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Ancestral heaths : reconstructing the barrow landscape in the central and southern Netherlands

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Environmental research on barrows, an overview so far

In this chapter an overview of previous environmental barrow research is given. This chapter starts with a general overview of the Holocene vegetation history of the Netherlands, followed by a more specific overview of environmental barrow research.

2.1 The vegetation history of the Netherlands in the Holocene

Before looking into detail at barrow landscapes it is useful to provide a sketch of the regional vegetation development during the second part of the Holocene (from the Subboreal period onwards), the period in which barrows were built. This vegetation development is mostly derived from pollen records preserved in peat and lake sediments. The following vegetation development will focus on the central and southern Netherlands, this research's area of interest (see section 3.2).

The Holocene is divided into periods based on artefact remains, the vegetation history of the Holocene, however, is divided into climatic zones based on peat stratigraphy (Blytt-Sernander) and on data from pollen cores. Three separate pollen zone descriptive schemes (formulated individually by Firbas, Jessen/Iversen, and the *Rijksgeologische Dienst* [RGD, the Dutch State Geological Service]) are commonly used to describe the Holocene vegetation development in the Netherlands (see table 2.1).

The first barrows were built during the Subboreal period. A deciduous forest dominated the Netherlands during the preceding Atlantic period. *Quercus*, *Tilia*, *Ulmus* and *Corylus* were the main forest species in the drier regions, with also *Fraxinus* increasing its presence throughout this period. In the wetter areas *Alnus* was the dominant species. *Pinus*, a coniferous tree that had been present in large numbers in the preceding periods, rapidly decreased during the Atlantic and was almost absent in the Netherlands.

During the Subboreal, which correlates with the Neolithic and the Bronze Age for most of the Netherlands and pollen zone VIII (in the schemas of Firbas and Iversen), several changes in vegetation occurred. At its start there is a decline of *Ulmus*. In large parts of Northwest Europe this was a very rapid decline, also referred to as the *Ulmus* fall. This decline was not as pronounced in the Netherlands, but still a decrease of a few percentages that can be seen with respect to the Atlantic. *Tilia* also decreased and almost disappeared at the end of the Subboreal, a process that started in the north of the Netherlands and proceeded to the middle and south of the Netherlands (Waterbolk 1954). This period is also characterised by the appearance of *Fagus*. The Subboreal is also the period where man seriously started to interfere with the landscape. The character of the vegetation changed. Natural forests were cleared for agricultural activities. In some places the forest could recover, but in others a *Calluna*-heath established

years (cal BC)	Archaeological period	Blytt Sernander	Firbas (1949)	Jessen/Iversen (1935-1941)	RGD	Vegetation development according to general pollen diagrams			
AD 1500	Modern History	Subatlantic	X	IX	Vb2	Anthropogenic indicators increase			
AD 500	Medieval Period		IX				IX	Vb1	<i>Fagus</i> >5% <i>Carpinus</i> >1%
12	Roman Period				IX	IX		Va	<i>Fagus</i> >5% <i>Carpinus</i> <1%
250	Late Iron Age								
500	Middle Iron Age								
800	Early Iron Age		Subboreal		VIII	VIII	IVb	<i>Fagus</i> >1%) <i>Tilia</i> decreases	
1100	Late Bronze Age								
1500	Middle BA B								
1800	Middle BA A								
2000	Early Bronze Age	VIII		VIII			IVa	<i>Ulmus</i> decreases (<5%) <i>Fagus</i> increases Increase anthropogenic indicators	
2500	Late Neolithic B								
2900	Late Neolithic A	Atlantic	VII	VII	III	<i>Quercus, Ulmus, Tilia</i> and <i>Alnus</i> dominant <i>Pinus</i> decreases			
3750	Middle Neolithic								
4200	Early Neolithic								
4900		Atlantic	VI	VII	III	<i>Quercus, Ulmus, Tilia</i> and <i>Alnus</i> dominant <i>Pinus</i> decreases			
7000	Mesolithic								
8000							Boreal	Vb	VI
		Va	V	<i>Pinus</i> dominant, but decreasing <i>Quercus, Ulmus, Corylus</i> increase					
		Preboreal	IV	IV	I	<i>Pinus</i> and <i>Betula</i> dominant			
10000									

itself. Natural forests alternated with a cultivated landscape, such as fields, pasture land and settlements.

The Subatlantic period that followed the Subboreal started around 800 cal BC (when the Subboreal climate deteriorated) and continues to the present day. *Fagus* and *Carpinus* expanded and *Quercus* declined. *Tilia* and *Ulmus* have almost disappeared. Herbs became more prevalent, which seemed to be favoured by human influence. *Artemisia*, *Plantago*, Cerealia and grasses gained importance. In the early Middle Ages, also known as the Dark Ages, the vegetation changed. After the fall of the Western Roman Empire, during the Migration Period (300-600 cal AD), human pressure on the vegetation seemed to lessen. Forests were able to recover in the South and Southeast of the Netherlands, while a concurrent decline of human influence was almost absent in the northern Netherlands (Janssen and Ten Hove 1971, Renes 1988, Bunnik 1999). For example in the loess area in the Netherlands between the Rhine and the Meuse *Corylus* and *Quercus* could expand first, succeeded by *Fagus* and *Carpinus*. In the wetter areas *Alnus* was able to expand enormously (Bunnik 1999). During the Merovingian and Carolingian dynasty (ca. 600-900 cal AD) human cultivation activities increased again and in the late Medieval Period most of the natural forest had disappeared due to forest clearing. Due to (agri-) cultural activities, the soil impoverished and *Calluna*-heath could establish itself at great scale. The heath was exploited (grazing, sod cutting, etc.) and was therefore able to expand. From the 16th century onwards the forest was able to regenerate, mostly due to the planting of trees. *Pinus* was planted in enormous amounts in the 19th century, and at present Dutch forests consist of about 20% deciduous forest, 20% coniferous forest and 50% of mixed forest. (Waterbolk 1954, Janssen 1974, Berendsen 2004, Bastiaens and Deforce 2005).

2.2 Environmental research on barrows

2.2.1 An overview

There are several ways to investigate the prehistoric landscape in which the barrows were situated. The appearance of a landscape is for a great deal determined by the vegetation that is in it. No understanding of a barrow landscape can be considered complete without knowledge of its vegetation. Palynological analysis is a common way of reconstructing a landscape's vegetation in the past. In an ideal scenario pollen analysis can be applied to a deposit that has accumulated over time, such as peat or lake mud. The pollen rain that precipitated on the surface was embedded in the deposit as it built up. In this way the peat or the sediment in a lake became an archive of vegetation history for the surrounding area. When pollen precipitates onto a soil surface there is no incorporation by layers built on top of the surface and it is very likely that pollen grains on the surface will be corroded or washed away. However, after construction of a barrow, the surface containing the pollen precipitation was covered and protected from the air, reducing microbiological activity and thus corrosion of the pollen grains. In addition, the tumulus will prevent new pollen from precipitating on the old surface. The old surface under the barrow is often still recognizable as a darker layer and can be sampled for pollen analysis. Besides the old surface, the sods of which the barrow is constructed are also suitable for pollen analysis, since they also contain the upper part of the soil profile (Waterbolk 1954, van Zeist 1967b). This topic will be treated more fully in Chapter 4.

Table 2.1. An overview of commonly used pollen zones for the Holocene period and the general vegetation development in the central and southern Netherlands per zone. RGD= Rijks Geologische Dienst.

Soils in Neolithic barrows were first investigated in Denmark by Müller and Sarauw (Müller 1884, Sarauw 1898). As mentioned in Chapter 1, van Giffen initiated investigations into the environmental aspects concerning barrows in the Netherlands and the first pollen analysis of barrows dates from before World War II. The ideas of van Giffen were carried out and improved upon by Waterbolk (1954). The barrow database, and barrow interpretations, was later enlarged through contributions made by van Zeist (1955), and Groenman-van Waateringe and Casparie (1980). Barrow palynology was practiced mainly in the Netherlands, although barrows in regions outside the Netherlands were also subjected to palynological analyses. For example in Belgium barrows were palynologically investigated by Groenman-van Waateringe (1977) and van Zeist (1963), and in Denmark by Andersen (1988); Averdieck (1980) and Groenman-van Waateringe (1979) investigated several barrows in Germany, Dimbleby and Evans (1974) in England and Groenman-van Waateringe (1983) in Ireland. Knowledge and ideas about barrows and their environment have evolved during the last century. These developments will be discussed in the coming sections.

2.2.2 Pollen analyses for dating purposes

Palynology was at first primarily used to date peat and sediment sequences. A general reference pollen diagram representing the vegetation history of the Netherlands during the Holocene, based on pollen data from mainly peat and lake deposits, can be divided into pollen zones (see table 2.1). Pollen spectra from undated sediment layers can often be fitted into a certain pollen zone and thus be linked to a certain time period. This method of dating is most reliable when multiple pollen spectra or a local pollen diagram is provided instead of a single pollen spectrum in order to create as much overlap with the reference pollen diagram as possible. In addition, this technique was extended to the dating of various archaeological objects and sites. An object that was found embedded in a sediment can be linked to a certain depth in the pollen diagram obtained from this sediment and therefore to a certain age, when the exact original location of the object in the sediment is known.

Palynological dating has also been applied to barrow research. When grave goods are absent, dating a barrow is difficult. When Waterbolk first derived palynological data from the old surfaces beneath numerous barrows in the Netherlands, they were used for dating purposes. Two barrows near Apeldoorn, extensively described and discussed in Chapter 8 of this thesis, were first palynologically dated to a pollen zone known to be contemporaneous to the Iron Age. This dating was later confirmed by the radiocarbon dating of charcoal from the ring ditches surrounding the barrows (see Chapter 8). However, dating barrows using palynological data has not always been completely accurate. For example, a large group of barrows at Toterfout-Halve Mijl has been chronologically ordered mostly based on their pollen spectra by Waterbolk (1954). Bourgeois, however, has shown that the chronological sequence of these barrows should probably be different, on the basis of radiocarbon dates and the surrounding features (Bourgeois 2013; see also Chapter 11).

Dating by palynological analysis is a form of relative dating, since chronologic checkpoints from other sources are needed. Presently, absolute dating methods like radiocarbon dating and OSL dating have displaced palynological dating to all intents and purposes. However, the method still finds application on occasion, when no datable material is available.

2.2.3 The reconstruction of local vegetation: regional and cultural differences

Besides dating, pollen data have also been used to reconstruct vegetation in the vicinity of the barrows at the time the barrows were built, providing information on the agricultural systems used by prehistoric man. In addition, these palynological analyses were used to show differences in land use (Waterbolk 1954, Van Zeist 1959, 1967a). Two different agricultural systems– the Iversen landnam and Troels-Smith landnam– can be distinguished during the Neolithic. These types of land use are named after the two Danish scientists who first described them. The Iversen landnam is a Neolithic land occupation phase (in the Middle Neolithic B), describing the clearance of the primeval forest by burning and cutting trees. The Iversen landnam was first described by Iversen (1941, 1973), based on the results of palynological analyses of Danish small lakes. The Iversen landnam consists of three phases, which can be recognised in the pollen diagrams as follows:

Phase 1: The first phase represents the actual forest clearance by cutting and burning: at first *Ulmus* declines, followed by the decrease of *Tilia* and *Quercus*. The pioneer tree *Betula* shows an increase.

Phase 2: This phase corresponds with the agricultural phase, involving grazing and crop cultivation. Anthropogenic and grazing indicators show a maximum; particularly *Plantago lanceolata*, but also Cerealia, Poaceae and *Rumex acetosella*.

Phase 3: The third phase represents the abandonment of the pastures and fields, allowing regeneration of the forest. This is shown by a maximum of *Corylus*, the increase of mainly *Quercus*, *Fraxinus* and *Tilia* and the decrease of *Betula*. Anthropogenic and grazing indicators decrease and disappear almost completely.

Troels-Smith introduced a second type of Neolithic occupation in Denmark, prior to the Iversen landnam (Troels-Smith 1953). He found various agricultural indicators, such as cereal pollen, contemporaneous with the *Ulmus* decline (around 3750 cal BC, see table 2.1). Troels-Smith suggested that the fall of the elm curve reflected pollarding of the trees for the purpose of cattle fodder. Together with the absence of pastures, deduced from very small numbers of *Plantago lanceolata*, Troels-Smith concluded that a farmer culture existed preceding the Iversen landnam, mainly based on small-scale arable farming with livestock kept within enclosures throughout the year.

The investigations and interpretations offered by Iversen and Troels-Smith triggered similar investigations in the Netherlands. In pollen diagrams derived from peats in the province of Drenthe (in the north of the Netherlands) named Bargerroosterveen, Emmen and Nieuw-Dordrecht, the two types of landnam were shown to have occurred (Van Zeist 1959, 1967a). In the period between ca. 3700 cal BC and 2800 cal BC the *Ulmus* decline can be seen, together with low percentages of *Plantago lanceolata*. The data reflect the type of land use described by Troels-Smith, characterised by small forest clearances and cattle kept within enclosures. In the period after ca. 2800 cal BC an increase of *Plantago lanceolata* can be observed, signalling the Iversen-landnam, with rather large cleared forest areas mostly used for grazing.

Van Zeist compared these pollen diagrams with spectra from Neolithic grave monuments. Grave monuments from three Neolithic cultures were investigated: megalithic tombs built by people from the oldest culture, the Funnel Beaker Culture (FB) (ca. 3400-2900 cal BC, van den Broeke *et al.* 2005, 28) and barrows built by people belonging to the later Protruding Foot Beaker Culture (PFB) (ca. 2900-2500 cal BC, van den Broeke *et al.* 2005, 28) and the Bell Beaker Culture

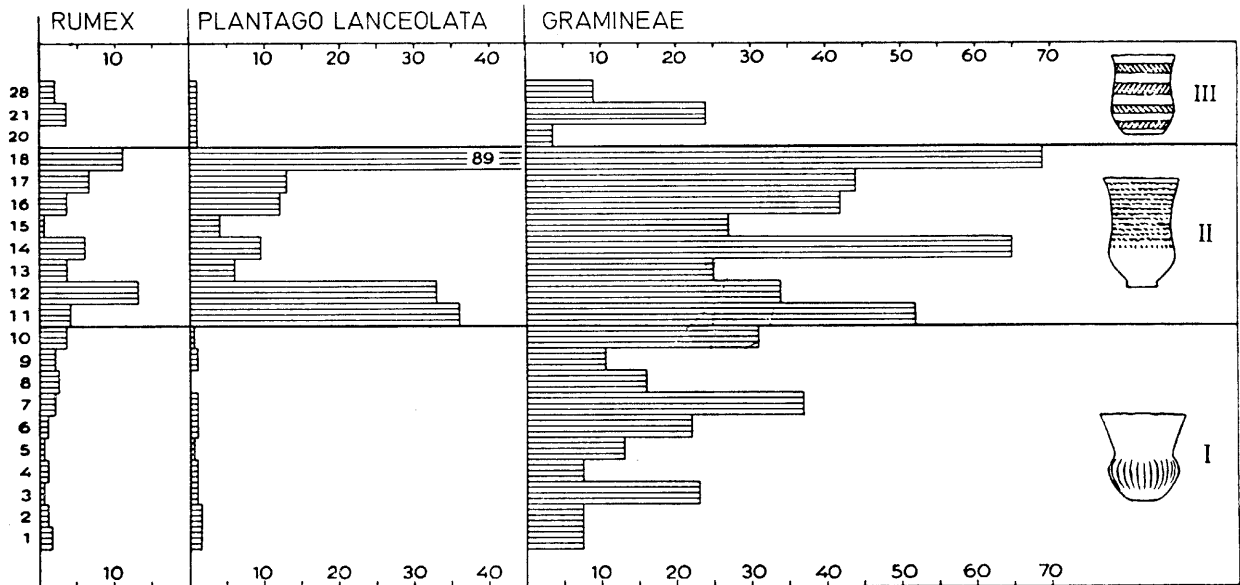


Figure 2.1. Cultural differences shown in barrow pollen spectra. I= Funnel Beaker Culture, II= Protruding Foot Beaker Culture, III= Bell Beaker Culture. Figure after van Zeist (1959, figure 11).

(BB) (ca. 2500-2000 cal BC, van den Broeke *et al.* 2005, 28). Pollen spectra from the FB grave monuments showed low values of *Plantago lanceolata*, *Rumex* and Poaceae, indicating a Troels-Smith landnam. Pollen spectra from the PFB burial mounds showed in general high percentages of *Plantago lanceolata*, *Rumex* and Poaceae, corresponding to the Iversen landnam. Pollen spectra from the BB mounds were very similar to those of the FB, characteristic of the Troels-Smith landnam. Van Zeist ascribed the Troels-Smith phase in the Bargerroosterveld diagram between ca. 3700 cal BC and ca. 2800 cal BC and the Funnel Beaker Culture and the Iversen phase after ca. 2800 cal BC to the Protruding Foot Beaker Culture (see figure 2.1). The Troels-Smith landnam used by the farmers of the Bell Beaker Culture was not shown in the Bargerroosterveld diagram. Van Zeist explained this by the dominating activities of the people of the Protruding Foot Beaker Culture (Van Zeist 1959).

Waterbolk also noted in his thesis that the maxima of herbs (like *Plantago*, *Rumex*, Poaceae, *Dryopteris*-type, Asteraceae and Caryophyllaceae) he found in the pollen spectra from barrows must have been caused by activities of the Corded Ware Culture, also known as the Protruding Foot Beaker Culture, who apparently practised an Iversen landnam (Waterbolk 1954).

For the Early and Middle Bronze Age Period van Zeist suggested a difference in farming practice between the north and the south of the Netherlands, based on the pollen spectra from barrows (Van Zeist 1967a). In the northern part of the Netherlands barrow pollen spectra showed high values for *Plantago lanceolata*, *Rumex* and Poaceae, comparable to the spectra from the Protruding Foot Beaker Culture (*e.g.* Iversen landnam). In barrows in the south of the Netherlands, especially those belonging to a regional culture called Hilversum Culture, the percentages of *Plantago*, *Rumex* and Poaceae were considerably lower than in the north, suggesting that the farming practice more resembled that of the Funnel and Bell Beaker Culture (*e.g.* Troels-Smith landnam). Van Zeist found that these differences in agricultural practice interestingly coincide with differences in culture between the north and the south of the Netherlands, namely the culture of the Barbed-wire Beakers in the north and the Hilversum Culture in the south.

The theory that these differences in land use were culturally bound was criticised by Casparie and Groenman- van Waateringe (1980). Their article (*re*)analysed many pollen spectra from barrows north and south of the IJssel river (see figure

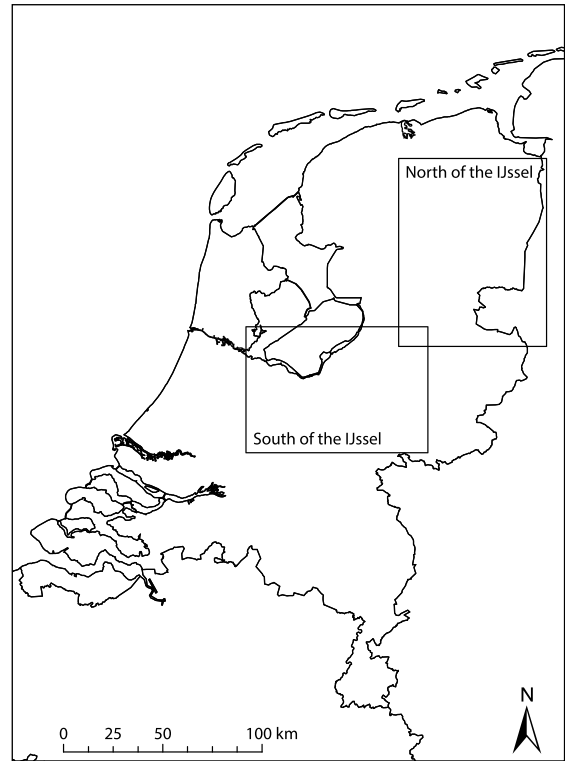


Figure 2.2. The areas north and south of the IJssel examined by Casparie and Groenman-van Waateringe (1980).

2.2) and compared them to the peat pollen diagrams from Bargeroofterveen, Emmen and Nieuw-Dordrecht (Van Zeist 1959, 1967a).

The differences between the Funnel Beaker and Protruding Foot Beaker period ascertained by van Zeist in the peat diagrams were, according to Casparie and Groenman-van Waateringe, not the result of differences in type of land use, but of soil conditions and nature of the cleared forest. The FB people living near the sampling sites apparently preferred to reclaim the *Ulmus*- and *Tilia*-rich forests that were present on soils relatively rich in nutrients. These forests were mainly situated on cover sand deposited on a weathered boulder-clay ridge. Because of this boulder-clay in the subsoil, the sandy soils were loamy and moist to wet. When the clearings were abandoned no great expansion of *Plantago lanceolata* took place here. Rather than explain this by the type of landnam activity, Casparie and Groenman-van Waateringe explained the absence of a *Plantago lanceolata* resurgence was due to the compactness of the soil (Casparie and Groenman-van Waateringe 1980, 59):

“It is conceivable that the loamy to very loamy soils of the boulder-clay ridge became compacted very readily, a process that checked considerably the establishment of Plantago lanceolata.”

The PFB people also cleared forest that had developed on cover-sand that was generally considerably poorer in nutrients, more drought-susceptible and far less loamy. Especially the latter was more in favour of *Plantago lanceolata*, which was able to expand here. So, Casparie and Groenman-van Waateringe explained the differences between the FB and PFB period as a result of which type of forest was cleared (rich versus poorer) and the condition of the soil (loamy versus less loamy and wet versus drier). In the period of the Bell Beaker (BB) Culture, *Tilia* shows a definitive decline, with an expansion of *Corylus*, *Pteridium*, Poaceae and *Plantago lanceolata* indicating the clearance of already degraded forest.

In addition, pollen spectral differences between barrows belonging to the FB and BB period on the one hand (*e.g.* low values for herbaceous plants, ascribed to the Troels-Smith landnam) and PFB period on the other (*e.g.* relatively high values for herbaceous plants, ascribed to the Iversen landnam) described by van Zeist (1967a) were not as explicit in Casparie and Groenman-van Waateringe's results. Within each culture, pollen spectra showed considerable differences, therefore the pollen spectra alone could not be used to culturally isolate a group. The differences van Zeist found in barrow pollen spectra were more likely to be due to dissimilarities in soil type, since all PFB barrows were located on the Drents plateau (Drenthe, northern Netherlands) and the BB barrows were located on the Veluwe (central Netherlands). Casparie and Groenman-van Waateringe did in fact find some differences between barrow pollen spectra from the Drents Plateau (north of the IJssel) and the Veluwe (south of the IJssel). The northern barrow pollen spectra showed an earlier and more pronounced expansion of heath than the southern spectra. These differences were ascribed to differences in the hydrological situation. The northern barrows were nearly all situated on the Drents Plateau, where soils were influenced by the presence of impervious boulder-clay not far below the surface.

"It was therefore precisely here, that disturbance of the vegetation cover and agricultural activities resulted in rapid exhaustion of the soil and a very drought-sensitive topsoil, that in many places facilitated rapid expansion of the heath." (Casparie and Groenman-van Waateringe 1980, 60)

In the area south of the IJssel the barrows analysed by Casparie and Groenman-van Waateringe (1980) were situated on the Veluwe. The Veluwe is a landscape consisting of pushed moraines, cover sands and fluvio-glacial material of porous nature, where water seeps down more easily. As a result the soils are much drier than on the Drents Plateau. According to Casparie and Groenman-van Waateringe the forest was therefore probably more open at the Veluwe with a well-developed undergrowth of herbaceous plants sufficient for grazing. Grazing pressure caused a gradually opening up of the woodland, allowing grasses and heath to expand. The research by Casparie and Groenman-van Waateringe showed that differences in land use were not culturally bound. As Casparie and Groenman-van Waateringe concluded:

"It seems more likely that prehistoric man adapted his methods of reclamation to a great extent to the possibilities available, and in such a way that no culturally-linked pattern is evident." (Casparie and Groenman-van Waateringe 1980, 62)

2.3 Vegetation reconstructions of the barrow environment: open spaces in the landscape

It has become clear from research that most of barrows in the Netherlands were built in open spaces. These open spaces might have been small or large. Waterbolk (1954) mentioned that practically all barrows were built in an open space without deliberate clearance of the area. Van Zeist (1967a) suggested after analysis of pollen data from several Neolithic and Bronze Age barrows in the Netherlands that they were constructed in either small clearings (Troels-Smith landnam) or larger clearings (Iversen landnam). Casparie and Groenman-van Waateringe concluded from their research (1980):

“The environment in the immediate vicinity of a barrow varied from only slightly degraded forest to extremely degraded, heath-rich vegetations, with all possible intermediate stages.”

De Kort palynologically investigated several barrows in the Netherlands. For a cemetery complex in North Brabant called Oss-Zevenbergen (see for an extensive description and discussion Chapter 12) he concluded that all barrows he investigated were erected in an open place covered with heath vegetation. This open place was probably already present before the oldest barrow was constructed and continued to be present during the period the barrows were built (*e.g.* from the late Neolithic until the Iron Age) (de Kort 2009, 166, 169). In another cemetery complex near Slabroek in North Brabant, an urn field that also contained some barrows that probably dated to the Bronze Age, de Kort found that the oldest barrow was built in a small open place with heath vegetation (see also chapter 12). The heath at this open place probably expanded during the Bronze Age when the younger barrows were built (de Kort 2010, 64).

Barrows in regions besides the Netherlands were also found to have been built in open places. Andersen found indications that in the Vroue area, West Jutland (Denmark), Early Neolithic barrows were built in natural woodland with heath patches (Andersen 1994-95). Later on trees became increasingly scarce and open spaces became larger. For Early Bronze Age barrows in Thy, Denmark, Andersen found indications that they were built in a rather treeless landscape, with remnants of woodlands that probably had been in the area some time before the barrows were built (Andersen 1996-97). It has been suggested that burial mounds in southern Sweden were built in a rather open landscape, with forest cover estimated at 20-40%, falling to 10% in the immediate surroundings of the barrow itself (Hannon *et al.* 2008).

The open spaces barrows were built in have mostly been interpreted in terms of prehistoric man's land use. Let us now focus on the open space itself and its relation to the barrow. First an overview of possible open spaces and their origin will be given, than follows an overview of open spaces in which barrows were built.

2.3.1 An overview of open spaces

Natural open spaces

The general view is, as has been described in section 2.1, that a closed canopy forest developed in the beginning of the Holocene in Western and Central Europe. When human interference with the landscape, the density of the forest decreased and open spaces were created. There is, however, an alternative hypothesis: a half-open park-like landscape, described by Vera (1997) as a landscape consisting of a continuous grassland with clumps of shrubs and forest. Vera claims that the initial Holocene vegetation of Western and Central Europe was not a closed forest system, but a half-open-park-like landscape. He points out that *Quercus* and *Corylus* would not be able to flower and regenerate in closed forests, while these species were continuously present in considerable numbers in Central and Western Europe since the last ice age. Vera's suggested type of half-open-park-like landscape was created and maintained by large herbivores, in a process he calls the theory of cyclical vegetation turnover (Vera 1997).

In Vera's cyclical vegetation turnover, thorny shrubs establish themselves in the grassland. In these clumps of thorny shrubs trees could grow, protected from grazers by the thorns. The trees developed into a forest, which would degenerate

back into grassland again due to large herbivores and climatic events such as drought and storms. The process could start over again, with the establishment of thorny shrubs in the grassland (Vera 1997).

Mitchell (2005) tested the hypothesis of Vera that large grazers kept the forest open. He compared palynological data of *Quercus* and *Corylus* from Ireland, where only two large herbivores were present during the Early Holocene, to that from other European countries with a greater assortment of large herbivores (Mitchell 2005). He found no obvious differences in *Quercus/Corylus* regenerative progression and concluded that large herbivores would have had little impact on the abundances of *Quercus* and *Corylus*. Mitchell also argued that, based on data from small forest hollows in Europe and eastern USA, opening up of the forest canopy was mainly artificial and caused by human activities.

Nevertheless, other researchers join Vera in believing that the natural structure of the northwest European forest in the Early Holocene was probably more open than previously thought. Svenning stated that closed forest would be predominant in 'normal' uplands, but with longer-lasting openings (Svenning 2002). These openings would have mainly occurred on floodplains, on calcareous or poor, sandy soil and in the continental interior of northwest Europe. At these locations the appropriate conditions would have existed for the presence of open vegetation like open woodland, scrub, heath and meadows. Fire would probably have been an important agent involved in the maintenance of this vegetation. Bradshaw *et al.* also argued that closed forest theory alone is not a perfect model for the Early Holocene vegetation structure (Bradshaw *et al.* 2003). They agreed that closed forest canopy is the dominant vegetation type, but they also argued that some parts of the landscape were open. This openness might have been created and maintained by events like floods, fires and wind throw. A combination of fire and grazing pressure may have created proper circumstances for regeneration of *Quercus* and *Corylus*. Whitehouse and Smith discussed that other proxy indicators may provide useful information that contributes to this subject (Whitehouse and Smith 2010). They showed, using beetle records from archaeological and palaeoecological sites in Britain, that the early Holocene was characterized by quite open woodland and that locally open areas may have played an important role. They found little evidence that those open areas were maintained by grazing activity of large herbivores, and proposed that other disturbance factors were probably of more importance.

To conclude, there are numerous indications that the west European Holocene landscape was probably more open than previously thought.

Fabricated open spaces: forest clearance

The landscape started to change rapidly with the onset of prehistoric man's interference. During the Neolithic, man switched from a hunter-gatherer strategy to an agricultural strategy. Farmers started to plant their own food and began to keep their own animals. This change to crop cultivation and animal husbandry had great impact on the vegetation and consequently on the landscape. Agricultural practise required open spaces for arable fields and livestock too, needed pasture to graze in. Forests were cleared and from the period of around 4100 cal BC, human influence becomes visible in palynological research in the form of cereal pollen grains and weeds from both arable and pasture land (Louwe Kooijmans 1974, Out 2009, Chapter 8 in this thesis). From 3000 cal BC there is a pronounced human impact on the environment. Both agriculture and stock breeding were practised on a large scale. For agriculture open space was needed on the most

fertile grounds. Forest areas were cleared, notable in palynological records by the rapid decline in trees, the increase of herbs growing in open vegetation and indicators for cultivation, such as cereal pollen (Louwe Kooijmans 1974).

The influence of human activity on the landscape was mainly notable in pollen spectra by the presence of anthropogenic indicators (Behre 1986). Bakker for example, reconstructed the emergence and expansion of agriculture on the Drenthe Plateau (eastern Netherlands) by using the indicator-species approach in combination with the use of modern pollen/land-use relationships (Bakker 2003). Bakker demonstrated that the first small-scale arable farming and livestock foddering took place on the Drenthe Plateau in the Subboreal (4050-3450 cal BC, according to Bakker 2003). An increase of Poaceae, Cyperaceae, *Calluna*, *Plantago lanceolata* and *Rumex acetosa*-type indicate the presence of various types of grass-rich vegetation, probably maintained by livestock. The appearance of *Cerealia* indicates the presence of arable fields. In the following phase (3450-2600 cal BC, Bakker 2003) more widespread clearances occurred, especially in the rich and higher forest. The further increase of *Cerealia* indicates the increased importance of arable fields.

After a period of decreased human influence on the vegetation during 2600-1770 cal BC (Bakker 2003), a more extensive clearance of the forest and their replacement by agricultural fields can be seen in the later phase of the Subboreal (1770-800 cal BC, Bakker 2003). Cleared forest areas could be used for crop cultivation for several years until the soil was exhausted. On these fallow fields grasses were able to expand and could be used as pasture (Groenman-van Waateringe *et al.* 1968). Grazing animals prevented the forest from regenerating and besides grasses heath was able to establish itself on the abandoned fields. Bakker (2003) showed that in the Subatlantic (800 cal BC-1500 cal AD), the exhausted and abandoned fields on the Drenthe Plateau were dominated by *Calluna* and extensive heath fields dominated the landscape. Heath was also grazed and maintenance and expansion of the heath was ascertained. The maintenance of these heath areas will be further discussed extensively in Chapters 8-13. Forest clearance might also have taken place for the sole purpose of providing pasture for grazing.

Forest clearings could have been accomplished by tree felling. Felled wood and other vegetation from the forest clearances could have been used as raw material, as fuel and served to cattle. As a raw material wood could serve as construction material for several structures in a settlement, such as houses, sheds, fences and palisades. Bakels for example showed that Linearbandkeramik settlements in the southern Netherlands (ca. 5300-4900 cal BC) used large quantities of wood. For a settlement of 200-250 houses that were built over a period of about 400 years, a woodland area of 50-1000 ha was needed (Bakels 1978). Wooden structures have also been found in association with barrows. Barrows were for example often encircled by wooden posts in the form of palisaded ditches (Late Neolithic), widely spaced post circles (1800-1400 cal BC) and closely spaced post circles (1700-1300 cal BC) (Bourgeois 2013, 34-36). Besides its use as fencing, wood was also used for the pyre when a body was cremated and in some cases a body was buried in a wooden coffin or a burial chamber constructed of wood (Bourgeois 2013).

Another method of forest clearing is burning. The deliberate use of fire to manipulate the vegetation in prehistory has been suggested by several authors (Mellars 1976, Simmons and Innes 1987, 1996a). Simmons and Innes suggest that fires were a deliberate tactic for resource management as early as the Mesolithic (Simmons and Innes 1996b). The resultant opening up of the landscape would have facilitated hunting by improving the sight and/or making the landscape more attractive for certain game species.

A combination of cutting and burning wood is applied in the so-called slash and burn agriculture. The forest is felled and the wood is left to dry, to be later burned. With this technique the soil is mixed with ash, enhancing the soil's fertility for crop cultivation. It has been suggested that slash and burn agriculture was already taking place in the Neolithic, as Iversen connected Neolithic forest clearance (*e.g.* Iversen landnam, see section 2.2.3) with slash and burn (Iversen 1941). Large amounts of charcoal in soil samples may be taken as indication of the use of fire. Odgaard suggests that charcoal layers found in soil samples indicate the use of fire in clearing woodland (Odgaard 1994). Andersen mentions deformed tree pollen grains found in Neolithic barrow soil samples (Andersen 1994-95). The deformed tree pollen grains were interpreted as an indication that trees had been felled and burned, when lying on the ground (Andersen 1992, 1994-95). However, deformed pollen grains were mixed with non-deformed herbaceous pollen grains, indicating that regeneration of the burnt area had already started. Therefore, in this case burning of the trees had already taken place sometime before the barrows were built. In some barrows in the north of the Netherlands high concentrations of charcoal particles were found, indicating that the local vegetation was burned intentionally before the barrow was built (Casparie and Groenman-van Waateringe 1980). Hannon *et al.* (2008) also found charcoal particles in most of the barrows they investigated on Bjäre Peninsula, southern Sweden. They concluded that slash and burn agriculture was practised in the area.

2.3.2 Which open spaces were chosen for the building of barrows?

Open spaces, whether created by man or by nature, were present in the Neolithic landscape. Since the Neolithic, man's interference with the landscape grew in range and magnitude. Forests were cleared and over time the vegetation became more and more open. During the Neolithic period erecting barrows in open spaces was already an established practise. Choice in open spaces was in all likelihood limited at that time, although the landscape may have been more open than previously thought (see section 2.3.1). In the Bronze and Iron Ages, the availability of open space was certainly greater. However, what do we know about the open spaces in which a barrow was set? Open spaces were created by man, but where these open spaces also chosen as building site for a barrow?

Barrows in arable fields

Cleared forest areas, mostly used for agriculture (see section 2.3.1), may have been chosen as sites for constructing barrows in. Some barrows were probably built on arable land that had recently or since a longer period been abandoned. Casparie and Groenman-van Waateringe (1980) found that, especially in the northeast of the Netherlands (Drenthe; see figure 2.3), the open spaces where barrows are placed were previously used as arable land, and that they were probably already long abandoned before the barrows were built. The open spots might originally have been cleared for agricultural purposes, but at the time the barrows were built the agricultural fields were no longer in use. In the central Netherlands (Veluwe, Gooi and Utrechtse Heuvelrug; see figure 2.3) indications for arable land are scarce. Casparie and Groenman-van Waateringe (1980) noted the difficulty in establishing with certainty whether an area had been used for crop cultivation, but concluded that in general, barrows were seldom constructed on or in the vicinity of arable land then in use.

Research outside the Netherlands has shown that barrows were not often built on arable land. Andersen (1994-95) found indications that mounds in Denmark were often built at sites that were less intensively exploited than areas in the near

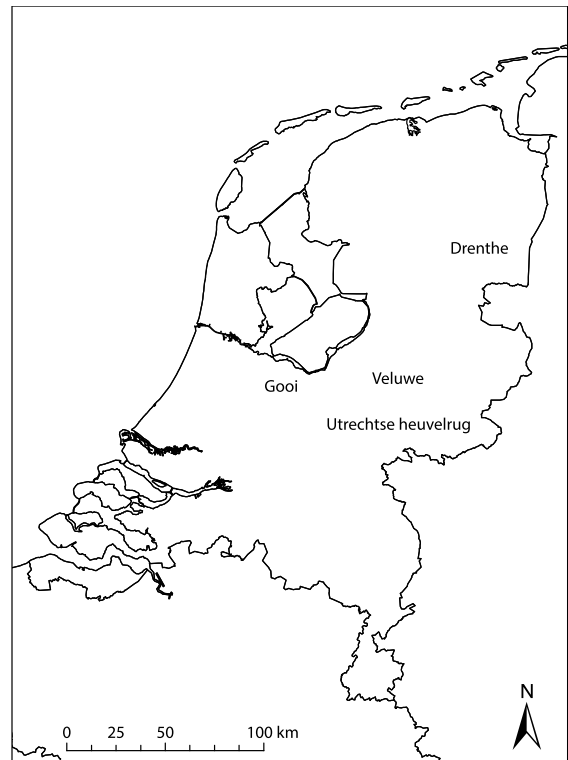


Figure 2.3. The Drenthe, Veluwe, Gooi, and Utrechtse Heuvelrug regions.

vicinity. Pollen spectra from some barrows in the Vroue area, (West Jutland, Denmark) dating to the Middle Neolithic, showed traces of agriculture, but on the whole the pollen spectra from barrows in the Vroue area showed no evidence of agricultural practice. In Thy (West Jutland, Denmark) Andersen concluded that the Early Bronze Age barrows were built in pastureland and that only some of the barrows were built in recently cleared coppice wood that had been used for cereal cultivation prior to the barrow building. Lawson *et al.* suggests that there seems to be a correlation between soils and the distribution of barrows in Norfolk (Southeast England), where barrows were placed on agriculturally poor, light soils (Lawson *et al.* 1981). Altogether there seems to be a preference for building a barrow on a location that had not been used as arable land recently. It has even been suggested that barrows were preferably built on marginal land, so that no (economic) valuable land that could be used for cultivation was wasted (Ovrevik 1990, Field 1998). However, as Downes mentioned, this marginal land might have been very useful for other purposes (boggy ground could have served as source for fuel for example) and not have been as insignificant as assumed (Downes 1994)

Barrows in pastoral zones

The change in the Neolithic to a more agricultural way of living also included the raising of livestock. Farming communities became more and more dependent on livestock to provide meat, dairy products, manure and wool, leather or other raw materials, as well as for pulling ploughs. Livestock needed pasture for grazing, at least for part of the year. They might have been grazing in natural open places in the forest. Groenman–van Waateringe found, however, that a Neolithic farmer had to open up the forest, since woodland composed of less than 30% grasses was not suitable for grazing (Groenman–van Waateringe 1993). Adams also mentioned that forest cover needed to be less than 50% (Adams 1975). Forests were cleared

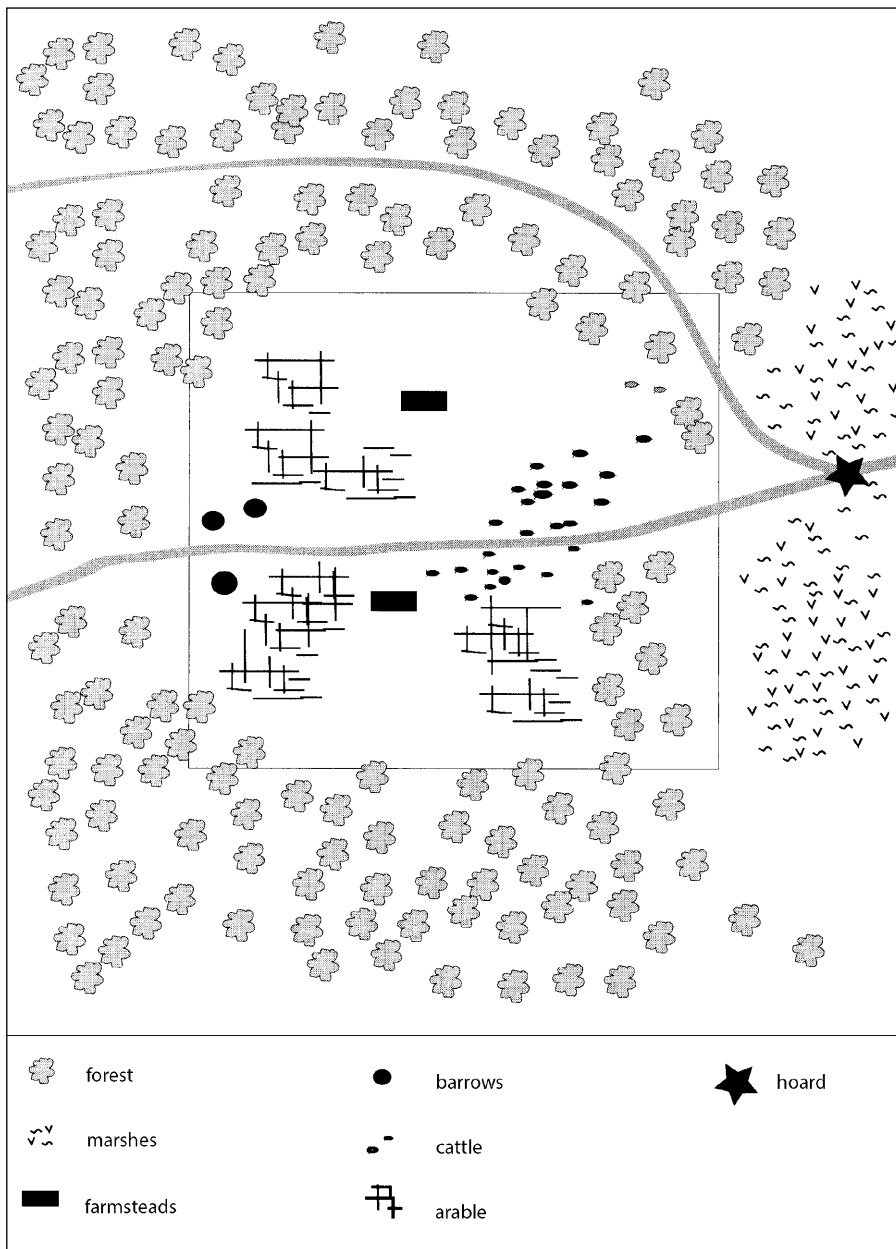


Figure 2.4. It was often assumed that barrows were located close to settlements. This figure shows a schematic drawing of two Bronze Age households, with barrows located at the settlement site. Figure after Fokkens (2005b, figure 20.3A).

for crop cultivation, but possibly also to create grazing areas for cattle. In addition, abandoned fields might have served as pasture (Groenman- van Waateringe *et al.* 1968).

Were spaces that were used as pasture also used to build barrows? Recent new research on the Vorstengraf barrow in North Brabant (see also section 12.1) shows that this barrow was probably built in an open space already present long before the building took place. This open space was covered with heath vegetation during that entire period, which might have lasted for several centuries. De Kort concluded that this heath vegetation had been used as pasture, with probably sheep grazing in the open spot. This might indicate that the barrow cemetery, where besides the Vorstengraf several other barrows are located, was deliberately kept open, while grazing prevented tree species from establishing and forest gradually covering the open place (de Kort 2002). Casparie and Groenman-van

Waateringe (1980) found some indications that barrows were built on pasture land, however, they conclude that it is extremely difficult to determine this with certainty (Casparie and Groenman-van Waateringe 1980).

The practise of mounds construction on pasture land also finds support outside the Netherlands, for example in Orkney (Bunting and Tipping 2001) and Thy, Denmark (Andersen 1996-97). Odgaard reports that two barrows that were built in *Calluna* heathland in Jutland (Denmark), where grazing had probably taken place (Odgaard 1988). Karg concluded that the heathland where the barrows in Skelhøj were built had been used as pasture as a form of heath management (Karg 2008).

Open spaces created for barrow building

There is also the possibility that open spaces were created for the purpose of barrow construction. Some barrows had been constructed in an area where the local vegetation was destroyed by fire shortly before the barrow was constructed. Samples from these barrows consisted almost exclusively of charcoal particles, which may indicate that the area was cleared intentionally before a barrow was constructed. This intentionally burning of the area could have been some kind of ritual activity. However, it may also represent a certain phase in the landnam and have no direct connection to the burial. Casparie and Groenman-van Waateringe (1980) could not find evidence of forest clearance for the purpose of burial of the dead.

Barrows and settlements

It is often assumed that barrows were built close to settlements (see figure 2.4). For the Middle Bronze Age Roymans and Fokkens argued that barrows were constructed in the near vicinity of the houses (Roymans and Fokkens 1991). Barrows were assumed to be family graves and families buried their deceased relatives underneath a barrow close to their settlement. This theory is mainly based on the settlement excavated in Elp, where a Bronze Age barrow and several flat graves were situated close to several houses remains. This cemetery was assumed to be in use by the inhabitants of the settlement (Waterbolk 1964). Bourgeois and Fontijn tested the hypothesis of Roymans and Fokkens by re-analysing the data from the only 15 sites where traces of both houses and barrows dating to the Middle Bronze Age were found in close association (Bourgeois and Fontijn 2008). The houses and barrow of Elp seem to be contemporaneous, which also applies for three other sites Bourgeois and Fontijn analysed. They showed however, that most barrows that were found in Middle Bronze Age settlements were much older than the houses in question, with Elp forming an exception rather than the rule. Middle Bronze Age barrows were not built close to houses, but Middle Bronze Age houses were often built close to already existing barrows, which were then re-used by the residents of the settlement. They emphasize however, that the number of sites that could be used for such analyses is very low and that no firm conclusions can be drawn yet. For the Late Neolithic and Early Bronze Age barrows there is hardly any evidence that they were built close to houses. Casparie and Groenman-van Waateringe (1980) mention some PFB barrows were built on abandoned settlement areas, based on artefact finds. In fact there are very few examples of Late Neolithic and Early Bronze Age settlements, making it difficult to draw any conclusions on the relation between burial mounds and settlements in the Late Neolithic and Early Bronze Age.

On the one hand one could expect that barrows were placed close to a settlement, where one lived close to one's deceased ancestors. On the other hand, the place a burial mound was located in could be seen as a ritual and/or sacred area that would be kept separate from the world of the living.

2.3.3 What was the size of the open spaces barrows were built in?

Barrows were built in open spaces in the forest. It is likely that open spaces in Neolithic times were smaller than in later periods, since prehistoric man created more and more openness in the forest during the Holocene. However, there is not much known about the size of the open places that were used to build burial mounds. Sods were used to construct a burial mound. These sods were most likely taken from the near surroundings of the place where the barrow was planned (Waterbolk 1954, van Zeist 1967a). This suggests a larger open place was necessary than just the size of the barrow. Jonassen concludes that in a forest non arboreal pollen (NAP) shows values of approximately 10%, but that a few hundred metres from the forest values rise up to about 100% NAP. Spectra with NAP of 100-500% could indicate an open landscape in a forested area with forest at a distance of about 1 km (Jonassen 1950, 71-72). Waterbolk (1954) estimated the size of the open space around the Neolithic barrows at a few to tens of hectares. De Kort estimated in his MA-thesis that the size of the open space that was needed to take sods from to build the Vorstengraf barrow in Oss was about 1.5 ha (de Kort 1999; see also Chapter 12).

Conclusions

A large amount of vegetation data of barrows is available, as has been described in the previous paragraphs. The data that informs us on how the barrow landscape looked like is still limited, however, and many questions about the barrow environment remain. The next chapter will be on this subject.