *Moehringia trinervia* is the only species of this group occurring frequently in a waterlogged state (frequency 33%) and occurring in a carbonised state. *M. trinervia* prefers partly shaded woodland and shrub vegetation on slightly moist sand ground rich in humus, where the decomposition rate of organic material is high. These conditions are present if the water table changes strongly, where the soil is rich in lime (calcium) or where vegetation is cleared. It occurs frequently under dune shrubs, along small channels and at vegetation clearances (Weeda *et al.* 1985). The high frequency of the species could indicate frequent occurrence of these conditions, or could alternatively indicate that people used the species in some way.

3.6.4 Crop plants

The macroremains assemblage contained mainly carbonised grains and chaff remains of *Triticum dicoccon* and *Hordeum vulgare* var. *nudum* that were generally found together in samples. The chaff remains of naked barley consisted of rachis internodes and rachis fragments (rachis fragments: a part of the rachis consisting of several internodes still attached to each other; quantity unknown). The identifications additionally included many stem fragments of Poaceae (in carbonised and waterlogged states), possibly representing Cerealia. The waterlogged remains contained only scarce chaff remains of *Triticum dicoccon*. The data show a trend that naked barley dominates the crop assemblage in the first phases (phases 1 and 1/2a), while emmer dominates the assemblage during the later phases, although the number of samples of phase 1 is not representative. The crop plant remains are extensively described in Kubiak-Martens (2006a).

Cereal remains were present in the majority of the investigated samples (52 of 60; possibly related to sample selection). The presence of cereal remains in all kinds of samples and the distribution pattern of the cereals (see the publication) indicate that the cereal remains were scattered over large parts of the site and were present in many samples, though in low densities. Most grains and chaff remains were found at the southeastern side of the dune in several clusters that are interpreted as farmyards, which indicates cereal processing and consumption on the household level (Kubiak-Martens 2006a). The number of cereal remains in individual samples is relatively large compared with most other Dutch wetland sites. The number of grains in single samples does however not exceed 50 grains and pure concentrations of cereals seem to be absent, especially since the samples generally contain macroremains of a variety of other taxa as well (potential arable weeds and food plants). There are two samples that may represent emmer chaff concentrations (Kubiak-Martens 2006a).

3.6.5 Arable weeds

Kubiak-Martens (2006a) suggested that two groups of taxa found in a carbonised state represent the arable weeds of the site Schipluiden. The first group consists of taxa that indicate disturbance and contains *Chenopodium album*, *Galium aparine*, *Persicaria maculosa*, *Solanum nigrum*, *Brassica rapa* and *Vicia hirsuta*. It is argued that the macroremains of these taxa arrived together with the harvest at the site since these taxa were "consistently found together with charred grain and chaff remains" (Kubiak-Martens 2006a, 329). Other potential arable weeds of this group that are listed are *Atriplex patula/prostrata*, *Capsella bursa-pastoris*, *Sisymbrium officinale* and *Malva* sp. The second group consists of taxa that are characteristic of salt marshes and drift litter zones on the salt marshes and contains *Althaea officinalis*, *Apium graveolens*, *Hordeum*

marinum, *Carex distans*, *Ruppia maritima* and *Suaeda maritima*. It is argued that the frequency of carbonised salt marsh taxa corresponds with the frequency of carbonised remains of crop plants and arable weeds from the first group. It is therefore hypothesised that the fields were located on the salt marshes and possibly on nearby dunes (Kubiak-Martens 2006a, 333). The hypothesis that the fields were located on the salt marshes is supported by evidence from the experiments of Van Zeist (1976) that yielded weed assemblages consisting of a comparable combination of taxa, and by the similar evidence from comparable Dutch sites dating to the Late Neolithic (Kubiak-Martens 2006a, 329).

The precise distinction of arable weeds at Schipluiden is more difficult than suggested, since closed context containing pure assemblages resulting from crop processing were scarce. There are three samples that may represent unmixed assemblages resulting from crop processing, since they contain relative large concentrations of chaff remains of emmer wheat (N = 111, N = 144, N = 120) as well as other cereal remains (sample nr. 37, 43 and 47). The samples all contain seeds of *Malva* sp. and stem fragments of Poaceae that both may represent arable weeds (although the stems may also represent the crops themselves), but the remaining content of the samples varies. The first sample contains few taxa that almost all may represent arable weeds, but the third sample that contains the most potential arable weeds also contains the most taxa that are unlikely to represent arable weeds. This variety suggests contamination of this sample and hampers distinction of the weeds.

taxon	freq. (%)
Poaceae, stems	56
Poa sp.	50
Prunus spinosa	50
Hordeum marinum	35
Malva sp.	25
Phragmites australis, stem fragments	23
Galium aparine	23
Chenopodiaceae	19
Galium sp.	19
Althaea officinalis	17
Malus sylvestris, parenchyma	15
Ruppia maritima	15
Solanum nigrum	15
Atriplex patula/prostrata	15

freq. = frequency

Table 3.4 Schipluiden, carbonised macroremains, the frequency of the taxa (%) that occur in a high frequency (≥ 15%) in the 52 samples that contain carbonised cereal remains.

Some comments can be made on the relationship between the two proposed groups of weeds. The distinction of the first group of arable weeds is based on the ecology of the taxa, and it is suggested that the distinction is based on consistent co-occurrence with crop plants as well. Almost all samples however contain not only cereals and taxa that indicate disturbance (typical arable weeds), but also taxa that represent shrubs, freshwater marshes, meadows and/or salt marshes. It must therefore be questioned whether the listed taxa indeed are found together with crop plants consistently. Table 3.4 shows the taxa that occur in 15% or more of the samples with cereal remains. Only carbonised remains are considered in order to assure the relation between the crop plants and the potential weeds. Firstly, this table shows that the data set does not support that the presumed weed taxa of group 1 are found consistently together with carbonised cereal remains. Only *Galium aparine* and *Malva* occur in *c.* 25% of the samples that contain carbonised cereal remains, *Atriplex patula/prostrata* and *Solanum nigrum* occur in 15% of the samples while the other taxa of group 1 occur in less than 10% of the samples (together with many other taxa). Secondly, the taxa in table 3.4 represent a combination of food plants, salt marsh taxa, forbs and indicators of disturbance. The broad ecological and functional variety of the taxa indicates that it is unlikely that this complete group of taxa represent arable weeds. Indeed, the association between

the cereal remains and the other carbonised remains must be doubted since the variety of taxa in the samples indicates that the samples do not represent pure assemblages but instead an assemblage of scattered remains that are the result of various deposition processes. Table 3.4 shows that taxa occurring in a relatively high frequency and with ecological preferences similar to arable weeds are *Poa* sp., *Hordeum marinum*, *Malva* sp., *Galium aparine* and Chenopodiaceae. Therefore, the analysis of frequent co-occurrence of taxa in a carbonised state together with carbonised cereal remains indicates that these taxa may represent arable weeds.

As suggested by Kubiak-Martens, the frequency analysis of carbonised taxa in samples that contain carbonised cereal remains also demonstrates that some of the mentioned salt marsh taxa are regularly present in a carbonised state in samples that contain carbonised cereal remains: *Hordeum marinum*, *Althaea officinalis* and *Ruppia maritima*. However, these taxa do not grow together in a single habitat in the modern-day vegetation (Weeda *et al.* 1987, 1991, 1994). *Ruppia maritima* is a water plant and is not expected to have functioned as a crop weed.[6] Some of the other frequently found taxa may represent vegetation of the (high) salt marsh as well (Chenopodiaceae, Poa sp., *Galium aparine*, *Phragmites australis*, *Solanum nigrum* and *Atriplex prostrata*), but this is unlikely for some of the other taxa (*Malva* sp., *Prunus spinosa* and *Malus sylvestris*). The samples furthermore only contain a few salt marsh taxa. This again indicates that the samples probably represent material of mixed origin. The presence of carbonised salt marsh taxa can moreover also be explained by hypotheses other than cultivation on the salt marsh (discussed above).

The new results from the frequency analysis of potential arable weeds can be used for reconstruction of the location of the arable fields, although it is not assured that the most frequent taxa all represent the same context. The analysis indicates that *Poa* sp., *Hordeum marinum*, *Malva* sp., *Galium aparine* and Chenopodiaceae most likely represent arable weeds. There were probably also other weeds, but these are difficult to distinguish. *Hordeum marinum* stands out from the list of likely arable weeds since it tolerates considerable brackish conditions. The dominance of the remaining taxa, which are not necessarily indicative of brackish conditions, indicates that in the particular case of Schipluiden it is not probable that crop cultivation took place on the high salt marshes, and that arable farming on the beach plain behind dunes, on dune slopes or on a low dune that was not used for occupation is more likely. Marine influence at such locations near the dune of Schipluiden was presumably considerable during the first occupation phase, as indicated by the geological reconstruction and the pollen analysis, but decreased afterwards (see paragraphs 3.1.4 and 3.6.2). Fields located in the dunes would have been closer to the settlement, reducing travel time and reducing the risk of flooding. The location of the fields near the site corresponds with the scarce exploitation of other marine resources. Furthermore, the presence of fields at locations more inland than the high salt marshes corresponds with the dominance of emmer wheat during the majority of the phases. The salinity of the environment at Schipluiden decreased through time. Although emmer wheat can be cultivated on the high salt marshes, naked barley tolerates brackish conditions better than emmer wheat (Bottema *et al.* 1982). Therefore, it is expected that naked barley would dominate the crop assemblage continuously when the fields would have been located on the salt marshes continuously. This is further discussed in paragraph 11.6.10.

The taxa *Hordeum marinum*, *Malva* sp., *Galium aparine* and Chenopodiaceae as well as the classical potential arable weeds are mainly annuals. This indicates that the field were not shifted frequently but were probably laid out permanently (see also chapter 10).

6 The fruits of *Ruppia maritima* may have arrived at the site in one of the ways described in paragraph 3.6.3 (in other ways than together with the crops). Alternatively, fruits of *Ruppia maritima* may have been used intentionally for an unknown purpose, since they were found in a carbonised state in a hearth at Ypenburg (see paragraph 3.5.3), and since a carbonised find is known from Wangels (see paragraph 9.4.3).

3.6.6 Wood and charcoal analysis

The discussion on the wood and charcoal remains is based on Kooistra (2006b) and Louwe Kooijmans and Kooistra (2006). The assemblage of wood consists of unworked and worked wood. The excavated unworked wood was only partially investigated. In the publication of the site, the unworked wood is discussed together with wood remains that show traces of working other than artefacts or posts. This combined assemblage (N = 440), only representative of occupation phase 1-2a and phase 2a, is dominated by *Alnus* sp., Pomoideae, *Prunus* sp., *Juniperus communis* and *Salix* sp. (see table 3.5). The assemblage further contains shrubs, some deciduous trees and a few identifications of *Taxus baccata* and *Fraxinus excelsior*. The unworked wood is assumed to represent the natural vegetation in the exploitation area of the site.

taxon / category	unworked wood	worked wood and artefacts	charcoal	taxon / category	unworked wood	worked wood and artefacts	charcoal
Alnus sp.	159	39	370	Prunus spinosa-type	48	-	164
Cornus sp.	7	-	11	Quercus sp.	2	-	2
Corylus avellana	1	4	1	Rhamnus cathartica	3	1	106
Euonymus europaeus	4	6	4	Rosa sp.	3	-	-
Fraxinus excelsior	3	4	15	Salix sp.			
Juniperus communis	50	29	34	(not Salix repens)	26	8	112
Ligustrum vulgare	1	-	-	Taxus baccata	1	1	-
cf. Ligustrum vulgare /				Ulmus sp.	1	-	-
Lonicera sp.	-	-	2	Viburnum opulus	7	2	7
Lonicera sp.	-	1	-	Bark remains	43	-	-
Pomoideae	49	20	243	Indet.	32	13	63
Prunus sp.	-	57	-				
				total	440	185	1134

- = not present

Table 3.5 Schipluiden, unworked wood, worked wood and wooden artefacts, and charcoal (Kooistra 2006b; Louwe Kooijmans and Kooistra 2006).

The category of worked wood (primarily artefacts) comprises all excavated finds (N = 185 for the period studied, see table 3.5). The worked wood was divided into four groups: implements/tools, waste of woodworking, wattle and posts and stakes. The group of implements contains a bow (*Juniperus communis*), two paddles (*Fraxinus excelsior*), fragments of axe hafts (various taxa), straight sticks interpreted as spears or javelins (various taxa) and artefacts with an unknown function. The wood working waste consists of worked branches, wood chips, tangentially split-off rectangles, and tangential and radial planks and split pieces. The wood interpreted as wattle was unworked though it had a small diameter and showed traces of wear and deformation similar to that

observed in the active elements of wattle work. The investigated posts date to the Middle Neolithic and were all part of the fence that surrounded the site. A third of the post holes of the fence contained wood remains that were preserved well enough for wood identification (N = 91 out of N = 299). The fences were made of six taxa, of which *Prunus* sp., *Juniperus communis* and *Alnus* sp. were used most often. Many posts were made of freshly cut wood. The diameter of the posts was concentrated around 3.5-5 cm. Differences in preservation and the presence of post remains between various fences indicate that some fences were left behind (especially posts of *Juniperus communis* and *Alnus* sp.) while other fences were probably pulled down, possibly for re-use of the wood. There is no information on the taxa used for houses since it was not possible to reconstruct which groups of postholes formed single houses and since the relevant postholes did not contain wood anymore.

Most worked wood (artefacts *etc.*) dates to phase 2a because of the favourable embedding conditions during this phase. It is therefore not possible to investigate diachronic developments of wood working. It is highly likely that wood working occurred at the site since the taxa used for artefacts correspond with the other attested taxa, since mainly branches and few trunks were used and since sub-optimal taxa were used for artefact manufacture. The remains of phase 2a were concentrated at four locations that probably represent locations of wood working (Louwe Kooijmans and Kooistra 2006).

Charcoal was collected by hand during excavation and from 4 mm sieve residues. Data were derived from phase 1-2a, phase 2a, phase 3 and from phase 1-3 (not assigned to a single phase), resulting in 1134 identifications. The analysis included charcoal from the refuse layer at locations evenly distributed over the dune, and charcoal from wells, hearth pits and a single pit. The identified taxa are shown in table 3.5. The charcoal assemblage is dominated by *Alnus* sp., Pomoideae, *Prunus* sp., *Juniperus communis* and *Salix* sp. It shows high similarity with the assemblage of unworked wood, indicating that the gathering of firewood was in the first place based on availability of taxa in the natural vegetation. There are, however, also some differences with the unworked wood assemblage, since *Juniperus communis* is relatively scarce in the charcoal assemblage, *Rhamnus cathartica* is remarkably common in the material of phase 1-2a, and since individual hearths were dominated by Pomoideae, *Prunus* sp. or *Alnus* sp. However, the variety of the taxa that are more commonly found than expected and their common presence in the natural vegetation does not support selective use based on the qualities of the wood, and the combustion qualities of individual taxa cannot be related to charcoal selection for burning qualities either, except for Pomoideae. Most of the charcoal remains consisted of branches or twigs, supporting that the fuel was gathered in the exploitation area (Kooistra 2006b, 367). The publication does not contain information on the contents of single wells, or information on the use of moist wood or brush wood affected by fungi.

The analysis of wood and charcoal indicates that the wood supply did not change through time. Most of the wood was probably collected in the exploitation area of the site, *e.g.* in the surroundings of the site, since the taxa used for wooden artefacts corresponds with the assemblages of pollen, macroremains and unworked wood. Selective use of wood for artefacts based on the quality of the wood probably occurred on a small scale only. A positive indication of selective use of wood at Schipluiden consists of the use of *Fraxinus excelsior* for two paddles. Negative indications of selective use of wood at Schipluiden consist of the use of *Juniperus communis* instead of *Taxus baccata* for a bow, the use of branches of various taxa for hafts instead of trunks of only few taxa, and the use of various taxa for the fences. Analysis of the branch thickness and the number of annual rings indicated that there are no indications of re-use of the same groves or initial forms of management of vegetation. The number of annual rings could however not regularly be counted (Kooistra 2006b, 364) and management of the vegetation can therefore not be excluded (Kooistra 2006b; Louwe Kooijmans and Kooistra 2006).

3.6.7 Other sources

The molluscs found at Schipluiden are *Mytilus edulis*, *Scrobicularia plana*, *Cerastoderma glaucum* and *Cerastoderma edule*. These species indicate calm saline or brackish conditions, although they do not necessarily represent the local environment since they may have been transported from elsewhere naturally during spring tides or by people (Kuijper 2006). The analysis of pottery indicated that the occupants of the site used molluscs as pottery temper (*Cerastoderma edule/glaucum* and *Hydrobia ulvae/ventrosa*) but there are no indications of the consumption of molluscs.

The insect analysis indicates a very open landscape and does not provide indications of presence of woodland vegetation, dense shrub vegetation, or decaying wood. The number of investigated samples is however limited. The analysis supports that the environment was occasionally flooded during phase 1/2a. The insect remains further indicate the presence of *Brassica* sp., *Capsella bursa-pastoris* and *Beta vulgaris* (Hakbijl 2006). The background fauna indicate the presence of woodland vegetation and wetland conditions in the exploitation area (Zeiler 2006c).

3.6.8 Discussion

The site Schipluiden was located in the middle of various ecozones: the dunes behind the coast, the estuary and river area and the freshwater marshes. The plant and animal remains demonstrate that people exploited all these ecozones. The sea and the shoreline were however not intensively exploited.

The pollen, macroremains and insect assemblages indicate that the dune was very open. It was not covered with deciduous woodland vegetation or dense shrub vegetation, although the presence of small patches of shrubs remains a possibility. The pollen and macroremains data allow the presence of some shrub vegetation during the very early phases, and show an increase in open vegetation through time.

The wood and charcoal data are dominated by *Alnus* sp., Pomoideae and *Prunus* sp., while *Juniperus communis* and *Salix* sp. are additional important taxa. This varied composition and the contrast to the pollen and macroremains assemblages shows that the wood represents the vegetation in the exploitation area instead of the vegetation on the dune only. The dune shrub vegetation (Rhamno-Prunetea) probably grew on calcareous sand soils in the dune environment, generally west of the site, while the alder carr was present on eutrophic and mesotrophic peat soils in the freshwater marsh environment. These peat soils were presumably located east of the site in the parts of the beach plain that were hardly influenced by brackish influxes anymore (from phase 2a onwards). Kooistra (2006b) convincingly argues that *Juniperus communis* was probably part of this dune shrub vegetation, at least at those patches that were open and where sand was not blown over the vegetation. The fences show that small trees were present in the exploitation area at least from phase 2a onwards. The growing conditions for trees and shrubs that were present in the exploitation area were suboptimal, as indicated by the fact that many artefacts are made of branches and thin trunks instead of thick trunks and by the distance between annual rings of investigated wood remains. The diameters of many postholes however indicate that thick trunks were used at the site as well. Only alder may have grown under more favourable conditions. The waterlogged wood indicates that some deciduous trees were absent or had a limited presence in the region, including *Acer* sp., *Tilia* sp., *Fraxinus excelsior*, *Quercus* sp., *Ulmus* sp., *Corylus avellana* and *Taxus baccata* (but see the discussion below on the vegetation in the region).

Reconstruction of human impact on the vegetation is hardly possible since the pollen analysis does not allow reconstruction of the vegetation at the dune before, during and after occupation due to the character of the natural vegetation and due to the low sample density (Bakels 2006). The indications of the decreased presence of shrubs on the dune can be related to human impact. The herbs furthermore indicate the presence of disturbed, eutrophic and possibly enriched patches on the dune. Human impact probably influenced the vegetation in the exploitation area as well, as suggested by the calculation of wood needed for the fence (Hamburg and Louwe Kooijmans 2006).

The environment around the site of Schipluiden was suitable for crop cultivation, especially during phase 2 when marine influence was decreasing while the ground water level was not yet too high. It is concluded that crops were cultivated locally, in the surroundings of the site (Kubiak-Martens 2006a). Local crop cultivation at the dune or in the exploitation area of the dune is supported by the presence of chaff remains of naked barley, the presence of potential arable weeds, finds of querns, finds of sickles with sickle gloss in a longitudinal direction resulting from the cutting of cereals, and the site function (a year-round occupied settlement) (Kubiak-Martens 2006a; Louwe Kooijmans 2006b). The shift from naked barley to emmer dominating the crop assemblage also supports the practice of local cultivation in the exploitation area (see paragraphs 3.6.5 and 11.6.10). The arable weeds indicate that the fields that were used by the occupants of Schipluiden were probably not located on the high salt marshes (*contra* Kubiak-Martens 2006a, 333 and Louwe Kooijmans 2006b, 503) but on sheltered parts of the beach plain or on (the lower slopes of) dunes. Marine influence may have affected the fields though presumably decreased after the first phase. Further, the weeds indicate that the plots were not shifted frequently. The location of fields on the dune of Schipluiden itself seems unlikely since people needed their space for domestic activities, since chaff and straw is relatively scarce and since there is no evidence of tillage marks. However, scarcity of chaff may be related to use and taphonomy, and absence of tillage features can be explained by site-formation processes.

3.7 Wateringen 4

3.7.1 Archaeology

The site of Wateringen 4 (coordinates 78.280/448.430) was excavated in 1994 by the Institute of Prehistory Leiden (now the Faculty of Archaeology). The research methods and results are published in Raemaekers (1997) and Raemaekers *et al.* (1997). The site was the first Middle Neolithic site discovered in the region. The size of the excavated area is *c.* 2200 m^2, and the distribution of finds and features suggest a similar size for the site, although complete excavation of the dune was not possible. The top of the dune is at 3.60 m -NAP. Six stratigraphical units were recognised (see table 3.6). Unit 3, consisting of peat, represents the refuse layer. Occupation of the site took place sometime between 3625 and 3400 BC.

unit	sediment	site formation	period
6	clay	disturbance by marine sedimentation	
5	peat	peat formation	
4	clay	erosion and clay sedimentation	from 3350 BC onwards
3	peat with sand lamina	peat formation and occupation	3650-3400 BC
2	fine sand	dune formation and soil formation	circa 3800-3650 BC
1	calcareous sand and clay	beach barrier formation	circa 4000 BC

Table 3.6 Wateringen 4, stratigraphical units and related processes (Raemaekers *et al.* 1997).

Features at the site comprise postholes, some with the remains of posts, unlined wells, shallow pits interpreted as watering places for animals, pits with an unknown function, and a single hearth outside the house. In the postholes a two-aisled house (11 x 4 metres) has been recognised. Finds comprise flint, stone and organic material. The occupation period and presence of a single cluster of postholes suggest that Wateringen 4 represents a single house site used by several generations, estimated at *c.* 50 years. The pottery is characteristic of the Hazendonk group. It was mainly spread on the top of the dune and around the house, similar to the distribution of the flint. Most of the flint (*c*. 90%) could have been obtained locally (from southerwestern coastal sources), but the sources indicate contact with the south as well. The stone assemblage comprised querns, but sickle inserts were absent. Use-wear analysis of the flint demonstrated working of siliceous plants (reed or grasses), wood, bone, hide and unknown mineral material. The animal bone assemblage (N = 657) was dominated by cattle, pig (wild/domestic) and red deer. Bones of sheep/goat were absent.

Most of the birds and fish indicate a freshwater environment, while a minority is indicative of brackish conditions. The mammal remains indicate that the focus of exploitation was in the coastal plain rather than the freshwater marshes or the sea. The faunal remains (birds and fish included) indicate occupation during summer and in early autumn and winter (between October and March). The investigators argue in favour of year-round occupation because of the suitability of the region for year-round occupation, the presence of a house and the indications of a relative broad spectrum of subsistence activities (Raemaekers *et al.* 1997).

3.7.2 Archaeobotanical materials and methods

The archaeobotanical research included the analysis of pollen, macroremains, wood and charcoal (Bakels in Raemaekers *et al.* 1997, Hänninen and Vermeeren 1995; Hänninen and Vermeeren in Raemaekers *et al.* 1997). The pollen analysis consisted of two samples with a volume of 1 cm^3 collected from the base (4.02 m -NAP) and the top (3.95 m -NAP) of the refuse layer at 50 metres distance from the top of the dune. The analysis is based on a total pollen sum. The density of pollen was low. The macroremains analysis consisted of 59 samples that were collected by interval sampling (standard samples collected at five metres distance from each other) and 15 samples from features (unlined wells, a watering place, a posthole and pits). The sediment of most samples consisted of (humic) sand. The sample volume varied between 0.5 and 3 litres. The mesh width of sieves was 0.5 mm. The results presented in Raemaekers *et al.* (1997) represent a selection of the macroremains below (see also the discussion there). A small number of identifications has been revised.[7] The macroremains assemblage is strongly influenced by selective corrosion since mainly resistant macroremains were preserved. The wood assemblage can be divided into unworked wood remains (N = 64), pointed wood remains (N = 15) and worked wood remains (N = 12). Only the assemblage of worked wood remains was investigated completely, while a selection of remains was investigated from the other categories. A part of the unworked and worked wood remains was collected from unlined wells and watering places. The pointed wood remains were partly collected at the location of the house. The charcoal (N = 65) was mainly derived from four concentrations collected from macroremains samples, and a hearth that contained 106 grams charcoal of which 8.8 grams were identified (25 identifications).

7 The identification of *Potentilla reptans* has been replaced by *Ranunculus sceleratus*. The identification of *Bromus* sp. has been rejected. The identification of a carbonised seed of *Brassica nigra* from sample N94 has been rejected. The identification of *Brassica nigra* from sample C88 is replaced by *Brassica rapa*. The identification of *Berula erecta* is replaced by *cf. Apium graveolens*. The identifications of *Polygonum minor* (C88, UU119) are replaced by *Persicaria maculosa/minor*. *Sambucus nigra* is replaced by *Sambucus cf. nigra*.

3.7.3 Pollen analysis

The results of the pollen analysis from the refuse layer are shown in table 3.7. The pollen sum of the sample from the base of the peat is very low and restricts the representativity. Both samples do not indicate the presence of dryland woodland/shrub vegetation on top of the dune, but the presence of shrub vegetation cannot be excluded since pollen of shrubs are generally underrepresented. At the start of the formation of the peat, Asteraceae liguliflorae, possibly representing *Eupatorium cannabinum*, were present in the local vegetation. The sample from the top of the peat shows increased values of Chenopodiaceae, Poaceae and Foraminiferae, which probably indicate increased marine influence related to the presence of clay above the peat. It is not possible to recognise human impact in the pollen spectra due to the small numbers of samples, the scarce information on the (natural) vegetation and the distance between the sample location and the top of the dune where the house was located.

3.7.4 Macroremains analysis

The results of the macroremains analysis are shown in table 3.8 (at the end of the chapter). The macroremains analysis gives no evidence of the presence of dryland trees in the extra-local vegetation. It is argued that the common presence of *Prunus spinosa* and *Sambucus nigra* indicates that these shrubs were part of the local vegetation on top of the dune, although import cannot be excluded (Raemaekers *et al.* 1997, 156). Presence of shrub vegetation is supported by the presence of herbs indicative of shade and woodland edges, although these

	base peat	top peat		base peat	top peat
Upland taxa			*Wetland taxa (cont.)*		
Pinus	22.4	4.8	Sparganium erectum-type	1.1	0.5
Tilia	1.1	1.7	Urtica dioica-type	-	+
Quercus	1.6	9.5			
Corylus	1.1	2.6	*Ecologically indeterminate*		
Betula	-	+	Apiaceae	+	+
Artemisia	-	+	Asteraceae tubuliflorae	2.7	4.5
Chenopodiaceae	4.4	11.7	Cyperaceae	1.1	5.5
Polygonum persicaria-type	+	-	Poaceae	3.8	18.6
Polypodium	1.6	-	Poaceae > 37 µm	-	+
			Monoletae, psilatae	20.2	16.7
Wetland taxa			Triletae, psilatae	1.1	0.5
Alnus	2.2	6.2	Foraminiferae	2.7	14.8
Asteraceae liguliflorae	31.1	1.9	Lycopodium (marker)	66.1	30.1
Calystegia sepium-type	-	+			
Euphorbia palustris	-	+			
Filipendula	1.6	0.5	Pollen sum	185	427

+ = present - = not present

Table 3.7 Wateringen 4, pollen identifications of two samples based on a total pollen sum, analyst: W.J. Kuijper, 1995.

could also have grown in the shade of the house. The more open parts of the dune were probably overgrown with forb vegetation and taxa that are indicative of disturbance of the soil (*e.g. Chenopodium album* and *Persicaria lapathifolia*). The distribution of these taxa at the site, corresponding with the distribution of marshy taxa and not corresponding with the distribution of cereal remains, supports their presence in the local vegetation. However, some of the taxa indicative of disturbance may also have functioned as arable weeds (discussed below). Taxa of riparian vegetation, marsh vegetation and moist grassland rich in nitrogen are found in the lower parts around the dune (*e.g. Eupatorium cannabinum* and *Euphorbia palustris*). There are no indications of a nearby presence of alder carr or open water. The data from primary and secondary pit fills suggest that the vegetation hardly changed through time (Raemaekers *et al.* 1997, 151). Taxa that tolerate and prefer moderate brackish or saline conditions are *Alopecurus geniculatus*, *Apium graveolens*, *Bolboschoenus maritimus*, *Chenopodium rubrum*, *Phragmites australis*, *Schoenoplectus tabernaemontani* and *Suaeda maritima*. The presence of these taxa indicates that minor brackish influxes may have occurred, although the number of taxa that are indicative of true brackish conditions is low. The fruits of *Suaeda maritima* were concentrated around the house and it is presumed that they were imported with clay used at the site, or that they arrived at the site after consumption by cattle (*cf.* Raemaekers *et al.* 1997).

The group of taxa found in a carbonised state (see table 3.8 at the end of this chapter) consists of many taxa that together represent various ecological groups: crop plants, potential arable weeds, potential gathered food plants and taxa that represent the natural vegetation including marsh taxa. Potentially gathered food plants found in a carbonised state are *cf. Malus sylvestris*, *Corylus avellana*, *Prunus spinosa* and *Rosa* sp. Other potential food plants that were found in a waterlogged state only are *Cornus sanguinea*, *Sambucus cf. nigra* and *Rubus caesius*.

The assemblage of crop plants found at the site included carbonised grains and chaff remains of *Triticum dicoccon* and *Hordeum vulgare* var. *nudum*. The ratio of both cereals is approximately equal when considering grains and chaff remains. Concentrations of carbonised cereal remains or chaff remains were absent. The potential arable weeds are presented in the synthesis of the region (see paragraph 3.10.4.3). The macroremains assemblage from Wateringen 4 contains many taxa that are known as arable weeds. It is however unclear which taxa represent true arable weeds. It is not possible to distinguish weeds by the analysis of concentrations of crop products since the samples that were rich in carbonised remains of cereals (the samples in pit C88) also contain carbonised remains of food plants, potential arable weeds, and marsh taxa or water plants, which suggest that the samples are of mixed origin and do not represent pure products of crop processing. Frequency analysis of taxa found in a carbonised state in samples with carbonised remains of cereals indicates that *Prunus spinosa*, *Galium aparine* and *Persicaria lapathifolia* are most frequently found together with cereals, suggesting that these taxa functioned as food plants or as arable weeds.

3.7.5 Wood and charcoal analysis

The large variety of taxa in the unworked wood assemblage suggests the presence of open dune vegetation, dune woodland vegetation and moist beach plains in the exploitation area of the site. *Alnus* sp. and *Juniperus communis* dominated both the unworked wood assemblage and the worked wood assemblage, indicating that these taxa were most easily available in the exploitation area. The outer posts of the house were made of *Juniperus communis* (diameter 6-16 cm; see fig. 3.4 and 3.5) while the inner posts of the house were made of *Alnus* sp. (diameter 8-13 cm). The trunks of *Juniperus communis* indicate good growing conditions. The selective choice of the two taxa for the two types of posts is presumed to be related to the function of the posts and the characteristics of the wood although selection due to a religious and/or symbolic meaning especially of the evergreen *Juniperus communis* has been suggested as well (Hänninen and Vermeeren 1995). The post of *Quercus* sp. probably was not part of the house since it was located outside the structure and since the wood taxon does not correspond with the results of the remaining posts (*ibid.*). There is no explicit information on the

Figure 3.4 Wateringen 4, post of the house (*Juniperus communis*), scale 1:2 (photograph: Biax *Consult*).

Figure 3.5 Wateringen 4, post of the house (*Juniperus communis*), scale 1:2 (photograph: Biax *Consult*).

function of some of the other worked wood remains, partly due to poor preservation. They are all interpreted as waste products of wood working, except for a single artefact with an unknown function (see publication).

The charcoal analysis demonstrated a large variety of taxa as well. The results confirm the dominance of *Alnus* sp. and *Juniperus communis* when not taking into consideration the charcoal of the hearth. All the charcoal of the hearth was identified as Pomoideae (*Crataegus* sp./*Malus* sp./*Pyrus* sp./*Sorbus* sp.) that is very suitable as fuel, which is interpreted as an indication of selective use of wood based on the qualities of the wood (Hänninen and Vermeeren 1995). The publication does not give information on the indications of the use of moist wood or brushwood.

3.7.6 Discussion

The natural vegetation of the dune at Wateringen 4 was probably very open during and after occupation, characterised by herb vegetation of disturbed and marshy terrain. Dune shrub vegetation was probably present at the dune before and at the beginning of occupation with *Prunus spinosa* and *Sambucus nigra* as important species, although overrepresentation of these taxa due to intentional gathering from other locations cannot be excluded. *Juniperus* trees and alder carr were also common in the exploitation area. Deciduous woodland of dry terrain was instead very scarce, although various taxa of such vegetation were present in the wood assemblage. The charcoal identification of *Prunus avium* is remarkable since there are no macroremains of cherry[8] known from the Netherlands from the Late Mesolithic and Neolithic. The lower parts of the dune were rather moist during some parts of the year. Brackish influxes occurred occasionally but did not result in the local presence of salt marsh vegetation. There is little information available on the development of the vegetation through time. Human impact on the vegetation is indicated by the presence of macroremains of taxa that indicate disturbance and selective use of wood as indicated by the wood and charcoal assemblage (*Juniperus communis*, *Alnus* sp. and Pomoideae).

The excavation of Wateringen 4 provides little information on the practice of local crop cultivation. The moist sandy soil of the dune is principally suitable for local crop cultivation, and the interpretation as a year-round occupied site enables local cultivation as well (Raemaekers *et al.* 1997). Cultivation may have occurred on the dune itself, on other nearby dunes, in relatively dry parts of former beach plains, or on the high salt marshes. It is however unlikely that cereals were cultivated on the salt marshes since the number of macroremains and taxa that are indicative of salt marshes is very low. The finds of querns, grains of emmer and naked barley, chaff remains of naked barley and the presence of potential arable weeds in a carbonised state indicate local consumption and enable local crop cultivation, but do not exclude import of cereals from another region. The use-wear analysis did not distinguish sickle gloss characteristic of the harvesting of cereals from other plant working, which does not confirm or reject local cultivation either.[9] The excavation did not reveal traces of soil tillage, but these do not always remain preserved and may have been located outside the excavated area.

3.8 Sion (AHR-42)

Sion (AHR-42) is located on a coastal dune 400 metres northeast of the site of Schipluiden. The locations of Sion and Rijswijk-A4 location 4 may be located on the same dune and may even represent the same site. A surface of 345 m^2 was excavated at Sion, which only represents a part of the total site (Rieffe *et al.* 2006, 256). The excavation revealed some postholes, posts, pottery characteristic of the Hazendonk group, flint, stone, bone remains including cattle and plant remains. The amount of refuse and the number of features is, however,

8 Cherry refers to non-cultivated cherry here.

9 See Van Gijn (in press) for new results on the use-wear analysis of finds from Wateringen 4.

small. One ^{14}C date dates the site to 3640-3370 BC.[10] Investigators of BIAX *Consult* analysed pollen from two sections, macroremains from three samples and charcoal. The pollen analysis represents the period before, during and after occupation. The pollen sum of the first section is a total pollen sum, varying between *c.* 600 and 800 pollen grains. The pollen sum of the second section is a total pollen sum that excludes spore plants, varying between *c.* 200 and 500 grains. The pollen analysis indicates the presence of salt marshes and local freshwater marshes around the site before occupation, the possible presence of salt marshes during occupation, and the presence of reed marshes *c.* 500 years after occupation. The spectra that correspond with occupation were poor in pollen and provide limited information on the development of the vegetation during occupation. The macroremains analysis showed the presence of carbonised and waterlogged remains. Attested crop plants are *Triticum dicoccon* (grains and glume bases) and *Hordeum vulgare* var. *nudum* (grains) in a carbonised state. Potential food plants found in a carbonised state are *Malus* sp./*Pyrus* sp. and *Prunus spinosa*. Other taxa represent ruderals and marsh taxa. Identified potential arable weeds are presented in the synthesis of the region (see paragraph 3.10.4.3). Charcoal identifications from material present in the macroremains samples demonstrated the presence of *Alnus* sp., *Fraxinus excelsior*, *Juniperus communis*, Pomoideae and *Prunus* sp. (Rieffe *et al.* 2006).

3.9 Rijswijk-A4

3.9.1 Archaeology

The site of Rijswijk-A4 comprises four locations or sub-sites in the stretch of the motorway A4, two of which were excavated as an emergency excavation in 1993 by J.M. Koot, municipality of Rijswijk, in cooperation with Leiden University and the National Service for Archaeological Investigations. The site was partially destroyed by construction activities and possibly by a later erosive channel (Gantel). A site report is to be published in the future. The sub-sites were all located on NW-SE oriented dunes that were formed on top of a beach plain. Preliminary results indicate occupation at locations 1 and 4 that belong to the Hazendonk group (pers. comm. Koot 2007). Location 1 is located at the northwestern side of the motorway (coordinates 81.802/449.017), and location 4 is at the southeastern side (coordinates 81.714/448.749), probably situated on two dunes separated by a tidal channel. The size of the dunes and the sites could not be reconstructed because of the destruction of the site. Location 4 is located some tens of metres distance from the site of Sion and may be situated on the same dune.

The extent of the excavation at location 1 is 196 m^2 divided over two trenches, one situated on the top of the dune (1) and a smaller one in a depression (2). Four ^{14}C dates indicate occupation in the period between 3940 and 2900 BC[11] (see Lanting and Van der Plicht 2000), which can presumably be narrowed down the period 3900-3400 BC. A first refuse layer was present on the lower part of the dune (layer 50/51/52), as well as an upper refuse layer covered by clay and peat (layer 30), suggesting two occupation phases. The lower layer, consisting of sandy clay, contained finds. The upper layer, consisting of humic sand, contained both finds and features. The features and finds comprised unlined wells, a ditch, flint, stone, pottery and organic remains (Koot 1994, in prep.). The faunal remains include domestic and wild animals and indicate both summer and winter occupation (Laarman in De Vries 2004). The data indicate that the importance of hunting was very small, in contrast to contemporaneous sites in the region.

10 Poz-12996, 4750 ± 40 BP.

11 Dates of location 1 on charcoal: 4960 ± 50 (layer 50), 4640 ± 150, 4790 ± 50, and 4780 ± 40 BP (all three layer 30); dates of location 4 on charcoal: 4770 ± 30 and 5120 ± 90 BP. The presented periods may be longer than the occupation period since the precise occupation period is not reconstructed in detail.

At location 4, the excavation comprised a single trench on the slope of the dune with an extent of *c.* 300 m^2. Two ^{14}C dates indicate occupation in the period between 4250 and 3380 BC, although it is expected that occupation occurred after 4000 BC (Lanting and Van der Plicht 2000). At this location, only *c.* 10 pits interpreted as unlined wells remained of the site, related to the sandy layer 30 that was also distinguished at location 1. The finds comprise flint, stone, pottery and organic material (Koot in prep.). The faunal remains included both domestic and wild animals (Laarman in De Vries 2004).

3.9.2 Macroremains analysis

A group of 22 macroremains samples were collected at location 1 from the refuse layers, unlined wells and a ditch, mainly related to layer 30. Eight macroremains samples were collected at location 4 from features interpreted as unlined wells, although the deviating dimensions from a single feature indicate that this may have had a different function, possibly a watering place (feature 17). The sediment of most samples consisted of sand, while some samples consisted of sandy clay or clayey sand. W.J. Kuijper (Leiden University) analysed samples in 1993 and 1996. Most samples were sieved on a 0.25 mm sieve, but five samples were sieved on a 0.5 mm or 2 mm sieve (1.39, 1.40, 4.42, 4.54 and 4.65). Only a part of the residue of the fine sieve fractions was identified and therefore the results of these fractions are multiplied. *Atriplex littoralis*-type represents *A. littoralis* and *A. prostrata* var. *salina*. *Juncus articulatus*-type represents *J. acutiflorus*, *J. articulatus* and *J. bulbosus*. *Juncus effusus*-type represents *J. conglomerates*, *J. effusus* and *J. inflexus*. *Veronica beccabunga*-type represents *V. anagallis-aquatica*, *V. beccabunga* and *V. catenata*.

All samples suffered from selective corrosion. Seven samples from location 1 did not contain botanical macroremains other than fine charcoal.[12] The remaining samples from location 1 contain taxa of dune shrub vegetation, herb taxa of partly shaded understory vegetation (rare), taxa of freshwater marshes, taxa of grasslands (rare), taxa indicative of disturbed dry and moist soil and taxa of high salt marshes and crop plants (see table 3.9). The assemblages of both layers are rather similar. Taxa of dune shrubs, disturbed terrain and freshwater marshes are dominant. There are no indications of a nearby presence of deciduous woodland vegetation, alder carr or large patches of open water of considerable depth. The herb taxa that are present in high numbers are indicative of a humid eutrophic environment. The macroremains of dune shrub vegetation may also have functioned as food plants, and they may represent gathered plant food instead of taxa of the extra-local vegetation. This concerns *Prunus spinosa*, *Malus sylvestris*, *Rosa* sp., *Sambucus* sp. (probably representing *Sambucus nigra*), *Cornus sanguinea*, *Rubus fruticosus* and *Rubus caesius*. The presence of these taxa suggests that the gathering of plant food still played a role in the subsistence, despite the marginal role of hunting. The taxa of the high salt marsh are mainly present in the samples of the lower layer 50. They may have been deposited during floods (spring tide, storms, *etc.*) or may have been imported with clay or by domestic animals, and probably do not represent the local vegetation. Slightly brackish conditions cannot be excluded since many marsh taxa tolerate at least weak brackish conditions. Ephippia of *Daphnia* sp. (water fleas) are present in high numbers in samples of pits as well as in other samples, indicating very moist conditions.

The taxa found in a carbonised state are *Triticum dicoccon* (one glume base), *Hordeum vulgare* (two internodia), *Galium aparine*, *Ceratophyllum submersum* and Poaceae, divided over the two refuse layers. Carbonised cereal grains are absent at this site, which can be related to the small number of samples and the small number of carbonised remains. Samples that contain carbonised remains of crop plants do not contain any other carbonised remains. Carbonised fruits of *Galium aparine* are often found at similar sites, and its carbonised state indicates human activity during the late summer or autumn. *C. submersum*, a species that tolerates brackish conditions, is uncommon at the sites studied. Another carbonised find is known from Swifterbant-S3 (Van Zeist and Palfenier-Vegter 1981).

12 Samples 1-106, 1-135, 1-172, 1-349, 1-365, 1-368 and 1-371 did not contain botanical remains other than fine charcoal.

sample	1-154	1-171	1-271	1.39	1.40
layer	50	50	50	30	30
trench	1	1	1	1	1
square	F1	D2			
feature	-	-	21	4	2
context	refuse layer	refuse layer	water pit	water pit	water pit
notes			sec. fill	sec. fill	sec. fill
sediment	sand	sand	sand	sandy clay	sand
volume (litre)	1	1	1	2	2
Woodland vegetation of dry terrain					
Cornus sanguinea	-	-	-	1	-
Juniperus communis, wood	-	-	-	-	-
Malus sylvestris	-	-	3	cf. 2	cf. 1
Malus sylvestris, parenchyma	-	-	-	-	-
Prunus spinosa	-	1	1	2	2
Rosa sp.	-	1	1	4	1
Rubus caesius	-	-	3	-	-
Rubus fruticosus	-	-	-	1	+
Sambucus sp.	1	1	-	-	-
Alnus glutinosa	-	-	8	1	-
Alnus sp., wood	-	-	-	-	-
Salix sp., twigs	1	-	-	-	-
cf. Fallopia dumetorum	-	-	-	-	-
Galeopsis sp.	-	-	-	-	-
Galium aparine	-	-	-	-	-
Moehringia trinervia	-	-	-	-	-
Urtica dioica	-	-	4	+	++
Ruderals and pioneers of dry terrain					
Atriplex patula/prostrata	-	3	56	-	-
Atriplex sp.	-	-	-	+	+
Chenopodium album	-	-	4	-	+
Echinochloa crus-galli	-	-	3	-	-
Persicaria lapathifolia	10	6	116	+++	++
Solanum nigrum	-	-	-	-	-
Sonchus asper	-	-	-	-	-
Stellaria media	-	-	40	-	-
Plantago major	-	-	-	++	+
Polygonum aviculare	-	3	28	cf. 1	+
Crop plants					
Triticum dicoccon, glume bases	-	-	-	-	-
Hordeum vulgare, internodia	-	-	2 c	-	-

Table 3.9 part 1a.

sample	1-154	1-171	1-271	1.39	1.40
Carr and marsh vegetation					
Bolboschoenus maritimus	8	4	36	-	-
Cardamine sp.	-	-	-	-	-
Cladium mariscus	-	-	-	-	-
Eupatorium cannabinum	8	-	4	-	-
Euphorbia palustris	2	2	1	+	+
Galium palustre	-	-	-	-	1
Hypericum sp.	-	-	-	-	-
Iris pseudacoris	1	1	3	1	+
Juncus articulatus-type	-	-	+++	-	-
Lycopus europaeus	+++	32	52	+	+++
Lythrum salicaria	16	-	8	2	1
Phragmites australis	-	-	-	-	+
Prunella vulgaris	-	-	-	-	-
Rumex hydrolapathum	-	-	-	-	-
Schoenoplectis lacustris/tabernaemontani	1	1	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-
Solanum dulcamara	7	-	8	+	-
Typha sp.	-	-	-	-	-
Veronica beccabunga-type	-	-	-	-	-
Zannichellia palustris s.l.	-	-	32	+	+
Wetland pioneer vegetation					
Bidens cernua/tripartita	2	-	-	2	+
Chenopodium glaucum/rubrum	88	28	64	+++	++
Juncus bufonius	++	++++	*+	-	-
Juncus effusus-type	++	++++	*+	-	-
Potentilla anserina	-	-	2	-	+
Ranunculus sceleratus	-	-	++++	++++	++++
Open water vegetation					
Ceratophyllum submersum	-	1 c	-	-	-
Lemna sp.	-	-	-	-	1
Potamogeton sp.	-	-	1	1	-
Salt marsh vegetation					
Apium graveolens	-	-	-	1	1
Aster tripolium	-	-	20	+	-
Atriplex littoralis-type	2	1	16	-	-
Glaux maritima	-	-	-	+	-
Ruppia maritima	-	-	4	-	-
Salicornia europaea	-	-	8	-	-
Suaeda maritima	-	1	8	-	-

Table 3.9 part 1b.

sample	1-154	1-171	1-271	1.39	1.40
Ecologically indeterminate					
Apiaceae	-	-	-	1	1
Bolboschoenus sp./Schoenoplectus sp.	-	-	-	+++	+
Carex sp.	-	-	-	+++	+++
Carex sp., bicarpellate	4	-	++++	-	-
Carex sp., tricarpellate	6	9	48	-	-
Cerastium sp.	-	-	-	-	1
Cirsium sp.	2	-	-	1	2
Juncus sp.	-	-	-	+	-
Mentha aquatica/arvensis	8	-	-	-	+
Poa sp.	-	-	-	-	-
Poaceae	-	-	16	1	1 c
Potentilla sp.	-	-	-	-	-
Rumex sp.	1	-	-	-	-
Silene sp.	-	-	-	-	-
Spergularia sp.	-	-	-	+	-
Stellaria sp.	-	-	-	-	+
Thalictrum sp.	2	-	4	1	1
Varia					
Charcoal	+	+	+	+	+
Pottery	-	-	1	+	-
Bone remains	-	-	+	+	+
Fish remains	-	-	-	+	+
Daphnia sp., ephippia	++++	++++	++++	++++	++++
Cocoons	-	-	-	++++	+
Moss remains	+	-	-	-	-
Insect remains	-	+	-	+	+
Nereis sp., mandibulae	-	-	-	-	1
Cristatella mucedo, statoblasts	-	-	-	-	-
Sus scrofa/domestica, molar	-	-	-	-	1

prim. = primary
sec. = secondary
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
+++++ = many hundreds (500-999)
*+ = some thousands (1000-5000)
- = not present

Table 3.9 Rijswijk-A4, macroremains from location 1, part 1c.

sample	1-102	1-103	1-107	1-134	1-140
layer	30	30	30	30	30
trench	1	1	1	1	1
square					
feature	1	1	8	13	11
context	water pit	water pit	water pit	water pit	ditch
notes	sec. fill	prim. fill	prim. fill	sec. fill	
sediment	sand	sand	sand	sand	sand
volume (litre)	1	1	1	1	1
Woodland vegetation of dry terrain					
Cornus sanguinea	-	-	-	-	-
Juniperus communis, wood	-	-	-	-	-
Malus sylvestris	6	6	-	-	-
Malus sylvestris, parenchyma	-	1	-	-	-
Prunus spinosa	19	2	3	1	-
Rosa sp.	13	-	-	-	-
Rubus caesius	-	-	1	-	-
Rubus fruticosus	-	-	-	-	-
Sambucus sp.	-	-	-	-	-
Alnus glutinosa	-	-	-	-	-
Alnus sp., wood	-	-	-	-	-
Salix sp., twigs	-	-	-	-	-
cf. Fallopia dumetorum	-	-	-	-	-
Galeopsis sp.	-	-	-	1	-
Galium aparine	-	-	-	-	-
Moehringia trinervia	-	-	-	-	-
Urtica dioica	+++	+++	-	+++	-
Ruderals and pioneers of dry terrain					
Atriplex patula/prostrata	-	-	-	-	-
Atriplex sp.	-	-	-	-	-
Chenopodium album	-	-	-	-	-
Echinochloa crus-galli	-	-	-	-	-
Persicaria lapathifolia	11	14	4	8	-
Solanum nigrum	50	10	-	-	-
Sonchus asper	-	-	-	-	-
Stellaria media	+++	++++	-	-	-
Plantago major	-	-	-	-	-
Polygonum aviculare	26	74	4	-	-
Crop plants					
Triticum dicoccon, glume bases	-	1 c	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-

Table 3.9 part 2a

sample	1-102	1-103	1-107	1-134	1-140
Carr and marsh vegetation					
Bolboschoenus maritimus	-	-	-	-	-
Cardamine sp.	-	-	-	-	-
Cladium mariscus	-	-	-	-	-
Eupatorium cannabinum	-	1	-	-	-
Euphorbia palustris	-	-	-	-	-
Galium palustre	-	-	-	-	-
Hypericum sp.	-	-	-	-	-
Iris pseudacoris	2	1	-	-	-
Juncus articulatus-type	++	++	-	-	++
Lycopus europaeus	-	5	-	-	8
Lythrum salicaria	-	-	-	-	-
Phragmites australis	-	-	-	-	-
Prunella vulgaris	-	-	-	-	-
Rumex hydrolapathum	-	-	-	-	-
Schoenoplectis lacustris/tabernaemontani	1	-	-	-	-
Schoenoplectus tabernaemontani	-	2	-	-	-
Solanum dulcamara	1	-	-	8	1
Typha sp.	-	-	-	-	-
Veronica beccabunga-type	-	-	-	-	-
Zannichellia palustris s.l.	-	-	-	-	-
Wetland pioneer vegetation					
Bidens cernua/tripartita	-	-	-	-	-
Chenopodium glaucum/rubrum	-	8	-	-	-
Juncus bufonius	++++	*+	*+	++++	++
Juncus effusus-type	++	*+	-	++	++
Potentilla anserina	2	9	1	4	-
Ranunculus sceleratus	24	56	4	+++	52
Open water vegetation					
Ceratophyllum submersum	-	-	-	-	-
Lemna sp.	-	-	-	-	-
Potamogeton sp.	-	1	-	-	-
Salt marsh vegetation					
Apium graveolens	-	-	-	16	-
Aster tripolium	-	-	-	-	-
Atriplex littoralis-type	-	-	-	-	-
Glaux maritima	-	-	-	-	-
Ruppia maritima	-	-	-	-	-
Salicornia europaea	-	-	-	-	-
Suaeda maritima	-	-	-	-	-

Table 3.9 part 2b

sample	1-102	1-103	1-107	1-134	1-140
Ecologically indeterminate					
Apiaceae	-	-	-	-	-
Bolboschoenus sp./Schoenoplectus sp.	-	-	-	-	-
Carex sp.	-	-	-	-	-
Carex sp., bicarpellate	4	11	-	20	6
Carex sp., tricarpellate	10	37	14	++++	19
Cerastium sp.	-	-	-	-	-
Cirsium sp.	-	-	-	-	-
Juncus sp.	-	-	-	-	++
Mentha aquatica/arvensis	-	-	-	-	8
Poa sp.	-	12	-	-	-
Poaceae	-	-	-	-	-
Potentilla sp.	1	-	-	-	-
Rumex sp.	-	2	-	-	-
Silene sp.	-	-	-	-	-
Spergularia sp.	-	-	-	-	-
Stellaria sp.	-	1	-	16	-
Thalictrum sp.	-	-	-	-	-
Varia					
Charcoal	+	+	+	+	+
Pottery	1	-	-	-	-
Bone remains	-	1	-	-	-
Fish remains	1	-	-	-	-
Daphnia sp., ephippia	++	++	+	++	++
Cocoons	-	-	-	-	-
Moss remains	-	-	-	-	-
Insect remains	-	-	-	-	-
Nereis sp., mandibulae	-	-	-	-	-
Cristatella mucedo, statoblasts	-	-	-	1	-
Sus scrofa/domestica, molar	-	-	-	-	-

prim. = primary
sec. = secondary
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
+++++ = many hundreds (500-999)
*+ = some thousands (1000-5000)
- = not present

Table 3.9 Rijswijk-A4, macroremains from location 1, part 2c.

sample	1-272	1-274	1-312	1-318	1-366
layer	30	30	30	30	30
trench	1	1	1	1	2
square			A5	A5	
feature	21	30	-	-	5
context	water pit	water pit	refuse layer	water pit	water pit
notes	prim. fill				prim. fill
sediment	sand	sand	sand	sand	sand
volume (litre)	1	1	1	1	1
Woodland vegetation of dry terrain					top dune
Cornus sanguinea	-	1	-	-	-
Juniperus communis, wood	-	1	-	-	-
Malus sylvestris	1	2	2	cf. 1	3
Malus sylvestris, parenchyma	-	-	-	-	1
Prunus spinosa	2	1	1	2	-
Rosa sp.	8	4	1	1	-
Rubus caesius	6	-	-	-	1
Rubus fruticosus	4	1	-	1	1
Sambucus sp.	1	-	-	-	-
Alnus glutinosa	-	-	-	-	-
Alnus sp., wood	-	1	-	-	-
Salix sp., twigs	-	-	-	-	-
cf. Fallopia dumetorum	-	-	-	-	3
Galeopsis sp.	-	-	-	-	-
Galium aparine	-	-	-	-	1 c
Moehringia trinervia	-	-	-	-	++++
Urtica dioica	-	8	16	-	32
Ruderals and pioneers of dry terrain					
Atriplex patula/prostrata	4	24	4	-	-
Atriplex sp.	-	-	-	+	-
Chenopodium album	4	8	4	-	-
Echinochloa crus-galli	-	-	-	-	-
Persicaria lapathifolia	48	+++	28	++	-
Solanum nigrum	-	6	-	-	-
Sonchus asper	-	1	-	-	-
Stellaria media	4	cf. 14	-	+	-
Plantago major	4	24	-	1	-
Polygonum aviculare	-	8	4	-	-
Crop plants					
Triticum dicoccon, glume bases	-	-	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-

Table 3.9 part 3a

sample	1-272	1-274	1-312	1-318	1-366
Carr and marsh vegetation					
Bolboschoenus maritimus	12	-	12	-	-
Cardamine sp.	-	12	-	-	-
Cladium mariscus	4	-	-	-	-
Eupatorium cannabinum	-	-	-	-	4
Euphorbia palustris	3	1	-	1	1
Galium palustre	-	-	-	-	-
Hypericum sp.	-	-	-	-	-
Iris pseudacoris	2	1	1	1	-
Juncus articulatus-type	++	++	-	-	-
Lycopus europaeus	9	48	52	+	-
Lythrum salicaria	-	8	-	-	-
Phragmites australis	-	16	-	-	-
Prunella vulgaris	-	4	-	-	-
Rumex hydrolapathum	-	-	-	-	1
Schoenoplectis lacustris/tabernaemontani	4	++	-	-	-
Schoenoplectus tabernaemontani	-	-	4	-	-
Solanum dulcamara	4	16	-	+	-
Typha sp.	-	-	++	-	8
Veronica beccabunga-type	5	8	-	-	-
Zannichellia palustris s.l.	1	++++	++++	+++	-
Wetland pioneer vegetation					
Bidens cernua/tripartita	1	1	-	+	-
Chenopodium glaucum/rubrum	8	104	48	++	-
Juncus bufonius	++++	+++++	++++	-	++
Juncus effusus-type	++++	++++	++++	-	-
Potentilla anserina	-	-	-	-	-
Ranunculus sceleratus	+++	++++	+++++	+++	-
Open water vegetation					
Ceratophyllum submersum	-	-	-	-	-
Lemna sp.	-	-	16	-	-
Potamogeton sp.	-	2	4	1	-
Salt marsh vegetation					
Apium graveolens	-	-	-	-	-
Aster tripolium	-	10	1	-	-
Atriplex littoralis-type	-	-	-	-	-
Glaux maritima	-	-	-	-	-
Ruppia maritima	-	-	-	-	-
Salicornia europaea	-	-	-	-	-
Suaeda maritima	-	2	-	-	-

Table 3.9 part 3b

sample	1-272	1-274	1-312	1-318	1-366
Ecologically indeterminate					
Apiaceae	-	8	-	-	-
Bolboschoenus sp./Schoenoplectus sp.	-	-	-	-	-
Carex sp.	-	-	-	+++	-
Carex sp., bicarpellate	8	++	56	-	-
Carex sp., tricarpellate	6	14	36	-	-
Cerastium sp.	-	8	-	-	-
Cirsium sp.	1	1	-	-	1
Juncus sp.	++	-	-	++	-
Mentha aquatica/arvensis	-	16	4	1	24
Poa sp.	8	-	-	-	-
Poaceae	-	-	-	-	-
Potentilla sp.	-	-	-	-	-
Rumex sp.	-	-	-	-	1
Silene sp.	-	-	-	-	-
Spergularia sp.	-	-	-	-	-
Stellaria sp.	-	-	-	-	40
Thalictrum sp.	-	1	-	-	-
Varia					
Charcoal	+	+	+	+	+
Pottery	-	-	-	-	-
Bone remains	1	+	+	+	-
Fish remains	-	1	+	+	-
Daphnia sp., ephippia	-	++++	++++	+	++
Cocoons	-	-	-	-	-
Moss remains	-	-	-	+	+
Insect remains	+	-	-	+	-
Nereis sp., mandibulae	-	-	1	-	-
Cristatella mucedo, statoblasts	-	-	-	-	-
Sus scrofa/domestica, molar	-	-	-	-	-

prim. = primary
sec. = secondary
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
+++++ = many hundreds (500-999)
*+ = some thousands (1000-5000)
- = not present

Table 3.9 Rijswijk-A4, macroremains from location 1, part 3c.

The ruderals and pioneers of dry terrain (see table 3.9) may have grown at the site due to various sources of disturbance, resulting from the presence of people and domestic animals. The taxa may also represent arable weeds. Analysis of arable weeds is however not possible because of the absence of concentrations of carbonised crop remains. A remarkable potential weed found at Rijswijk-A4 is *Echinochloa crus-galli*. This species, known as a weed from the LBK, is very rare at this period in the Dutch wetlands though it has been found at the Mesolithic site Randstadrail CS as well (Guiran and Brinkkemper 2007). The sample that contained the fruit (sample 1-271) deviates from the other samples since it contained macroremains of crop plants, *Alnus* sp., *Echinochloa crus-galli* and various salt marsh taxa. The varied composition of the sample and the context (a secondary pit fill) indicates that the assemblage of this sample does probably not represent a closed context but instead represents settlement refuse that resulted from various deposition processes.

The macroremains analysis from location 1 resulted in the identification of waterlogged wood of *Alnus* sp., *Juniperus communis* and *Salix* sp. The identification of alder and willow indicates the presence of alder carr vegetation in the exploitation area of the site, and shows the contradiction between macroremains and wood identifications, as is the case at the other sites in the region.

The samples from location 4 (see table 3.10) are highly similar to the samples from location 1 and are dominated by marsh taxa that tolerate weak brackish conditions. The number of macroremains and taxa of dune shrub vegetation, indicators of disturbance, salt marsh and grassland appears to be smaller than in the samples of the same period of location 1, which possibly indicates slightly different ecological conditions at location 4. The apparent differences may however also be related to the small number of samples of location 4. The only carbonised remains are a grain of *Triticum dicoccon* and a fragment of a shell of *Corylus avellana*. *Corylus avellana* was probably not part of the local vegetation since only a single carbonised fragment was found and since this species was scarce at other contemporaneous coastal sites as well. One sample (4-80) contains many seeds of *Juncus bufonius* and *Juncus effusus*-type that probably represents *Juncus effusus*, as well as other taxa that are indicative of disturbance and tread. These finds indicate that this location may concern a watering place.

3.9.3 Discussion

The botanical data from Rijswijk-A4 indicate the presence of a varied exploitation area around the site, comprising dune shrub vegetation with some partly shaded patches, freshwater marshes where occasional brackish influxes may have occurred, high salt marsh at some distance from the sites, and open, moist disturbed terrain that was trodden intensively or was strongly influenced by the activity of the channel. The scarcity of data from different layers and periods restricts the analysis of the development of the vegetation through time. The vegetation offered a variety of wild food plants (presented above). The crop plants found are emmer and naked barley, which corresponds with the crop plant assemblage at other sites of the Hazendonk group in the coastal region. There is not enough information available to discuss local crop cultivation. The indications of the importance of agriculture in the bone assemblage are not confirmed by the botanical assemblage. The reconstruction of the natural vegetation and plant subsistence at Rijswijk-A4 presented here is based on the analysis of the macroremains only, which leaves many questions unanswered. Publication of the excavation and additional botanical research will probably lead to a better understanding of the available data.

sample	4-42	4-54	4-65	4-80	4-87	4-91	4-96	4-100
layer	30	30	30	30	30	30	30	30
feature	21	12	17	17	16	23	1	11
context	water pit	water pit	water pit?	water pit?	water pit	water pit	water pit	water pit
notes	prim. fill	prim. fill	sec. fill	sec. fill	prim. fill?	prim. fill	sec. fill	sec. fill?
sediment	sandy clay	sandy clay	clayey sand	sand	sand	sand	sand	sand
volume (litre)	1	2	1	1	1	1	1	1
^{14}C dates (yrs BP)	-	-	4770±30	-	-	-	-	5120±90
Woodland vegetation of dry terrain								
Cornus sanguinea	cf. 1	-	-	-	-	-	-	-
Corylus avellana	-	-	1 c	-	-	-	-	-
Malus sylvestris	cf. 1	-	cf. 1	-	1	-	-	-
Prunus spinosa	1	-	-	-	-	-	-	-
Rosa sp.	+	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	8	-	-	-
Rubus fruticosus	+	-	-	-	-	-	-	-
Galeopsis sp.	-	1	-	-	-	-	-	-
Glechoma hederaceae	-	-	-	-	-	-	4	-
Moehringia trinervia	+	+	+	8	-	-	+++	3
Urtica dioica	++	+++	++++	32	-	-	++++	9
Ruderals and pioneers of dry terrain								
Arenaria serpyllifolia	-	-	+	-	-	-	-	-
Atriplex patula/prostrata	-	-	-	16	4	-	4	-
Atriplex sp.	+	-	++	-	-	-	-	-
Chenopodium album	-	1	-	-	8	-	2	-
Malva sp.	-	-	1	-	-	-	-	-
Persicaria lapathifolia	-	++	-	2	-	-	-	-
Sonchus asper	-	-	-	1	-	-	-	-
Plantago major	+	+	+++	4	-	-	-	-
Crop plants								
Triticum diccocon	-	-	-	-	1 c	-	-	-

Table 3.10 part 1

sample	4-42	4-54	4-65	4-80	4-87	4-91	4-96	4-100
Carr and marsh vegetation								
Bolboschoenus maritimus	-	-	-	-	21	-	-	-
Daucus carota	-	-	-	-	-	-	-	1
Eupatorium cannabinum	+	-	+	21	124	-	-	2
Euphorbia palustris	+	+	+	2	49	-	1	1
Galium palustre	-	-	+	-	-	-	-	-
Hypericum sp.	-	+	-	8	-	-	++++	-
Iris pseudacoris	+	-	+	1	3	-	1	-
Lycopus europaeus	++	-	+	4	+++	-	-	-
Lythrum salicaria	-	-	-	-	20	-	-	-
Phragmites australis	-	-	+	-	-	-	-	-
Schoenoplectis lacustris/ tabernaemontani	-	-	-	-	-	-	2	1
Solanum dulcamara	+	-	++	-	2	-	-	1
Trifolium sp., petali	-	-	+	-	-	-	-	-
Typha sp.	-	-	-	-	-	-	1	-
Veronica beccabunga-type	-	-	-	2	-	-	-	-
Zannichellia palustris s.l.	-	-	-	15	-	-	-	-
Wetland pioneer vegetation								
Chenopodium glaucum/rubrum	-	-	++	16	-	-	-	-
Juncus bufonius	-	-	-	*+	++++	-	-	-
Juncus effusus-type	-	-	-	*+	-	-	++++	-
Persicaria cf. minor	-	+	-	-	-	-	-	-
Potentilla anserina	-	-	+	-	-	7	-	-
Ranunculus sceleratus	-	++	++++	++++	-	-	32	-
Open water vegetation								
Potamogeton sp.	-	1	-	-	-	-	-	-
Salt marsh vegetation								
Apium graveolens	1	-	-	-	1	-	-	-
Suaeda maritima	1	-	-	-	-	-	-	-

Table 3.10 part 2.

sample	4-42	4-54	4-65	4-80	4-87	4-91	4-96	4-100
Ecologically indeterminate								
Apiaceae	-	-	1	5	4	-	-	-
Bolboschoenus sp./								
Schoenoplectus sp.	2	-	1	-	-	-	-	-
Carex sp.	+	+++	+++	-	-	-	-	-
Carex sp., bicarpellate	-	-	-	28	+++	-	18	7
Carex sp., tricarpellate	-	-	-	46	9	14	+++	7
Cirsium sp.	1	-	-	1	-	-	2	-
Carduus sp./Cirsium sp.	-	-	-	-	-	-	-	1
Lychnis sp./Silene sp.	-	-	1	-	-	-	-	-
Mentha aquatica/arvensis	+	++	+++	56	+++	-	-	7
Poa sp.	-	-	-	-	8	-	-	-
Rumex sp.	-	+	+	3	-	-	-	-
Silene sp.	-	-	-	-	2	-	-	-
Spergularia sp.	-	-	+	-	-	-	-	-
Stachys sp.	-	+	-	-	-	-	-	-
Stellaria sp.	-	++	+++	44	4	-	+++++	-
Thalictrum sp.	1	-	-	-	-	-	-	-
Varia								
Charcoal	+	+	+	+	+	+	+	+
Pottery	-	-	-	-	-	-	-	-
Bone remains	+	+	+	-	-	1	-	1
Fish remains	+	-	+	-	-	-	-	-
Daphnia sp., ephippia	-	+	+++	++	+	-	-	-
Cocoons	+	+	+	-	-	-	-	-
Insect remains	-	+	-	-	-	-	-	-
Cristatella mucedo, statoblasts	-	-	-	-	-	-	1	1
Bryozoa, statoblasts	-	-	+	-	-	-	-	-

prim. = primary
sec. = secondary
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
+++++ = many hundreds (500-999)
*+ = some thousands (1000-5000)
- = not present

Table 3.10 Rijswijk-A4, macroremains from location 4, part 3.

3.10 Synthesis coastal region

3.10.1 Occupation and neolithisation

The analysis of the natural vegetation, human impact and plant subsistence in the coastal region is based on five archaeological sites dating to approximately the same period and mainly belonging to the same cultural group, the Hazendonk group. Table 3.11 shows a general overview of occupation periods at each site, except for Rijswijk-A4 since information on the precise occupation period is not available for this site. The five sites include three sites with a considerable amount of information and two less informative sites. At Ypenburg three households were present per phase and a formal cemetery. At Schipluiden four or five households were present, surrounded by a common fence. Schipluiden is interpreted as a year-round occupied settlement, and Ypenburg may have functioned in the same way. Wateringen 4 represents a single house site, most probably year-round occupied, that was used for a relatively short period compared with Schipluiden and Ypenburg. Minor differences in pottery style suggest that occupation at Wateringen 4 may have occurred relatively late in the range of the occupation period reconstructed for that site (Raemaekers and Rooke 2006, 126). Common features at these three main sites other than houses are postholes, pits, unlined wells and hearths. Sion and Rijswijk-A4 both represent small parts of larger sites that were not excavated completely and for which the site function remains unknown.

The data on subsistence indicate an extended broad-spectrum economy for all sites except for Rijswijk-A4, based on the exploitation of domestic animals (almost exclusively cattle and pig), wild mammals, birds, fish, cultivated plants and gathered plants from the dune area, the estuary and the freshwater marshes in the east. Evidence of the exploitation of marine resources is rather scarce despite the close distance from the sites to the sea, except at Ypenburg where the evidence is stronger than at the other sites.

The sites in the coastal region show the position of the Hazendonk group in the neolithisation process. The importance of hunting and gathering, and the presence of 'Mesolithic' hearths pits indicate continuation of Mesolithic life at the coastal sites of the Hazendonk group (Hamburg and Louwe Kooijmans 2006, 46-47; Louwe Kooijmans 2006b, 488). On the other hand, the relative importance of domestic animals (Louwe Kooijmans in press) and the strong indications of local arable farming indicate full incorporation of domestic resources into subsistence. Moreover, several (small) houses, probably occupied year-round, have been documented. At Schipluiden the house sites were surrounded by fences, which can be seen as the reflection of the typical Neolithic concept of separating the domestic parts of life from the wild (Louwe Kooijmans in press *cf.* Hodder 1990). All these characteristics give the sites a considerable Neolithic character.

site	occupation (yrs cal BC)
Sion	3640-3380
Wateringen	3625-3400
Schipluiden	3630-3380
Ypenburg	3860-3435

Table 3.11 The coastal region, general overview of the (maximal ranges of the) occupation periods (years BC).

The archaeological data from the sites studied in the coastal region provide some information on occupation in the later Neolithic. At both Ypenburg and Schipluiden a few Vlaardingen sherds were found. A younger site of the Vlaardingen group, AHR-32 (Schaapsweg), shows that occupation in the region continued. Archaeobotanical investigations at this site resulted in the identification of emmer wheat and possibly einkorn (Rieffe *et al.* 2006). Comparable fully agrarian Vlaardingen sites are known slightly farther to the north at Voorburg, Leidschendam and Voorschoten (Louwe Kooijmans in press).

3.10.2 Reconstruction of the natural vegetation

3.10.2.1 Reconstruction of the regional vegetation

The pollen, macroremains, wood and charcoal identifications give detailed information on the natural vegetation that was present in the coastal region. Data from all sites indicate the presence of salt marshes, reed marshes and sedge marshes, alder carr, dune grassland, dune shrub vegetation in the region, while especially data from Ypenburg indicate the restricted presence of woodland vegetation comparable with softwood alluvial woodland vegetation (discussed below). There is little evidence of the presence of large patches of fresh water, since pollen and macroremains from freshwater plants are hardly found outside wells.

The presence of salt marshes and freshwater marsh vegetation is broadly supported. The pollen diagrams and available macroremains assemblages from Schipluiden, Schipluiden-Zuidkade, Ypenburg, Ypenburg-Postenkade, Sion and Rijswijk-A4 show a general development from salt marshes to freshwater reed and sedge marshes in the region during the Middle Neolithic occupation. The gradual rise of the ground water that caused the peat growth on the beach plain also resulted in a gradual decrase in the dry surface of the dunes and the submerging of the sites. This has been well documented at Schipluiden, Ypenburg-Postenkade and in lesser degree also at Sion.

In contrast to the other sites, the botanical data from Wateringen 4 show that the environment at Wateringen 4 was mainly a freshwater environment, and there are no indications of the presence of marine influence that is of comparable strength as at Schipluiden or Ypenburg. This is unexpected since the (partly hypothetical) reconstruction of the beach barrier development indicates that Wateringen 4 was located behind the southern part of the beach barrier that was relatively open during the Middle Neolithic (see Mol 2006, 270). The reconstruction of the natural vegetation at Wateringen 4 therefore suggests that occupation at the site occurred during the later part of the occupation in the region, around 3400 BC, which is comparable with the third occupation phase at Schipluiden. This is supported by the pottery style at Wateringen 4 (Raemaekers and Rooke 2006, see also paragraph 3.10.1) and fits in the range of the dated occupation period of the site (Raemaekers *et al*. 1997).

The combination of all data on woody taxa from the various sites gives a quite consistent view on the regional vegetation. Table 3.12 shows identifications of trees and shrubs from all available botanical material groups from the archaeological sites in the region. These results indicate that many taxa mentioned in the table were present in the region (*Alnus glutinosa*, *Acer campestre*, *Cornus sanguinea*, *Salix* sp., *Juniperus communis*, *Malus sylvestris*, *Prunus spinosa*, *Rhamnus cathartica*, *Rubus* sp., *Rosa* sp. and in lesser degree also *Corylus avellana*, *Crataegus monogyna*, *Fraxinus excelsior*, *Ilex aquifolium*, *Quercus* sp., *Rhamnus frangula*, *Ulmus* sp., *Taxus baccata* and *Viburnum opulus*). There are however strong indications of the absence of *Tilia* sp. and *Prunus avium*[13], an extreme scarcity of *Pyrus communis* ssp. *pyraster* and *Berberis vulgaris* (identified by single macroremains only) and a scarcity of *Betula* sp., *Euonymus europaeus*, *Hedera helix*, *Hippophae rhamnoides*, *Ligustrum vulgare*, *Lonicera periclymenum*, *Populus* sp., *Prunus padus* and *Sorbus aucuparia*. Boreal wood of *Pinus* sp. was probably present in the subsurface near to Ypenburg, while living stands of *Pinus* sp. were probably absent. *B. vulgaris, L. vulgare*, *P. communis* ssp. *pyraster, P. padus and S. aucuparia* may all have been present in low numbers in the regional natural vegetation, but import into the region cannot be excluded due to their scarcity.

13 The presence of *P. avium* in the natural vegetation is discussed above and in chapter 7.

taxon	category	pollen	macroremains	wood/charcoal	presence in exploitation area	taxon	category	pollen	macroremains	wood/charcoal	presence in exploitation area
Acer sp.		+	-	+	+	Prunus avium		-	-	+	-
Alnus sp.		+	+	+	++	Prunus padus		-	+	+	+/-
Berberis vulgaris		-	+	-	+/-	Prunus spinosa		-	+	+	+
Betula sp.		+	-	+	+/-	Pyrus communis ssp. pyraster		-	+	-	+/-
Cornus sp.		+	+	+	+	Quercus sp.		+	-	+	+
Corylus avellana		+	+	+	+	Rhamnus cathartica		-	-	+	+
Crataegus monogyna		-	+	-	+	Rhamnus frangula		-	-	+	+
Euonymus europaeus		-	-	+	+	Rhamnus sp.		+	-	-	+
Fraxinus excelsior		+	-	+	+	Rosa sp.		-	+	+	+
Hedera helix		+	-	-	+/-	Rosaceae		+	-	-	+
Hippophae rhamnoides		+	-	-	+	Rubus caesius		-	+	-	+
Humulus lupulus		+	+	-	+	Rubus fruticosus		-	+	-	+
Ilex aquifolium		+	-	+	+	Salix sp.		+	+	+	+
Juniperus communis		+	+	+	++	Sambucus nigra		+	+	-	+
Ligustrum sp.		-	-	+	+/-	Sorbus aucuparia		-	-	+	+/-
Lonicera sp.		+	-	+	+/-	Taxus baccata		-	-	+	+
Malus sylvestris		-	+	-	+	Tilia sp.		+	-	-	-
Pinus sp.		+	-	+	+/-	Ulmus sp.		+	-	+	+
Pomoideae		-	+	+	++	Viburnum opulus		+	-	+	+
Populus sp.		+	-	-	+/-						
Prunus sp.		+		+	++						

+ = present
- = not present
+/- = present in small numbers?
++ = frequently present

Table 3.12 Ypenburg, Wateringen 4, Schipluiden, Sion and Rijswijk-A4, pollen, macroremains and wood/charcoal identifications of trees and shrubs.

The list of taxa combined with the palaeogeographical reconstruction of the region indicates the common presence of patches of alder carr and dune shrub vegetation in the region (further discussed below). The data suggest that deciduous woodland vegetation (comparable with softwood alluvial woodland vegetation) was however mainly present in the exploitation area of Ypenburg, and was only to a lesser degree available to people from other sites (Kooistra in press; Kooistra and Hänninen 2008). This vegetation is expected to have included taxa such as *Quercus* sp., *Fraxinus excelsior*, *Ulmus* sp., *Acer campestre*, *Ilex aquifolium* and *Taxus baccata* (see also Deforce and Bastiaens 2007 for occurrence of *Taxus baccata* on peaty soils). It is unknown where exactly in the region and under which conditions such vegetation would have been present, and why this was not exploited in the same way by occupants of other sites. Interestingly, the presence of *T. baccata* in the exploitation area of Schipluiden was tentatively rejected despite the presence of the taxon in the assemblage of unworked wood (Kooistra 2006b, 370). The conclusion that *T. baccata* was present in the exploitation area at Ypenburg indicates that yew may have been available in the exploitation of Schipluiden after all.

3.10.2.2 Reconstruction of the dune vegetation

Reconstruction of the vegetation at the occupied dunes is partly in contrast to the reconstructions of the vegetation in the region. There was probably no alder carr on top of or next to the dunes as the pollen percentage of alder is rather low. In addition, alder macroremains are scarce at most sites, and their presence can also be explained by import together with wood. Only at Schipluiden do the characteristics of wood suggest that alder may have grown in the extra-local vicinity of the site (Louwe Kooijmans and Kooistra 2006, 242). Alder vegetation may have been present on a moderate scale in marshy areas on the beach plain. Alder carr was additionally present on a large scale in the freshwater area east of the coastal region. There are no indications of the local presence of deciduous woodland vegetation at the dunes either, since the pollen percentages of *Tilia* sp., *Quercus* sp., *Fraxinus* sp., *Ulmus* sp. and *Corylus* sp. are very low and since relevant macroremains identifications are scarce or absent.

Dune shrub vegetation is expected to have grown on the scarce low dunes in the region. The presence of dune shrub vegetation at the occupied dunes is difficult to demonstrate or reject. The presence of soils at Schipluiden and Ypenburg suggests that some vegetation must have been present, at least before occupation, and dune shrub vegetation is the expected climax vegetation.[14] Firstly, macroremains found at the sites suggest that dune shrubs may have been present at the site. At Wateringen 4, macroremains of *Prunus spinosa* and *Sambucus nigra* were dominant, suggesting that they represented the local vegetation. At Schipluiden, the large number of macroremains of *Malus sylvestris* and *Prunus spinosa* were considered as an indication of local presence of these taxa (Kooistra 2006b, 373). All three taxa are however potential food plants, and (some of) the fruits may have been imported to the site, as supported by the spatial distribution of *Prunus spinosa* at both sites, which makes the macroremains less suitable for reconstruction of the natural vegetation. Secondly, pollen identifications can give information on the presence of dune shrub vegetation at the occupied dunes. The taxa that are expected as part of the natural vegetation however produce little pollen that additionally disperses over small distances only. If scarce pollen of such taxa is found, it is however not necessarily clear whether this pollen represents local vegetation at the dune or that the pollen was washed in after secondary transport. The sporadic presence of pollen of dune shrub vegetation is attested in the diagrams of Schipluiden (*Acer* sp., *Cornus sanguinea*, *Hippophae rhamnoides*, *Prunus avium/spinosa*, *Prunus* sp., *Viburnum opulus*), Sion (*Acer campestre*-type), Ypenburg (*Acer campestre*-type, *Hippophae rhamnoides*, *Juniperus communis*) and Ypenburg-Postenkade (*Acer campestre*-type, *Rhamnus frangula*).[15] The low percentages suggest that none

14 The term 'climax vegetation' in this study refers to the potential natural vegetation.

15 Data of pollen diagrams without known archaeological context are not included in the discussion.

of the taxa grew at the sample locations at the edge of the dune themselves (compare with *e.g.* the pollen percentages of shrubs at the Hazendonk), but their presence cannot be excluded. Pollen analysis from the wells at Schipluiden, revealing information on the vegetation on the top of the dune, indicates that shrub vegetation at the dune was probably not more than scarce, but the small number of analysed wells restricts the validity of the conclusion.

The available data from Schipluiden provide the strongest evidence of the presence of shrub vegetation at this site, since the data of this site show a relatively large variety of dune shrub taxa and present relatively many identifications. The data however suggest that the identification of dune shrub pollen and the variety of attested taxa is not related to the amount of shrub vegetation but instead with the investments in the pollen analysis, since most taxa were identified at Schipluiden, where the number of analysed diagrams (sample locations) as well as the pollen sum is relatively high. In contrast, the results were intermediate for Ypenburg, small for Sion, and not available for Wateringen 4, sites that were investigated on a more restricted scale. Very detailed pollen analysis could therefore give more information on the development of the vegetation at archaeological sites on dunes in the coastal region.

Macroremains of taxa indicative of shaded and partly shaded conditions (*Circaea lutetiana*, *Fallopia dumetorum*, *Lapsana communis* and *Moehringia trinervia*) are found at all sites except for Sion, and indicate that shrub vegetation may have been present at the sites when assuming that they represent the local vegetation. The taxa may however also have grown in the shade of anthropogenic structures instead of shrubs. The variation of taxa and the frequency of finds interestingly appear to be quite similar to the Alblasserwaard where relatively dense deciduous woodland vegetation was present at the investigated sites. This similarity in the assemblage of taxa indicative of shade on the one hand and the differential interpretation of the density of woodland vegetation between the regions on the other hand remains unexplained.

Identifications of especially wood and pollen indicate the presence in the region of *Juniperus communis*, which is confirmed by a single waterlogged seed found at Schipluiden. *Juniperus communis* grows at open terrain that is not overblown with sand, and may have grown at a distance of *c.* 1 km behind the coast on dunes where other dune shrubs were present as well. The characteristics of the juniper wood at Wateringen 4 indicates good growth conditions. Pollen diagrams from the coastal region indicate the common presence of the species in the dunes until in the Middle Ages, but the species is practically absent in the coastal zone today (Kooistra 2006b, 372-3 and references cited there). The use of *Juniperus communis* for the house structure at Wateringen 4 and for the fence at Schipluiden has resulted in discussion on the possible symbolic meaning of this evergreen species (Louwe Kooijmans and Kooistra 2006; Raemaekers *et al.* 1997).

3.10.3 Human impact

3.10.3.1 Pollen and diatoms

Pollen diagrams from a studied context that display human impact are available from Schipluiden, Ypenburg and Sion. All diagrams except for one from Sion are based on a total pollen sum and can be compared with each other. The number of spectra from separate occupation phases is small. Pollen analysis from Schipluiden potentially gives the most precise information on human impact because of the relatively large number of analysed diagrams and the high pollen sum. For studies of wooded dryland patches in the wetland studied, deforestation can be used as an indication of the strength of human impact on the vegetation (see chapter 2). However, the absence of woodland in the coastal region makes it impossible to use deforestation as an indication of human impact. Moreover, the composition of the natural vegetation, characterised by scarce vegetation that produced little pollen, strongly restricts visibility of any human impact in pollen diagrams.

The pollen diagrams from Schipluiden suggest a possible decrease in shrub vegetation. The diagrams furthermore show the presence of Cerealia-type pollen during phase 1 and 3, and one diagram even shows a

continuous curve of Cerealia-type pollen during phase 1. There are no identifications of non-pollen palynomorphs indicative of decaying plant remains and/or dung. The waterlogged macroremains from Schipluiden indicate a decrease in herbs indicative of shade (*Carex elongata*, *Moehringia trinehrvia*, *Stachys cf. sylvatica*, *Carex remota*, *Circaea lutetiana* and *Fallopia dumetorum*), which may indicate that the vegetation at the dune became increasingly more open as a result of occupation. The pollen diagrams from Ypenburg possibly indicate a decrease in shrubs as well. This can be a result of underrepresentation due to high values of other taxa that dominated the local vegetation (Van Beurden 2008b), but it may also concern a true decrease in shrubs related to human impact. The data from Ypenburg further indicate the presence of pollen of Cerealia-type and herbs of ruderal, disturbed terrain at the end of phase 3/C and in the phase 11/K. Non-pollen palynomorphs indicative of dung are present at the end of phase 3/C. The diagram thus suggests an increase in disturbed terrain within phase 3/C, although comparison of changes within this phase is based on three spectra. Spectra from the pollen diagrams from Sion that probably correspond with occupation and contain sufficient pollen do not give precise information on human impact. The diagrams contain identifications of pollen grains of grasses larger than 40 µm and non-pollen palynomorphs indicative of decaying plant remains and/or dung, but Cerealia-type pollen is absent, and the relationship with occupation is unclear.

3.10.3.2 Carbonised macroremains

Table 3.13 shows the taxa found in a carbonised state for each site. Schipluiden and secondly Ypenburg and Wateringen 4 yielded the most taxa in a carbonised state and show the largest ecological variety of taxa found in a carbonised state, which can primarily be related to the detailed botanical analyses at those sites. It can not however be excluded that specific environmental conditions, human activities and/or preservation processes explain part of the observed variation as well. Shrubs from woodland vegetation of dry terrain and tubers may represent potential food plants. Tubers have been identified at Schipluiden and Ypenburg. Taxa of disturbed dry terrain may represent general disturbance indicators, arable weeds or food plants. Taxa that were found at more than three sites in a carbonised state are *Galium aparine*, *Corylus avellana*, *Prunus spinosa* and *Rumex* sp. Taxa found at three sites are *Rosa* sp., *Solanum nigrum*, *Mentha aquatica/arvensis*, *Galium* sp., Poaceae, stem fragments of Poaceae, stem fragments of *Phragmites australis* and *Carex* sp. The finds in a carbonised state at relatively many of the sites suggest that these taxa represent food plants, other use plants and/or arable weeds. Poaceae may represent crop plants. Finds of carbonised macroremains in anthropogenic contexts furthermore support use of *Ruppia maritima* (Ypenburg) and *Suaeda maritima* (Wateringen 4). A concentration of waterlogged fruits of *Prunus spinosa* in a pit at Schipluiden suggests intentional collection as well. Crop plants and potential arable weeds are discussed below.

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Woodland vegetation of dry terrain					
Cornus sanguinea	-	+	-	-	-
Corylus avellana	+	+	+	+	-
Crataegus monogyna	-	+	-	-	-
Malus sp./Pyrus sp.	-	-	-	-	+
Malus sp./Pyrus sp., parenchyma	-	-	-	-	+
Malus sylvestris	-	+	cf. +	-	-
Malus sylvestris, parenchyma	-	+	-	-	-
Prunus spinosa	+	+	+	-	+
Prunus spinosa, parenchyma	-	+	-	-	-
Rosa sp.	+	+	+	-	-
Circaea lutetiana	+	-	-	-	-
Galeopsis bifida-type	+	-	-	-	-
Galium aparine	+	+	+	+	+
Moehringia trinervia	-	+	-	-	-
Torilis japonica	-	+	-	-	-
Urtica dioica	-	+	-	-	-
Ruderals and pioneers of dry terrain					
Brassica rapa	-	+	-	-	-
cf. Bromus sp.	+	-	-	-	-
cf. Capsella bursa-pastoris	-	+	-	-	-
Chenopodium album	+	-	+	-	-
Chenopodium cf. ficifolium	-	-	+	-	-
Fallopia convolvulus	-	-	+	-	-
Galium tricornutum	-	+	-	-	-

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Ruderals and pioneers of dry terrain (cont.)					
Malva neglecta	+	-	-	-	-
Malva sp.	+	+	-	-	-
Persicaria lapathifolia	+	-	+	-	-
Persicaria maculosa	-	+	-	-	-
Plantago major	-	+	-	-	-
Polygonum aviculare	-	+	cf. +	-	+
Sisymbrium officinale	-	+	-	-	-
Solanum nigrum	-	+	+	-	+
Stellaria media	+	+	-	-	-
Veronica arvensis	-	+	-	-	-
Vicia hirsuta	-	+	+	-	-
Vicia sativa	+	-	-	-	-
Vicia sp.	+	-	+	-	-
Vicia tetrasperma/hirsuta	-	-	+	-	-
Crop plants					
Hordeum vulgare var. nudum	+	+	+	-	+
Hordeum vulgare var. nudum internodia	-	+	+	+	-
Hordeum vulgare var. nudum (series of) rachis fragments	-	+	-	-	-
Triticum dicoccon	+	+	+	+	+
Triticum dicoccon, glume bases/ spikelet forks	+	+	+	+	+
Triticum dicoccon, rachis segments	+	+	-	-	-

Table 3.13 part 1.

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Grassland vegetation					
Galium cf. mollugo	-	-	+	-	-
Medicago lupulina	-	+	-	-	-
Trifolium campestre	-	+	-	-	-
Carr and marsh vegetation					
Alnus sp., cones	-	+	+	-	-
cf. Bolboschoenus sp./ cf. Schoenoplectus sp./cf. Scirpus sp.	-	-	+	-	-
Cladium mariscus	-	+	-	-	-
Eupatorium cannabinum	-	-	+	-	-
Iris pseudacorus	+	-	-	-	-
Phragmites australis, stem fragments	+	+	+	-	-
Schoenoplectus lacustris	-	+	+	-	-
Schoenoplectus lacustris/ tabernaemontani	-	+	-	-	-
Schoenoplectus tabernaemontani	-	+	+	-	-
Sparganium emersum/natans	-	+	-	-	-
Sparganium sp.	+	-	-	-	-
Typha sp., tubers	+	-	-	-	-
Wetland pioneer vegetation					
Atriplex littoralis-type	-	+	-	-	-
Atriplex patula/prostrata	-	+	-	-	-

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Wetland pioneer vegetation (cont.)					
Carex otrubae	-	+	-	-	-
Persicaria mitis	-	+	-	-	-
Rumex crispus-type	-	+	-	-	-
Trifolium repens	-	+	-	-	-
Open water vegetation					
Ceratophyllum demersum	-	+	+	-	-
Ceratophyllum submersum	-	-	-	+	-
Potamogeton cf. natans	-	+	-	-	-
Potamogeton sp.	+	+	-	-	-
Salt marsh vegetation					
Althaea officinalis	-	+	-	-	-
Apium graveolens	-	+	cf. +	-	-
Beta vulgaris ssp. maritima, roots	-	+	-	-	-
Bolboschoenus maritimus	-	-	+	-	-
Bolboschoenus maritimus, tubers	-	+	-	-	-
Carex distans	-	+	-	-	-
Hordeum marinum	-	+	-	-	-
Ruppia maritima	+	+	-	-	-
Suaeda maritima	-	+	-	-	-

Table 3.13 part 2.

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Ecologically indeterminate					
Agrostis sp./Poa sp.	-	+	-	-	-
Allium sp., tubers	+	+	-	-	-
Althaea sp./Malva sp.	-	+	-	-	-
Asparagus officinalis	+	-	-	-	-
Brassicaceae	+	-	-	-	+
Carex sp.	+	+	+	-	-
Caryophyllaceae	-	+	-	-	-
Cerastium sp.	-	+	-	-	-
Cerealea/Phragmites australis sp., stem fragments	+	-	-	-	-
Chenopodiaceae	-	+	-	-	+
Eleocharis palustris/uniglumis	-	+	-	-	-
Euphrasia sp./Odontites sp.	+	-	-	-	-
Fallopia sp./Persicaria sp./ Polygonum sp./Rumex sp	-	-	+	-	-

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4	Sion
Ecologically indeterminate (cont.)					
Galium sp.	+	+	+	-	-
Lathyrus sp./Vicia sp.	-	+	-	-	+
Luzula sp.	-	+	-	-	-
Mentha aquatica/arvensis	+	+	-	-	+
Persicaria maculosa/minor	-	-	+	-	-
Phragmites sp./Poa sp.	-	-	+	-	-
Poa sp.	-	+	+	-	-
Poaceae	-	+	+	+	-
Poaceae, stem fragments	+	+	-	-	+
Pterydophyta, rhizomes	+	-	-	-	-
Rumex sp.	+	+	+	-	+
Stellaria aquatica/media	-	+	-	-	-
Stellaria sp.	-	+	-	-	-
Trifolium sp.	+	-	-	-	+

+ = present - = not present

Table 3.13 Ypenburg, Schipluiden, Wateringen 4, Sion and Rijswijk-A4, carbonised macroremains, part 3.

3.10.3.4 Wood and charcoal

Wood identifications are available from Ypenburg, Schipluiden, Wateringen 4 and Rijswijk-A4. The data from Rijswijk-A4 are based on three identifications of wood remains that were found in the macroremains samples. Comparison of Ypenburg and Schipluiden on the one hand and Wateringen 4 on the other hand suggest that the number of taxa per site is related to the number of analysed samples and occupation intensity of sites.

Table 3.14 shows the identifications of unworked wood. Taxa that are found at three or four sites in the assemblage of unworked wood are *Alnus* sp., *Cornus sanguinea*, *Corylus avellana*, *Juniperus communis*, Pomoideae, *Prunus* sp., *Quercus* sp. and *Salix* sp. Table 3.15 shows the identifications of worked wood and wooden artefacts. Taxa found at three sites in the assemblage of worked wood and artefacts are *Alnus* sp., *Fraxinus excelsior*, *Juniperus communis* and *Salix* sp. Comparison of the unworked wood and the worked wood assemblage from the region indeed suggests that people used primarily those species most that were most commonly available. The analysis of artefacts and structures nevertheless gives minor indications of the selective use of wood based on the qualities of the wood on a small scale. The posts from the house of Wateringen 4 are a possible example, since the inner posts were made of *Alnus glutinosa* and the outer posts were made of *Juniperus communis*. At Ypenburg a potential fish trap in preparation was made of *Cornus* sp. (interpreted as *C. sanguinea*), which seems to support selective use as well (*cf.* Out 2008b). The artefacts from Schipluiden support selective use on a small scale since two paddles were made of *Fraxinus excelsior*. The wood from the sites in the coastal region does not give indications of re-use of the same groves or initial forms of management of vegetation.

Table 3.16 shows the charcoal identifications from Ypenburg, Schipluiden, Wateringen 4 and Sion. The data of Sion are based on a small number of samples. *Alnus* sp., *Fraxinus excelsior*, *Juniperus communis* and Pomoideae were found at all four sites, while *Cornus sanguinea*, *Prunus* sp., *Quercus* sp. and *Rhamnus cathartica* were found at three sites, and other taxa at less sites. There are no explicit indications of the selective use of fuel based on the qualities of the wood, except that three contexts at Ypenburg, Wateringen 4 and Schipluiden were all dominated by Pomoideae. This probably indicates the selective use of Pomoideae because of the good burning qualities of the wood.

Comparison of the assemblages of unworked wood, worked wood and charcoal indicates that *Prunus avium* and *Sorbus aucuparia* were only identified as charcoal, which may indicate selective use of these taxa for fuel based on the qualities of the wood and/or import (but see the discussion on *P. avium* in paragraph 3.10.2.1). *Lonicera* sp. has only been found as an artefact and possibly as charcoal, but not as unworked wood. Such a find pattern is usually interpreted as an indication of the import of wood from outside the exploitation area, but scarcity in the natural vegetation and relatively small preservation chances of wood of *Lonicera* sp., which probably had a relative small diameter, may play a role here as well.

Reconstruction of the natural vegetation indicated that softwood alluvial woodland was present in the exploitation area of Ypenburg, while indications of the presence of such vegetation are less strong at Wateringen 4 and Schipluiden. If the data of both sites are representative of the use of wood, this would suggest that people did not share exactly the same exploitation area, despite all sites being located in the same region (*cf.* Kooistra in press; Kooistra and Hänninen 2008).

taxon \ site	Ypenburg	Schipluiden	Wateringen 4	Rijswijk-A4
Acer sp.	+	-	+	-
Alnus sp.	+	+	+	+
Cornus sanguinea	+	+	+	-
Corylus avellana	+	+	+	-
Euonymus europaeus	-	+	-	-
Fraxinus excelsior	+	+	-	-
Juniperus communis	+	+	+	+
Ligustrum sp.	-	+	-	-
Pinus sp.	+	-	-	-
Pomoideae	+	+	+	-
Prunus padus	-	-	cf. +	-
Prunus spinosa	-	cf. +	cf. +	-
Prunus padus/spinosa	+	-	-	-
Quercus sp.	+	+	+	-
Rhamnus cathartica	+	+	-	-
Rosa sp.	-	+	-	-
Salix sp.	+	+	-	+
Taxus baccata	+	+	-	-
Ulmus sp.	-	+	-	-
Viburnum opulus	+	+	-	-
bark remains	-	+	-	-

+ = present - = not present

Table 3.14 Ypenburg, Schipluiden, Wateringen 4 and Rijswijk-A4, unworked wood.

taxon \ site	Ypenburg	Schipluiden	Wateringen 4
Acer sp.	-	-	+
Alnus sp.	+	+	+
Cornus sanguinea	+	-	-
Corylus avellana	-	+	-
Euonymus europaeus	-	+	-
Fraxinus excelsior	+	+	+
Juniperus communis	+	+	+
Lonicera sp.	-	+	-
Pomoideae	-	+	-
Prunus sp.	-	+	-
Quercus sp.	+	-	+
Rhamnus cathartica	+	+	-
Salix sp.	+	+	+
Taxus baccata	-	+	-
Viburnum opulus	-	+	-

+ = present - = not present

Table 3.15 Ypenburg, Wateringen 4 and Schipluiden, worked wood and artefacts.

site / taxon	Ypenburg	Schipluiden	Wateringen 4	Sion
Acer sp.	+	-	-	-
Alnus sp.	+	+	+	+
Betula sp.	+	-	-	-
Cornus sanguinea	+	+	+	-
Corylus avellana	+	+	-	-
Euonymus europaeus	+	+	-	-
Fraxinus excelsior	+	+	+	+
Ilex aquifolium	+	-	-	-
Juniperus communis	+	+	+	+
cf. Ligustrum sp./Lonicera sp.	-	+	-	-
cf. Ligustrum sp.	+	-	-	-
Pinus sp.	+	-	-	-
Pomoideae	+	+	++	+
Prunus sp.	+	-	+	+
Prunus avium	-	-	+	-
Prunus avium/padus	+	-	-	-
Prunus padus/spinosa	-	-	+	-
Prunus spinosa	+	cf. +	cf. +	-
Prunus sp./Sorbus sp.	-	-	+	-
Quercus sp.	+	+	+	-
Rhamnus cathartica	+	+	+	-
Rhamnus frangula	+	-	-	-
Rosa sp.	-	+	-	-
Salix sp.	+	+	-	-
Sorbus sp.	+	-	-	-
Ulmus sp.	+	-	-	-
Taxus baccata	+	-	-	-
Viburnum opulus	+	+	-	-
cf. Viscum sp.	+	-	-	-
bark remains	-	+	-	+

+ = present - = not present

Table 3.16 Ypenburg, Wateringen 4, Schipluiden and Sion, charcoal.

3.10.4 Crop cultivation

3.10.4.1 Suitability of the landscape for cultivation

The landscape in the coastal region in the Middle Neolithic was a relative dynamic landscape due to marine influxes. Marine influence was relatively strong during the early occupation phases at the sites studied and decreased through time. The gradual rise of the water table resulted in peat growth in the region starting at *c.* 3640-3340 BC (see also paragraph 3.1). The decreasing marine influence probably made the region more suitable for local arable farming through time, while the rise of the water table gradually decreased the suitability of the landscape for arable farming. Flooding would have resulted in the enrichment of the arable soils in the region, but too much marine influence during the growing season would have destroyed the crop.

In the region, three habitats were probably suitable for arable farming: high salt marshes, dunes and parts of the beach plain located in between dunes behind the beach barrier. This variety of dryland patches suitable for cultivation made the region more suitable for arable farming than other regions. Salt marshes would only have been suitable when flooding did occur less than yearly, or yearly but not during the growing season. Therefore, the salt marshes near Schipluiden and Sion were initially not optimally suitable, but arable farming could potentially have taken place there during later phases of occupation. Dunes may have been suitable if the ground water table had a sufficient height, *i.e.* if the water table was not too low and not too high. A low water table could have been compensated when sufficient capillary water was present in the soil. The surface of these dunes was however only 5-10% of the exploitation area. Parts of the beach plain were probably suitable for local crop cultivation before peat growth started in the region, if sufficiently sheltered from marine influxes. The advantage of fields on the dunes and/or on the beach plain would have been the short distance from the sites, while fields located on the high salt marsh were probably further away, especially during the late reoccupation phases. Overall, local cultivation is expected to have been possible in the exploitation area of all sites.

3.10.4.2 Crop plants

All sites in the coastal region were occupied in the Middle Neolithic when cereals had already been introduced in the Dutch wetlands, and indeed macroremains of emmer wheat (*Triticum dicoccon*) and naked barley (*Hordeum vulgare* var. *nudum*) have been found at all investigated sites. Pollen of Cerealia-type and *Hordeum*-type was found at Schipluiden and Ypenburg. Remains of other crop plants were not found, in contrast to the nearby-located site of the Hazendonk group Barendrecht 20.125 which revealed remains of *Pisum sativum* (Meirsman and Moree 2006; see also chapters 6 and 11). Detailed analysis of the naked barley at Schipluiden indicates that it concerned six-rowed, pedicellate naked barley, certainly from a lax-eared variety and possibly also from a dense-eared variety (Kubiak-Martens 2006a). Grains of barley that showed some similarity with *Hordeum vulgare* var. *vulgare* (hulled barley), found at Schipluiden and Ypenburg, were interpreted as grains of naked barley that were harvested in a not completely ripe state (Van Beurden 2008a; Kubiak-Martens 2006a). At Wateringen 4, Ypenburg, Sion and Schipluiden not all cereal grains could be identified up to genus level, which is related to sub-optimal preservation.

Grains and chaff remains of both emmer wheat and naked barley were found at almost all sites in a carbonised state, including glume bases, spikelet forks and occasionally rachis segments of emmer wheat and (series of) rachis fragments of naked barley (see table 3.13). A few concentrations of chaff remains of emmer wheat were present at Schipluiden and Ypenburg. Exceptions to the ubiquitous presence of the various crop plant remains are the apparent absence of grains of naked barley at Rijswijk-A4 and absence of chaff remains of naked barley at Ypenburg and Sion. However, the small number of samples sieved on fine sieves and the small number of carbonised remains indicate that research methods and preservation probably restrict the representativity of the results from those sites and that grains and chaff remains of naked barley were probably present there as well. Waterlogged remains only include chaff remains of emmer wheat at Schipluiden. In addition to the grains

and chaff remains of cereals, stem fragments of grasses have been identified at four of the five sites. The stem fragments may represent stems of Cerealia.

The number of cereals found at Wateringen 4, Schipluiden and Ypenburg allows a discussion on the ratio of emmer wheat and naked barley. The cereal grains and chaff remains from Wateringen 4 indicate an equal ratio, correlated with the absence of strong marine influence. At Schipluiden naked barley dominated in the first phase that was characterised by relatively brackish conditions, while emmer dominated during the later phases when the environment became more dominated by freshwater conditions. At Ypenburg emmer dominated the identified cereal grains that mainly date to phase 3/C that was characterised by freshwater conditions. At this site only about half of the cereal grains could be identified to genus level, while information on chaff remains is available from a relatively small number of botanical samples only. It is therefore uncertain whether the results on the ratio are representative. It is not clear whether the crop plants from Ypenburg show a shift in the ratio of emmer wheat and naked barley in relation to the prevalence of marine conditions since the assemblage from Ypenburg does not enable the reconstruction of changes through time.

3.10.4.3 Arable weeds

Table 3.17 shows a list of potential arable weeds found in a carbonised and waterlogged state at the sites in the coastal region. The table includes only taxa from ecological groups that grow in habitats where arable fields could have been present (see also chapter 10). All taxa may have been present in the natural vegetation in the coastal region, while taxa that would strongly indicate cultivation on soils that are only present outside the coastal region, *i.e.* import of cereals, are absent. The list of taxa contains well-known ruderals (found at all the sites) as well as some more unusual taxa characteristic of the specific vegetation in the region. Similar to the number of carbonised taxa per site, the number of carbonised weeds is maximal at Schipluiden and approximately equal at Ypenburg and Wateringen 4, while it is very small at Sion and Rijswijk-A4. The data of Ypenburg are probably not representative when considering that the site represents a multiple of Wateringen 4 that is comparable with Schipluiden.

Representative analysis of arable weeds by analysis of concentrations of carbonised cereals (*cf.* Hillman 1981) is not possible for the coastal regions since large concentrations of carbonised cereal grains were not found. At Sion a small concentration of cereal remains was found (Rieffe *et al.* 2006), but this sample did not contain other taxa. Concentrations of chaff remains of emmer wheat were found at Schipluiden and Ypenburg, and taxa that were present in these samples in the same preservation state as the chaff may represent arable weeds. The samples with emmer chaff remains from Schipluiden all contained seeds of *Malva* sp. amongst others, suggesting that *Malva* sp. was an arable weed at Schipluiden. The two concentration samples from Ypenburg did not contain identifiable macroremains of other taxa.

An alternative method applied in this study to identify arable weeds is to investigate which taxa are frequently found in a carbonised state in samples that contain carbonised cereals. This is assumed to be worthwhile only for those sites from which a considerable number of samples were analysed and where considerable numbers of carbonised cereals and other taxa have been found, thus excluding Sion and Rijswijk-A4. In the 11 samples with carbonised cereal remains of Ypenburg available to the author, *Malva neglecta* was the only potential arable weed occurring in more than one sample.[16] At Schipluiden, taxa found in a carbonised state in more than 15% of the samples that contain carbonised cereal remains are Poaceae (stem fragments), *Poa* sp., *Prunus spinosa*, *Hordeum marinum*, *Malva* sp., *Phragmites australis* (stems), *Galium aparine*, Chenopodiaceae, *Galium* sp. and *Althaea officinalis*. From this group *Poa* sp., *Hordeum marinum*, *Malva* sp., *Galium aparine* and Chenopodiaceae are the most likely candidates for arable weeds (discussed above). The high percentage of *Prunus spinosa* however suggests that the method does not result in distinction of weeds only, since sloe

16 The data of samples collected from sieve residue were not available to the author.

probably represents a food plant. Frequency analysis of Wateringen 4 indicates that *Prunus spinosa*, *Galium aparine* and *Persicaria lapathifolia* are most frequently found together with cereals, suggesting that *Galium aparine* and *Persicaria lapathifolia* represent potential arable weeds. It is however also possible that all three species represent food plants.

The suggested potential arable weeds as well as the taxa that are frequently found in a carbonised state in samples that contain carbonised cereals indicate that fields were primarily located in an environment that was not daily affected by direct marine influence, *i.e.* not on the high salt marsh. The indications that *Hordeum marinum* and *Malva neglecta* may represent arable weeds however indicate that cultivation was probably practised in the region and that weak brackish conditions may have occurred occasionally at the arable plots, since these taxa have only been found in the coastal region and since *Hordeum marinu*m tolerates brackish conditions (see also chapter 10). *Galium aparine*, *Hordeum marinum*, *Malva* sp. interpreted as *Malva neglecta* and *Persicaria lapathifolia* point to summer cultivation.

site	Ypenburg		Schipluiden		Wateringen 4		Rijswijk-A4		Sion	
category	C	W	C	W	C	W	C	W	C	W
taxon										
Aethusa cynapium	-	+	-	-	-	-	-	-	-	-
Agrostis sp.	-	-	+	-	-	-	-	-	-	-
Agrostis sp./Poa sp.	-	-	-	+	-	-	-	-	-	-
Ajuga reptans	-	+	-	-	-	-	-	-	-	-
Althaea officinalis	-	-	+	+	-	-	-	-	-	-
Althaea sp./Malva sp.	-	-	-	+	-	-	-	-	-	-
Anthriscus sylvestris	-	-	+	-	-	-	-	-	-	-
Apium graveolens	-	+	+	+	-	-	-	-	-	-
Arctium lappa	-	-	+	-	-	-	-	-	-	-
Arctium sp.	-	-	+	-	-	+	-	-	-	-
Arenaria serpyllifolia	-	+	-	-	-	-	-	+	-	-
Asparagus officinalis	+	-	-	-	-	-	-	-	-	-
Atriplex littoralis-type	-	+	+	+	-	-	-	+	-	-
Atriplex patula/prostrata	-	+	+	+	-	+	-	+	-	+
Atriplex sp.	-	cf. +	-	-	-	-	-	+	-	-
cf. Avena sp.	-	+	-	-	-	-	-	-	-	-
Beta vulgaris ssp. maritima, roots	-	-	-	+	-	-	-	-	-	-
Brassica rapa	-	-	+	+	-	+	-	-	-	-
Brassica sp.	-	-	+	-	-	-	-	-	-	-
Brassica sp./Sinapis sp.	-	-	+	-	-	-	-	-	-	-
Brassicaceae	+	-	-	-	-	-	-	-	-	-
cf. Bromus sp.	+	-	-	-	-	-	-	-	-	-
Capsella bursa-pastoris	-	-	+	cf. +	-	-	-	-	-	-
Cardamine hirsuta	-	+	-	-	-	-	-	-	-	-
Cardamine sp.	-	-	-	-	-	-	-	+	-	-
Carduus sp./Cirsium sp.	-	+	+	-	-	-	-	+	-	-

Table 3.17 part 1

site	Ypenburg		Schipluiden		Wateringen 4		Rijswijk-A4		Sion	
category	C	W	C	W	C	W	C	W	C	W
taxon										
Carex arenaria	-	+	+	-	-	-	-	-	-	-
Carex brizoides	-	+	-	-	-	-	-	-	-	-
Carex distans	-	+	+	+	-	-	-	-	-	-
Carex disticha	-	+	+	-	-	-	-	-	-	-
Carex divulsa	-	+	-	-	-	-	-	-	-	-
Carex elongata	-	-	+	-	-	-	-	-	-	-
Carex remota	-	-	+	-	-	-	-	-	-	-
Carex riparia	-	+	+	-	-	-	-	-	-	-
Carex rostrata	-	-	+	-	-	-	-	-	-	-
Carex rostrata/vesicaria	-	-	+	-	-	-	-	-	-	-
Carex vesicaria	-	+	-	-	-	-	-	-	-	-
Cerastium cf. fontanum	-	-	+	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	+	-	+	-	+	-	-
Ceratophyllum demersum	-	+	+	+	-	-	-	-	-	-
Chenopodium album	+	+	+	-	+	+	-	+	-	-
Chenopodium ficifolium	-	-	+	-	+	+	-	-	-	-
Chenopodium sp.	-	cf. +	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	+	-	-	-	-	-
Circaea lutetiana	+	+	+	-	-	-	-	-	-	-
Cirsium arvense/palustre	-	+	+	-	-	-	-	-	-	-
Cirsium cf. vulgare	-	+	+	-	-	-	-	-	-	-
Cirsium oleraceum/vulgare	-	-	+	-	-	-	-	-	-	-
Cirsium sp.	-	-	-	-	-	-	-	+	-	-
Cirsium vulgare	-	+	-	-	-	-	-	-	-	-
Cladium mariscus	-	+	+	+	-	-	-	-	-	-
Conium maculatum	-	-	+	-	-	-	-	-	-	-
Daucus carota	-	+	+	-	-	-	-	+	-	-
Echinochloa crus-galli	-	-	-	-	-	-	-	+	-	-
Elytrigia atherica/repens	-	-	+	-	-	-	-	-	-	-
Fallopia convolvulus	-	+	+	-	+	+	-	-	-	-
Fallopia dumetorum	-	+	+	-	-	-	-	cf. +	-	-
Galeopsis bifida-type	+	+	+	-	-	+	-	-	-	-
Galeopsis sp.	-	-	-	-	-	-	-	+	-	-
Galium aparine	+	-	+	+	+	-	+	-	+	-
Galium cf. mollugo	-	-	-	-	+	-	-	-	-	-
Galium sp.	+	-	-	+	+	-	-	-	+	-
Galium tricornutum	-	-	+	+	-	-	-	-	-	-
Glaux maritima	-	-	+	-	-	-	-	-	-	-

Table 3.17 part 2

site	Ypenburg		Schipluiden		Wateringen 4		Rijswijk-A4		Sion	
category	C	W	C	W	C	W	C	W	C	W
taxon										
Glechoma hederacea	-	-	+	-	-	+	-	+	-	-
Hordeum marinum	-	-	+	+	-	-	-	-	-	-
Hyoscyamus niger	-	+	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	+	-	-	+	-	-	-	-
Hypericum sp.	-	-	+	-	-	+	-	+	-	-
Hypericum tetrapterum	-	+	+	-	-	-	-	-	-	-
Juncus gerardii	-	+	+	-	-	-	-	-	-	-
Lapsana communis	-	+	-	-	-	+	-	-	-	-
Lathyrus sp./Vicia sp.	-	-	-	+	-	-	-	-	+	-
Limonium vulgare	-	-	+	-	-	-	-	-	-	-
Linaria vulgaris	-	+	+	-	-	-	-	-	-	-
Luzula sp.	-	-	-	+	-	-	-	-	-	-
Lychnis flos-cuculi	-	+	+	-	-	+	-	-	-	-
Malva neglecta	+	-	-	-	-	-	-	-	-	-
Malva sp.	+	-	+	+	-	-	-	+	-	-
Medicago lupulina	-	+	-	+	-	-	-	-	-	-
Melandrium sp./Silene sp.	-	-	-	-	-	+	-	-	-	-
Mentha aquatica/arvensis	+	+	+	+	-	+	-	+	+	+
Moehringia trinervia	-	+	+	+	-	+	-	+	-	+
Oenanthe lachenalii	-	-	+	-	-	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	+	-	-	-	-
Persicaria lapathifolia	+	+	+	-	+	+	-	+	-	-
Persicaria lapathifolia/maculosa	-	+	+	-	-	-	-	-	-	-
Persicaria maculosa	-	-	+	+	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	+	+	-	-	-	-
Persicaria mitis	-	-	+	+	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	+	-	-	-	-	-
Physalis alkekengi	-	+	-	-	-	-	-	-	-	-
Plantago major	-	+	+	+	-	+	-	+	-	-
Poa compressa/nemoralis	-	-	+	-	-	-	-	-	-	-
Poa pratensis/trivialis	-	-	+	-	-	-	-	-	-	-
Poa sp.	-	+	+	+	+	-	-	+	-	-
Poaceae	-	+	+	-	+	+	-	+	-	-
Poaceae, lemma bases	-	-	-	+	-	-	-	-	-	-
Poaceae, stem bases	-	-	-	+	-	-	-	-	-	-
Poaceae, stems fragments	+	-	+	+	-	-	-	-	+	-
Polygonum aviculare	-	+	+	+	+	+	-	+	+	-
Prunella vulgaris	-	-	-	-	-	-	-	+	-	-

Table 3.17 part 3

site	Ypenburg		Schipluiden		Wateringen 4		Rijswijk-A4		Sion	
category	C	W	C	W	C	W	C	W	C	W
taxon										
Rumex obtusifolius	-	-	+	-	-	-	-	-	-	-
Rumex sp.	+	+	+	+	+	+	-	+	+	-
Ruppia maritima	+	+	+	+	-	-	-	-	-	-
Scrophularia nodosa	-	-	+	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	+	-	-	-	-
Senecio vulgaris	-	+	-	-	-	-	-	-	-	-
Silene dioica	-	-	+	-	-	-	-	-	-	-
Silene otites	-	-	+	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	+	-	+	-	-
Sisymbrium officinale	-	-	+	+	-	-	-	-	-	-
Solanum nigrum	-	+	+	+	+	+	-	+	+	-
Sonchus asper	-	+	+	-	-	-	-	+	-	-
Spergularia sp.	-	-	-	-	-	-	-	+	-	-
Stachys cf. sylvatica	-	-	+	-	-	-	-	-	-	-
Stellaria aquatica/media	-	-	+	+	-	-	-	-	-	-
Stellaria media	+	+	+	+	-	+	-	+	-	-
Stellaria sp.	-	-	-	+	-	+	-	+	-	-
Suaeda maritima	-	+	+	+	-	-	-	-	-	-
Thalictrum cf. flavum	-	+	-	-	-	-	-	-	-	-
Thalictrum minus	-	-	+	-	-	-	-	-	-	-
Torilis japonica	-	+	+	+	-	-	-	-	-	-
Trifolium campestre	-	-	-	+	-	-	-	-	-	-
Trifolium repens	-	-	+	+	-	-	-	-	-	-
Trifolium sp.	+	-	-	-	-	-	-	-	+	-
Urtica dioica	-	+	+	+	-	+	-	+	-	-
Valeriana dioica	-	+	-	-	-	-	-	-	-	-
Valerianella locusta	-	-	+	-	-	-	-	-	-	-
Verbena officinalis	-	-	+	-	-	-	-	-	-	-
Veronica arvensis	-	-	-	+	-	-	-	-	-	-
Veronica hederifolia	-	+	-	-	-	-	-	-	-	-
Vicia hirsuta	-	-	-	+	+	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	+	-	-	-	-	-
Vicia sativa	+	-	-	-	-	-	-	-	-	-
Vicia sp.	+	-	-	-	+	-	-	-	-	-
Viola arvensis-type	-	+	-	-	-	-	-	-	-	-
total	19	57	82	45	18	29	1	32	9	3

C = carbonised
W = waterlogged
+ = present
- = not present

Table 3.17 Ypenburg, Wateringen 4, Schipluiden, Sion and Rijswijk-A4, macroremains of potential arable weeds, part 4.

3.10.4.4 Local cultivation

The coastal sites form a separate group of sites in the discussion on local arable farming at Dutch wetland sites since the environment allowed local arable farming on a larger scale, and since the sites were excavated relatively recently, resulting in the incorporation of new research strategies. The amount of archaeobotanical and archaeological information on Rijswijk-A4 and Sion does unfortunately not allow a discussion on local arable farming for these sites.

The results from Ypenburg, Schipluiden and Wateringen 4 are very similar, comprising cereal grains of emmer and naked barley, chaff remains of naked barley, carbonised stem remains of grasses that may represent cereals, potential arable weeds and querns. These finds do not confirm or reject local crop cultivation in the region. The research at Schipluiden and Ypenburg however yielded some additional data that enable further discussion and interpretation. Firstly, use-wear analysis of flint from both sites indicated the presence of gloss in a longitudinal direction indicative of cutting cereals (Van Gijn *et al.* 2006, 154). This is a strong argument in favour of arable farming in the exploitation area. Secondly, the indications of a shift in dominance from naked barley during early occupation towards dominance of emmer wheat during later occupation at Schipluiden, correlated with a decrease in marine influence in the extra-local surroundings of the site, may be explained by local cultivation (see paragraphs 3.6.8 and 11.6.10). It is not known whether such a shift in the crop plant assemblage may have taken place at other sites in the region since for most sites it was not possible to study changes of the macroremains assemblage through time. The results from Wateringen 4 do not reject the hypothesis on the relationship between the crop assemblage and the presence of marine influence. Thirdly, the analysis of arable weeds suggests cultivation in the region (see paragraph 3.10.4.3). A final argument in favour of local cultivation at Schipluiden and possibly also for Ypenburg is the broadly supported interpretation of the site as a year-round occupied settlement. Arable farming is expected as part of the subsistence of such a site.

Summarising, the evidence from Schipluiden and the preliminary evidence from Ypenburg strongly support local arable farming because of the presence of flint with gloss in a longitudinal direction resulting from cutting of cereals, while it is not possible to solve the discussion on local arable farming for the other sites. The available botanical and non-botanical evidence from Ypenburg, Wateringen 4, Schipluiden, Rijswijk-A4 and Sion is very similar, suggesting that occupants of all sites may have practised local arable farming, either at the site or in the exploitation area. Nevertheless, the sites also show subtle differences in for example occupation intensity, subsistence based on zoological evidence and burial ritual (Louwe Kooijmans in press). These differences within the region may also have affected cultivation practices.

In addition to the presented evidence of cultivation in the region, there is an interesting feature found in the coastal region that may be relevant for the discussion on arable farming and which needs further investigation. A fine layer of charcoal has been demonstrated at several of the sites. Charcoal remains and charcoal dust is also known from other Dutch wetland sites, but in the coastal region it has been related to specific practices and it is moreover also found at sites that were not used for intensive occupation. At Schipluiden the presence of fine charcoal dust is related to the removal of vegetation (Mol *et al.* 2006, 28) but this is not further discussed nor investigated by micromorphological analysis. At Sion a comparable layer of fine charcoal was found (*ibid.*), and this is hypothetically related to the presence of arable fields (Rieffe *et al.* 2006, 255). The relevant layers at Sion were however not subjected to micromorphological analysis and pollen analysis was not possible due to poor preservation (Rieffe *et al.* 2006, 255). At Ypenburg the presence of charcoal is explicitly related to the burning of the vegetation in the local and extra-local vicinity. The micromorphological analysis from two sections furthermore suggests the disturbance of tidal deposits and peat soil that was regularly flooded. The relevant layers are interpreted as arable plots, located in a brackish or freshwater environment (Kooistra *et al.* 2002). The extent and the period of use of the plots remain however unclear. At the four locations of Wateringse Veld charcoal was found at the top of the dunes (Louwe Kooijmans in press).

The sites were not used for occupation (Bakker and Burnier 1997), which makes the charcoal even more intriguing, since it can be questioned how the dunes were used instead. The locations at Rijswijk-A4 that were not occupied may have had a similar function, as well as the second dune at Wateringen 4 that was not occupied.

3.11 Suggestions for further research

An archaeobotanical subject related to Middle Neolithic occupation in the coastal region that is still poorly understood is the development of vegetation at the dunes through time. One approach to study this subject is by extensive pollen analysis. Future excavations of occupied dunes should involve analysis of several sections or cores from single sites, with a relatively small sample interval, as well as pollen analysis from wells and watering places. Such detailed studies could reveal information on the natural vegetation of the dunes as well as on human impact on the vegetation. In addition to the reconstruction of the vegetation of the dunes, reconstruction of the development of the vegetation in the exploitation area of the sites is crucial in order to understand from where people gathered their wood resources.

The evidence of local arable farming indicates that arable fields were present in the region. It deserves our further attention whether finds that are potentially related to the presence of fields, such as the presence of fine charcoal and the indications of burning of vegetation and disturbance of the soil, are indeed related to arable farming or not. Micromorphological studies should be included in research at all major sites. The discussion of micromorphological studies should also make a comparison with control samples from the sites and discuss, if possible, the differences between the disturbance of the soil related to arable farming and other forms of disturbance.

sample	C88	C88	C88	C88	F91	G62	G62	G64	G68	G72
trench	3	3	3	3	3	3	3	3	3	3
feature	1	1	1	1	1					
layer	1	1	2	2		1	2	1	2	
context	pit, sec. fill	pit, sec. fill, q A	q A	st	st	st	st	st	st	st
volume (litre)	2	3	2	2	0.5	1	1	2	1	2
sediment	s	s	h s	s	h s	s p	h s	p s	s	s
Woodland vegetation of dry terrain										
Cornus sanguinea	-	-	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-	-	-	-
cf. Malus sylvestris	-	1 c	-	-	-	-	-	-	-	-
Prunus spinosa	1 c	1 c	-	-	-	-	-	-	-	-
Rosa sp.	1 c	-	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	-	-	cf. 5	-	5	-
Galium aparine	4 c	-	-	-	-	-	-	-	-	-
Glechoma hederacea	-	-	-	-	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-	-	-	-
Moehringia trinervia	7	-	4	2	-	-	-	-	-	-
Urtica dioica	-	-	52	++++	-	1	1	1	-	4
Ruderals and pioneers of dry terrain										
Arctium sp.	-	-	1	2	-	-	-	-	-	-
Atriplex patula/prostrata	-	-	2	-	-	-	-	-	-	-
Brassica rapa	-	-	115	++	-	-	-	-	-	-
Chenopodium album	5	++	84	+++	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	2	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	5	+	-	-	-	-	-	-
Persicaria lapathifolia	1 c	4 c	-	++	-	-	-	-	-	-
Persicaria maculosa	-	-	35	-	-	-	-	-	-	-
Persicaria maculosa/minor	1 c	-	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-	-	-
Polygonum aviculare	-	-	2	-	-	-	-	-	-	-
Solanum nigrum	-	-	10	cf. +	-	-	-	-	-	-
Stellaria media	-	-	18	++	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-	-	-	-
Crop plants										
Cerealea indet.	-	-	-	-	2 c	-	-	-	-	1 c
Hordeum vulgare	4 c	5 c	-	-	-	-	-	-	-	cf. 1 c
Hordeum vulgare, internodia	9 c	8 c	2 c	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	6 c	11 c	-	-	-	-	-	-	-	-
Triticum dicoccon	1 c	-	-	-	-	-	-	-	-	-

Table 3.8 part 1a.

sample	C88	C88	C88	C88	F91	G62	G62	G64	G68	G72
crop plants (cont.)										
Triticum dicoccon, spikelet forks	-	2 c	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	7 c	20 c	3 c	3 c	-	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-	-	-	-
Carr and marsh vegetation										
Alnus glutinosa	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	1 c	-	-	cf. 1	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	3	-	2	-	-
Carex sp., bicarpellate	1 c	-	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	1 c	-	-	-	-	-	-	-	-	-
Eupatorium cannabinum	2	-	2	1	-	1	4	-	-	1
Euphorbia palustris	-	-	-	-	-	-	1	-	-	-
Galium cf. mollugo	-	-	-	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	6	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	1	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-	-	-	-
Schoenoplectus lacustris	1 c	-	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-	-	-	-	1
Solanum dulcamara	-	-	2	-	-	-	-	-	-	-
Stachys palustris	-	-	-	-	-	-	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	-	-	-	-
Wetland pioneer vegetation										
Persicaria hydropiper	-	-	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-	-	-	-
Ranunculus sceleratus	-	-	-	+	-	-	17	-	-	-
Stellaria aquatica	-	-	39	-	-	-	-	-	-	-
Open water vegetation										
Ceratophyllum demersum	-	cf. 1 c	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-	-	-

Table 3.8 part 1b.

sample	C88	C88	C88	C88	F91	G62	G62	G64	G68	G72
Salt marsh vegetation										
cf. Apium graveolens	-	-	-	-	-	-	-	-	-	-
Suaeda maritima	-	-	-	-	-	-	-	-	-	2
Ecologically indeterminate										
cf. Bolboschoenus sp./										
cf. Schoenoplectus sp./Scirpus sp.	-	1 c	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./										
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	-	-	-
Galeopsis-type	-	-	1	1	-	-	-	-	-	-
Galium sp.	-	1 c	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-	-	-
Lamiaceae	-	-	1	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	-	-	-	-	-
Poaceae	-	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	2	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-	-	-	-
Indet.	-	-	1 c	-	-	-	-	2	-	1 c
Indet., stem fragments	-	-	-	-	-	-	-	-	-	-
Varia										
Charcoal	++	++	+++	+	+	+	+	-	+	++
Bone remains	+	+	-	+	+	-	-	-	-	-
Fish remains	+	+	+	+	+	-	-	-	-	-
Flint remains	+	-	-	-	-	-	-	-	-	-
Pottery remains	-	+	-	-	-	-	-	-	-	-
Moss remains	-	-	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
x, yc = x macroremains including y carbonised macroremains

+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present

Table 3.8 Wateringen 4, macroremains, part 1c.

sample	G76	G80	G86	G88	G91	G92	G96	G98	G100	G102
trench	3	3	3	3	3	3	3	3	3	3
feature					1					
layer										
context	st	st	st	st	posthole	st	st	st	st	st
volume (litre)	2	2	2	2	1	2	2	2	2	2
sediment	s	s	h s	h s	s	h s	h s	h s	h s	h s
Woodland vegetation of dry terrain										
Cornus sanguinea	-	-	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	-	-	-	-
Prunus spinosa	-	-	1	1 c	-	1 c	-	-	1	1 c
Rosa sp.	-	-	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	-	-	-	-	-	-
Galium aparine	-	-	-	-	-	-	-	-	-	-
Glechoma hederacea	1	-	-	-	-	-	-	2	1	1
Lapsana communis	-	-	-	-	-	-	-	-	-	-
Moehringia trinervia	24	++++	-	72	-	16	16	35	+++	40
Urtica dioica	1	-	-	2	-	1	-	-	-	2
Ruderals and pioneers of dry terrain										
Arctium sp.	-	-	-	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	1	-	-	-	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-	-	-	-	-
Chenopodium album	-	-	-	-	-	1 c	-	-	-	1
Chenopodium ficifolium	-	-	-	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	-	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	-	-	-	-
Stellaria media	-	-	-	-	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	1 c	-	-	-	-	-	-
Crop plants										
Cerealea indet.	-	-	-	1 c	-	-	2 c	-	cf. 1	cf. 1 c
Hordeum vulgare	-	-	-	-	-	-	-	-	-	-
Hordeum vulgare, internodia	1 c	-	-	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	1 c	-	-	-	-	-	-
Triticum dicoccon	-	-	-	-	-	-	-	-	-	-

Table 3.8 part 2a.

sample	G76	G80	G86	G88	G91	G92	G96	G98	G100	G102
Crop plants (cont.)										
Triticum dicoccon, spikelet forks	-	1 c	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	-	1 c	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-	-	-	-
Carr and marsh vegetation										
Alnus glutinosa	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	-	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-	-	-	-
Eupatorium cannabinum	-	1	-	-	-	-	-	-	-	1
Euphorbia palustris	1	-	-	-	-	-	-	-	-	-
Galium cf. mollugo	-	-	-	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	1 c	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	1 c	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-	-	-	-	-
Stachys palustris	-	-	-	-	-	-	-	-	-	cf. 1
Thalictrum flavum	-	-	-	-	-	-	-	-	-	-
Wetland pioneer vegetation										
Persicaria hydropiper	-	-	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-	-	-	-
Ranunculus sceleratus	-	-	-	-	-	-	-	-	-	-
Stellaria aquatica	-	-	-	-	-	-	-	-	-	-
Open water vegetation										
Ceratophyllum demersum	-	-	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-	-	-

Table 3.8 part 2b.

sample	G76	G80	G86	G88	G91	G92	G96	G98	G100	G102
Salt marsh vegetation										
cf. Apium graveolens	-	-	-	-	-	-	-	-	-	-
Suaeda maritima	-	-	-	-	-	-	1	4	-	2
Ecologically indeterminate										
cf. Bolboschoenus sp./										
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./										
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	-	1	-	-	-
Poaceae	-	-	-	-	1 c	1 c	1 c	-	1	-
Rumex sp.	-	-	-	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-	-	1
Silene sp.	-	-	-	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-	-	-
Vicia sp.	-	1 c	-	-	-	cf. 1 c	cf. 1 c	-	-	-
Indet.	-	-	-	3 c	-	+ c	2, 1 c	5 c	-	-
Indet., stem fragments	-	-	-	-	-	+ c	-	-	+	-
Varia										
Charcoal	+	+	+	++	+	++	++	++	+	++
Bone remains	-	+	-	-	+	-	-	-	-	-
Fish remains	-	-	+	+	+	-	-	-	-	-
Flint remains	-	-	-	-	-	-	-	+	-	+
Pottery remains	-	-	-	-	-	-	-	-	-	+
Moss remains	-	-	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	2	-	-	5	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 2c.

sample	G102	G106	G110	G116	G120	G126	G132	I86	N76
trench	3	3	3	3		3	3	3	7
feature	1							2	
layer				3					
context	pit	st	st	st	st	st	st	pit?	st
volume (litre)	1.5	2	2	2	2	2	2	2	2
sediment	s	s	s	h s	s	s	s	s	s
Woodland vegetation of dry terrain									
Cornus sanguinea	-	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	-	-	-
Prunus spinosa	-	1 c	-	-	-	-	-	-	-
Rosa sp.	-	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	-	-	cf. 1	-	-
Galium aparine	1 c	-	-	-	-	-	-	-	-
Glechoma hederacea	-	3	-	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-	-	-
Moehringia trinervia	-	++	+++	19	1	-	-	-	63
Urtica dioica	-	-	-	-	3	-	-	-	-
Ruderals and pioneers of dry terrain									
Arctium sp.	-	-	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	-	-	1	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-	-	-	-
Chenopodium album	2 c	2	1	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	1 c	-
Fallopia convolvulus	-	-	-	-	-	-	-	-	-
Persicaria lapathifolia	-	cf. 1 c	-	1 c	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	-	-	-
Stellaria media	-	-	-	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-	-	-
Crop plants									
Cerealea indet.	-	1 c	-	-	-	-	-	cf. 1 c	-
Hordeum vulgare	cf. 1 c	-	2 c	-	-	-	-	-	-
Hordeum vulgare, internodia	1 c	-	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-	-	-	-
Triticum dicoccon	1 c	1 c	-	-	-	-	-	-	-

Table 3.8 part 3a.

sample	G102	G106	G110	G116	G120	G126	G132	I86	N76
Crop plants (cont.)									
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	cf. 1 c	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-	-	-
Carr and marsh vegetation									
Alnus glutinosa	-	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	1	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-	-	-
Eupatorium cannabinum	1	1	2	-	15	2	10	1 c	-
Euphorbia palustris	-	2	1	-	-	1	2	-	-
Galium cf. mollugo	-	-	-	-	-	-	-	-	2 c
Galium palustre	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	2	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-	1 c	-	1 c
Solanum dulcamara	-	-	-	-	-	-	-	-	-
Stachys palustris	-	-	-	-	-	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	-	-	-
Wetland pioneer vegetation									
Persicaria hydropiper	-	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-	-	-
Ranunculus sceleratus	-	-	-	-	-	-	-	-	-
Stellaria aquatica	-	-	-	-	-	-	-	-	-
Open water vegetation									
Ceratophyllum demersum	-	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-	-

Table 3.8 part 3b.

sample	G102	G106	G110	G116	G120	G126	G132	I86	N76
Salt marsh vegetation									
cf. Apium graveolens	-	-	-	-	-	-	-	-	-
Suaeda maritima	-	1	-	-	-	-	-	-	-
Ecologically indeterminate									
cf. Bolboschoenus sp./									
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./									
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	2	-	-	-
Poaceae	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-	-	-
Indet.	-	-	-	-	1 c	-	-	-	-
Indet., stem fragments	-	-	1 c	+	-	-	-	-	-
Varia									
Charcoal	+	+	+	+	-	+	-	+++	-
Bone remains	+	-	-	+	-	-	-	++	-
Fish remains	-	-	-	+	-	-	-	+++	-
Flint remains	+	-	-	-	-	-	-	-	-
Pottery remains	-	-	+	-	-	-	-	+	-
Moss remains	-	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	1 c	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 3c.

sample	N80	N86	N90	N94	N109	O85	OO102	O105
trench	7	7		7	2		6	2
feature					16			17
layer								
context	st	st	st	st	pit, sec. fill	st	st	pit, sec. fill
volume (litre)	2	2	2	2	2		2	1
sediment	s	s	s	s	h s		s	s
Woodland vegetation of dry terrain								
Cornus sanguinea	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	1 c	-	-	-	-
cf. Malus sylvestris	-	-	1 c	-	-	-	-	-
Prunus spinosa	1 c	1 c	1 c	1 c	-	1 c	-	-
Rosa sp.	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	cf. 3	-	-	-
Galium aparine	-	1 c	-	1 c	-	-	-	-
Glechoma hederacea	-	-	1	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-	-
Moehringia trinervia	+++	15	++++	+++	-	-	+	2
Urtica dioica	-	-	2	-	7	-	++	1
Ruderals and pioneers of dry terrain								
Arctium sp.	-	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	-	-	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-	-	-
Chenopodium album	1	-	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	1 c	-	-	-	-	-
Persicaria lapathifolia	-	-	-	2 c	-	-	-	cf. 1
Persicaria maculosa	-	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-
Polygonum aviculare	-	cf. 1 c	-	-	-	-	-	-
Solanum nigrum	-	-	1 c	-	-	-	-	-
Stellaria media	-	-	-	-	-	-	-	3
Vicia hirsuta	-	1 c	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-	-
Crop plants								
Cerealea indet.	1 c	2 c	1 c	-	-	-	-	-
Hordeum vulgare	-	-	-	-	-	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-	-	-
Triticum dicoccon	-	-	-	-	-	-	-	-

Table 3.8 part 4a.

sample	N80	N86	N90	N94	N109	O85	OO102	O105
Crop plants (cont.)								
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	-	-	-	-	cf. 1 c
Triticum sp.	-	-	2 c	-	-	-	-	-
Carr and marsh vegetation								
Alnus glutinosa	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	-	1	-
Carex sp., bicarpellate	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-	-
Eupatorium cannabinum	1	-	1	1	10	-	++	2
Euphorbia palustris	-	-	-	-	-	-	1	-
Galium cf. mollugo	-	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	1
Iris pseudacorus	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	1 c	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-	-	-
Stachys palustris	-	-	-	1	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	-	-
Wetland pioneer vegetation								
Persicaria hydropiper	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	1	-	-	-	-	-
Ranunculus sceleratus	-	-	-	-	2	-	-	2
Stellaria aquatica	-	-	-	-	-	-	-	-
Open water vegetation								
Ceratophyllum demersum	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-

Table 3.8 part 4b.

sample	N80	N86	N90	N94	N109	O85	OO102	O105
Salt marsh vegetation								
cf. Apium graveolens	-	-	-	-	-	-	-	-
Suaeda maritima	1	-	3	3	-	-	1	-
Ecologically indeterminate								
cf. Bolboschoenus sp./								
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./								
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	1 c
Galeopsis-type	-	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	-	-	-
Poaceae	-	-	-	1 c	-	-	-	-
Rumex sp.	1 c	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-
Silene sp.	-	-	-	5	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	1
Stellaria sp.	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-	-
Indet.	-	1 c	-	-	-	-	-	-
Indet., stem fragments	-	-	-	-	-	-	-	-
Varia								
Charcoal	+	+	+	+	+	-	+	+
Bone remains	-	-	-	+	-	-	-	-
Fish remains	-	-	-	-	-	-	-	+
Flint remains	-	-	-	+	-	-	-	-
Pottery remains	-	-	+	+	-	-	-	-
Moss remains	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 4c.

sample	OO106	OO108	OO110	OO112	OO116	P102	P114	P120	P124
trench	6	6		6	6	2	2	2	2
feature									
layer						1		1	2
context	st	st	st	st	st	st	st	st	st
volume (litre)	2	2	2	2	2	2	2	2	2
sediment	h s	s	h s	h s	h s	h s	h s	h s	h s
Woodland vegetation of dry terrain									
Cornus sanguinea	-	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	-	-	-
Prunus spinosa	-	-	1 c	-	-	-	-	-	-
Rosa sp.	-	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	-	-	-	-	cf. 2
Galium aparine	-	-	-	-	-	-	-	-	-
Glechoma hederacea	-	-	-	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-	-	-
Moehringia trinervia	58	18	8	24	21	10	-	-	-
Urtica dioica	5	-	1	4	-	7	-	8	-
Ruderals and pioneers of dry terrain									
Arctium sp.	-	-	-	-	-	-	-	-	-
Atriplex patula/prostrata	1	-	-	-	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-	-	-	-
Chenopodium album	-	-	-	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	-	-	-
Stellaria media	-	-	-	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-	-	-
Crop plants									
Cerealea indet.	-	-	-	-	-	-	-	-	1 c
Hordeum vulgare	-	-	-	-	-	-	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-	-	-	-
Triticum dicoccon	-	-	-	-	-	-	-	-	-

Table 3.8 part 5a.

sample	OO106	OO108	OO110	OO112	OO116	P102	P114	P120	P124
Crop plants (cont.)									
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	-	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-	-	-
Carr and marsh vegetation									
Alnus glutinosa	-	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	1	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-	-	-
Eupatorium cannabinum	10	2	1	16	4	2	-	-	-
Euphorbia palustris	1	-	1	1	2	-	-	-	-
Galium cf. mollugo	-	-	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	1	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-	-	-	-
Stachys palustris	-	-	-	-	1	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	-	-	-
Wetland pioneer vegetation									
Persicaria hydropiper	-	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-	-	-
Ranunculus sceleratus	-	-	-	-	-	-	-	-	-
Stellaria aquatica	-	-	-	-	-	-	-	-	-
Open water vegetation									
Ceratophyllum demersum	-	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-	-

Table 3.8 part 5b.

sample	OO106	OO108	OO110	OO112	OO116	P102	P114	P120	P124
Salt marsh vegetation									
cf. Apium graveolens	-	-	-	-	-	-	-	-	-
Suaeda maritima	3	1	-	3	2	-	-	-	-
Ecologically indeterminate									
cf. Bolboschoenus sp./									
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./									
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	1	-	-	-	-	11	-
Poaceae	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-	-	-
Indet.	-	-	-	-	-	-	2 c	1 c	-
Indet., stem fragments	-	-	-	-	-	-	-	-	-
Varia									
Charcoal	+	+	+	+	+	+	+	+	+
Bone remains	-	-	-	-	-	-	-	-	-
Fish remains	-	-	-	+	-	-	-	-	-
Flint remains	-	-	-	-	-	-	-	-	-
Pottery remains	-	-	-	-	-	-	-	-	-
Moss remains	-	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 5c.

sample	P126	P130	P132	P134	P136	QQ112	TT77
trench	2	2	2	2	2	6	1
feature						1	1
layer	1		2	2	2		2
context	st	st	st	st	st	unlined well, sec. fill	watering place
volume (litre)	2	1	2	1	2	2	2
sediment	h s	p s	h s	h s	h s	s	h s
Woodland vegetation of dry terrain							
Cornus sanguinea	-	-	-	-	-	-	1
Corylus avellana	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	1
Prunus spinosa	-	-	-	-	-	-	1
Rosa sp.	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	2
Sambucus nigra	-	-	cf. 3	cf. 1	cf. 2	-	8
Galium aparine	-	-	-	-	-	-	-
Glechoma hederacea	-	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-
Moehringia trinervia	-	-	1	-	3	2	16
Urtica dioica	-	-	12	2	2	1	42
Ruderals and pioneers of dry terrain							
Arctium sp.	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	1	-	-	1	-	2
Brassica rapa	-	-	-	-	-	-	-
Chenopodium album	-	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	2
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	-	-	10
Persicaria maculosa	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	8
Plantago major	-	-	-	-	-	-	2
Polygonum aviculare	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	2
Stellaria media	-	-	-	-	-	-	8
Vicia hirsuta	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-
.							
Crop plants							
Cerealea indet.	-	-	-	-	-	-	-
Hordeum vulgare	-	-	-	-	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-	-
Triticum dicoccon	-	-	-	-	-	-	-

Table 3.8 part 6a.

sample	P126	P130	P132	P134	P136	QQ112	TT77
Crop plants (cont.)							
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-
Carr and marsh vegetation							
Alnus glutinosa	-	-	-	-	-	-	102
Alnus glutinosa, cones	-	-	-	-	-	-	5
Alnus glutinosa, buds	-	-	-	-	-	-	+
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	1
Alopecurus geniculatus	-	-	-	-	-	-	2
Bolboschoenus maritimus	-	-	-	-	1	-	-
Carex acutiformis	-	-	-	-	-	-	cf. 32
Carex riparia	-	-	-	-	-	-	-
Carex sp.	-	4	-	1	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	6
Carex sp., tricarpellate	-	-	-	-	-	-	2
Eupatorium cannabinum	-	-	-	1	1	-	7
Euphorbia palustris	-	2	-	1	1	1	11
Galium cf. mollugo	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	2
Lychnis flos-cuculi	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	4
Lythrum salicaria	-	-	-	-	-	-	6
Phragmites australis, stem fragments	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-	4
Stachys palustris	-	-	-	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	4
Wetland pioneer vegetation							
Persicaria hydropiper	-	-	-	-	-	-	22
cf. Persicaria minor	-	-	-	-	-	-	-
Ranunculus sceleratus	-	-	2	3	22	-	280
Stellaria aquatica	-	-	-	-	-	-	-
Open water vegetation							
Ceratophyllum demersum	-	-	-	-	-	-	cf. 2
Potamogeton sp.	-	-	-	1	-	-	-

Table 3.8 part 6b.

sample	P126	P130	P132	P134	P136	QQ112	TT77
Salt marsh vegetation							
cf. Apium graveolens	-	-	-	-	-	-	-
Suaeda maritima	-	-	-	-	-	-	-
Ecologically indeterminate							
cf. Bolboschoenus sp./							
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./							
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	+
Lamiaceae	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	1	1	1	-	-
Poaceae	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	1	-	-	-
Vicia sp.	-	-	-	-	-	-	-
Indet.	1 c	-	-	-	-	-	-
Indet., stem fragments	-	-	-	-	-	-	-
Varia							
Charcoal	+	+	+	+	+	+	+
Bone remains	-	-	+	+	-	+	+
Fish remains	-	-	-	-	-	-	+
Flint remains	-	-	-	-	-	-	-
Pottery remains	-	-	-	-	-	-	-
Moss remains	-	-	-	-	-	-	+
Daphnia sp., ephihippia	-	-	-	-	-	-	++++
Cerastoderma sp.	-	-	-	-	-	-	+
Macoma balthica	-	-	-	-	-	-	+
Mytilis edulis	-	-	-	-	-	-	+
Radix peregra	-	-	-	-	-	-	+
Caenococcum geophilum	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
x, yc = x macroremains including y carbonised macroremains

+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present

Table 3.8 Wateringen 4, macroremains, part 6c.

sample	UU115	UU119	WW112	XX76	XX78	XX78	XX82
trench		1			1	1	1
feature	1	1					
layer					1	2	2
context	unlined well, prim. fill	unlined well, old surface	st	st	st	st	st
volume (litre)	3	2	2	2	1	1	1
sediment	s	h s	h s	p s	s p	h s	h s
Woodland vegetation of dry terrain							
Cornus sanguinea	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	-
Prunus spinosa	-	6, 2 c	-	-	-	-	-
Rosa sp.	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	cf. 5	-	cf. 4	cf. 11
Galium aparine	3 c	-	-	-	-	-	-
Glechoma hederacea	-	+	-	-	-	-	1
Lapsana communis	-	1	-	-	-	-	-
Moehringia trinervia	+	++++	+	1	-	-	6
Urtica dioica	++++	++	-	-	-	4	6
Ruderals and pioneers of dry terrain							
Arctium sp.	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	+	-	-	10	-	-
Brassica rapa	-	-	-	-	-	-	-
Chenopodium album	+	-	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	++	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-	-
Solanum nigrum	+	-	-	-	-	-	-
Stellaria media	-	cf. +	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-
Crop plants							
Cerealea indet.	-	-	-	-	-	-	-
Hordeum vulgare	4 c	2 c	-	-	-	-	1 c
Hordeum vulgare, internodia	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-	-
Triticum dicoccon	1 c	-	-	-	-	-	-

Table 3.8 part 7a.

sample	UU115	UU119	WW112	XX76	XX78	XX78	XX82
Crop plants (cont.)							
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	1 c	-	-	-	-	-	-
Triticum sp.	-	-	-	-	-	-	-
Carr and marsh vegetation							
Alnus glutinosa	-	-	-	-	-	-	-
Alnus glutinosa, cones	1 c	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-
Carex acutiformis	-	cf. 1	-	-	1	-	-
Carex riparia	-	-	-	-	6	-	-
Carex sp.	-	-	-	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-
Eupatorium cannabinum	-	-	-	-	2	2	-
Euphorbia palustris	-	-	-	-	15	-	-
Galium cf. mollugo	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-
Lycopus europaeus	-	+	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-
Phragmites australis, stem fragments	+ c	-	-	-	-	-	-
Phragmites sp./Poa sp.	2 c	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	1	-	-	10	-	-	-
Solanum dulcamara	-	+	-	-	-	-	-
Stachys palustris	-	1	-	-	-	-	-
Thalictrum flavum	-	-	-	-	-	-	-
Wetland pioneer vegetation							
Persicaria hydropiper	-	++	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-
Ranunculus sceleratus	-	+	-	140	-	86	43
Stellaria aquatica	-	-	-	-	-	-	-
Open water vegetation							
Ceratophyllum demersum	cf. 1	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-

Table 3.8 part 7b.

sample	UU115	UU119	WW112	XX76	XX78	XX78	XX82
Salt marsh vegetation							
cf. Apium graveolens	-	-	-	-	-	-	-
Suaeda maritima	-	-	-	-	-	-	-
Ecologically indeterminate							
cf. Bolboschoenus sp./							
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-
Cerastium sp.	-	cf. 1	-	-	-	-	-
Fallopia sp./Persicaria sp./							
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	-	-
Poaceae	-	-	-	-	-	-	-
Rumex sp.	-	++	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-
Silene sp.	-	++	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-
Stellaria sp.	+	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-
Indet.	-	-	2 c	1	-	-	-
Indet., stem fragments	-	-	-	-	-	-	-
Varia							
Charcoal	+++	++	++	+	+	+	+
Bone remains	+	+	-	-	-	-	-
Fish remains	++	-	-	-	-	-	-
Flint remains	-	-	-	-	-	-	-
Pottery remains	-	-	-	-	-	-	-
Moss remains	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	2	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 7c.

sample	XX82	XX86	XX90	XX92	XX94	XX96	XX102	XX106
trench	1	1		1	1			
feature								
layer	2							
context	st	st	st	st	st	st	st	st
volume (litre)	1	2	2	1	2	2	2	2
sediment	h s	h s	h s	h s	h s	h s	h s	h s
Woodland vegetation of dry terrain								
Cornus sanguinea	-	-	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-	-	-
Prunus spinosa	1 c	-	-	-	1 c	-	1 c	1 c
Rosa sp.	-	-	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-	-	-
Sambucus nigra	-	-	-	-	-	-	-	-
Galium aparine	-	-	-	-	cf. 2 c	-	-	-
Glechoma hederacea	-	-	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-	-	-
Moehringia trinervia	-	-	+++	25	34	+++	++	++++
Urtica dioica	4	4	1	2	-	-	1	-
Ruderals and pioneers of dry terrain								
Arctium sp.	-	-	-	-	-	-	-	-
Atriplex patula/prostrata	-	-	-	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-	-	-
Chenopodium album	-	-	1	-	-	-	-	-
Chenopodium ficifolium	-	-	-	-	-	cf. 1 c	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	1 c	1 c	-	-
Persicaria maculosa	-	-	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-	-	-
Stellaria media	-	-	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-	-	-
Crop plants								
Cerealea indet.	-	-	cf. 1 c	-	-	-	-	1 c
Hordeum vulgare	-	-	-	-	1 c	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	1 c	-	-	-	-
Triticum dicoccon	-	-	-	-	-	-	-	-

Table 3.8 part 8a.

sample	XX82	XX86	XX90	XX92	XX94	XX96	XX102	XX106
Crop plants (cont.)								
Triticum dicoccon, spikelet forks	-	-	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	-	-	1 c	-	-	-
Triticum sp.	-	-	-	-	-	-	-	-
Carr and marsh vegetation								
Alnus glutinosa	-	-	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-	-	-
Eupatorium cannabinum	3	-	-	1	-	-	-	-
Euphorbia palustris	-	1	-	-	-	-	-	-
Galium cf. mollugo	-	-	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-	-	-
Poa sp.	-	-	-	-	1 c	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	1 c	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-	-	-
Stachys palustris	-	-	-	-	-	-	-	-
Thalictrum flavum	-	1	-	-	-	-	-	-
Wetland pioneer vegetation								
Persicaria hydropiper	-	-	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-	-	-
Ranunculus sceleratus	1	-	-	-	-	-	-	-
Stellaria aquatica	-	-	-	-	-	-	-	-
Open water vegetation								
Ceratophyllum demersum	-	-	-	-	-	-	-	-
Potamogeton sp.	-	-	-	-	-	-	-	-

Table 3.8 part 8b.

sample	XX82	XX86	XX90	XX92	XX94	XX96	XX102	XX106
Salt marsh vegetation								
cf. Apium graveolens	-	-	-	-	-	-	-	-
Suaeda maritima	1	2	1	3	-	-	-	-
Ecologically indeterminate								
cf. Bolboschoenus sp./								
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-	-	-
Fallopia sp./Persicaria sp./								
Polygonum sp./Rumex sp.	-	-	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-	-	-
Mentha aquatica/arvensis	-	1	-	-	-	-	-	-
Poaceae	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-	-
Solanum sp.	-	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-	-	-
Indet.	-	-	-	-	-	1 c	-	-
Indet., stem fragments	-	-	-	+ c	-	-	-	-
Varia								
Charcoal	++	+	++	+	+	+	+	+
Bone remains	+	-	+	+	-	+	-	+
Fish remains	-	-	-	-	-	-	-	-
Flint remains	+	-	+	-	-	-	-	+
Pottery remains	-	-	-	-	+	+	-	-
Moss remains	-	-	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-	-	-
Mytilis edulis	-	-	-	-	-	-	-	-
Radix peregra	-	-	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 8c.

sample	XX110	YY102	YY120	YY120		
trench	1	1		1	5	5
feature		1	1	1		
layer					1	2
context	st	unlined well, old surface	unlined well, sec. fill	unlined well	st	st
volume (litre)	2	2	2	2	1	1
sediment	s	s	h s	s	s p	s
Woodland vegetation of dry terrain						
Cornus sanguinea	-	-	-	-	-	-
Corylus avellana	-	-	-	-	-	-
cf. Malus sylvestris	-	-	-	-	-	-
Prunus spinosa	-	-	cf. 1 c	-	-	-
Rosa sp.	-	-	-	-	-	-
Rubus caesius	-	-	-	-	-	-
Sambucus nigra	-	-	-	cf. 1	-	+
Galium aparine	-	-	2 c	-	-	-
Glechoma hederacea	-	-	-	-	-	-
Lapsana communis	-	-	-	-	-	-
Moehringia trinervia	++	1	++	15	-	-
Urtica dioica	++	5	-	1	3	-
Ruderals and pioneers of dry terrain						
Arctium sp.	-	-	-	-	-	-
Atriplex patula/prostrata	-	-	-	-	-	-
Brassica rapa	-	-	-	-	-	-
Chenopodium album	-	5	++	-	-	-
Chenopodium ficifolium	-	-	++	-	-	-
Chenopodium glaucum/rubrum	-	-	-	-	-	-
Chenopodium sp./Stellaria sp.	-	-	-	-	-	-
Fallopia convolvulus	-	-	-	-	-	-
Persicaria lapathifolia	-	-	-	-	-	-
Persicaria maculosa	-	-	-	-	-	-
Persicaria maculosa/minor	-	-	-	-	-	-
Plantago major	-	-	-	-	-	-
Polygonum aviculare	-	-	-	-	-	-
Solanum nigrum	-	-	-	-	-	-
Stellaria media	-	-	-	-	-	-
Vicia hirsuta	-	-	-	-	-	-
Vicia hirsuta/tetrasperma	-	-	-	-	-	-
Crop plants						
Cerealea indet.	-	-	-	-	-	-
Hordeum vulgare	-	-	7 c	-	-	-
Hordeum vulgare, internodia	-	-	-	-	-	-
Hordeum sp./Triticum sp.	-	-	-	-	-	-
Triticum dicoccon	-	-	2 c	-	-	-

Table 3.8 part 9a.

sample	XX110	YY102	YY120	YY120		
Crop plants (cont.)						
Triticum dicoccon, spikelet forks	-	-	-	-	-	-
Triticum dicoccon, glume bases	-	-	1 c	-	-	-
Triticum sp.	-	-	-	-	-	-
Carr and marsh vegetation						
Alnus glutinosa	-	-	-	-	-	-
Alnus glutinosa, cones	-	-	-	-	-	-
Alnus glutinosa, buds	-	-	-	-	-	-
Alnus glutinosa, fragments male catkins	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-
Bolboschoenus maritimus	-	-	-	-	-	-
Carex acutiformis	-	-	-	-	-	-
Carex riparia	-	-	-	-	-	-
Carex sp.	-	-	-	-	-	-
Carex sp., bicarpellate	-	-	-	-	-	-
Carex sp., tricarpellate	-	-	-	-	-	-
Eupatorium cannabinum	2	-	-	2	-	+
Euphorbia palustris	-	-	-	-	1	-
Galium cf. mollugo	-	-	-	-	-	-
Galium palustre	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-
Hypericum sp.	-	-	-	-	-	-
Iris pseudacorus	-	-	-	-	-	-
Lychnis flos-cuculi	-	-	-	-	-	-
Lycopus europaeus	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-
Phragmites australis, stem fragments	-	-	-	-	-	-
Phragmites sp./Poa sp.	-	-	-	-	-	-
Poa sp.	-	-	-	-	-	-
Schoenoplectus lacustris	-	-	-	-	-	-
Schoenoplectus tabernaemontani	-	-	-	-	-	-
Solanum dulcamara	-	-	-	-	-	-
Stachys palustris	-	-	-	-	1	-
Thalictrum flavum	-	-	-	-	-	-
Wetland pioneer vegetation						
Persicaria hydropiper	-	-	-	-	-	-
cf. Persicaria minor	-	-	-	-	-	-
Ranunculus sceleratus	-	-	-	-	-	++
Stellaria aquatica	-	-	-	-	-	-
Open water vegetation						
Ceratophyllum demersum	-	-	2 c	-	-	-
Potamogeton sp.	2	-	-	-	-	-

Table 3.8 part 9b.

sample	XX110	YY102	YY120	YY120		
Salt marsh vegetation						
cf. Apium graveolens	-	-	1 c	-	-	-
Suaeda maritima	1	-	-	-	-	-
Ecologically indeterminate						
cf. Bolboschoenus sp./						
cf. Schoenoplectus sp./Scirpus sp.	-	-	-	-	-	-
Cerastium sp.	-	-	-	-	-	-
Fallopia sp./Persicaria sp./						
Polygonum sp./Rumex sp.	-	-	-	-	-	-
Galeopsis-type	-	-	-	-	-	-
Galium sp.	-	-	-	-	-	-
Juncus sp.	-	-	-	-	-	-
Lamiaceae	-	-	-	-	-	-
Mentha aquatica/arvensis	-	-	-	-	-	-
Poaceae	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-
Scrophularia sp./Verbascum sp.	-	-	-	-	-	-
Silene sp.	-	-	-	2	-	-
Solanum sp.	-	-	-	-	-	1
Stellaria sp.	-	3	-	-	-	-
Thalictrum sp.	-	-	-	-	-	-
Vicia sp.	-	-	-	-	-	-
Indet.	-	-	-	-	-	-
Indet., stem fragments	-	-	-	-	-	-
Varia						
Charcoal	+	+	+++	+	-	+
Bone remains	-	-	+	+	-	-
Fish remains	-	+	+	+	-	-
Flint remains	-	-	-	-	-	-
Pottery remains	-	-	+	-	-	-
Moss remains	-	-	-	-	-	-
Daphnia sp., ephihippia	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	-
Macoma balthica	-	-	-	-	-	-
Mytilis edulis	-	1	-	-	-	-
Radix peregra	-	-	-	-	-	-
Caenococcum geophilum	-	-	-	-	-	-
Daldinia concentrica	-	-	-	-	-	-

prim. = primary
sec. = secondary
st = standard
q = quadrant
s = sand
h s = humic sand
s p = sandy peat
p s = peaty sand
c = carbonised
+ = few (1-10)
++ = some tens (10-49)
+++ = many tens (50-99)
++++ = some hundreds (100-499)
*+ = some thousands (1000-5000)
- = not present
x, yc = x macroremains including y carbonised macroremains

Table 3.8 Wateringen 4, macroremains, part 9c.