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The Nature and Dynamics of Pre-Roman Iron Age and Roman Iron Age Reclamation Settlements in the (Former) Peat and Clay-On-Peat Area of Friesland (The Netherlands)

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ABSTRACT

Recent research into Pre-Roman Iron Age and Roman Iron Age peat reclamations in Friesland has made clear that the margins of the peat area were intensively inhabited during both periods. This same research also provided insights into the local environmental circumstances under which the settlements were founded, the shapes these settlements took, and the way they functioned in a changing landscape. Although growing problems with peat subsidence, which increased the local water table, eventually forced the settlers to leave their settlements and settle on newly reclaimed peat land, this did not necessarily mean the end for the old sites. The old reclamations silted up, which raised the land surface and reversed the effect of the subsidence, thereby, in time, making the old reclamations once again attractive for habitation. In the Late Roman Iron Age all reclaimed areas were abandoned, as were most of the salt marshes.

KEYWORDS

Dwelling mounds; Frisia; landscape; peat reclamation; settlement archaeology; subsidence; terps; wetland archaeology

Introduction

During the Pre-Roman Iron Age (700 BC–0 AD) and the Roman Iron Age (0–400 AD), not only the Frisian salt marsh area experienced settlement and exploitation, but also, starting in the Middle Pre-Roman Iron Age (500–250 BC), the adjacent margins of the peat area (Van Giffen 1916, 1931, 18; Halbertsma 1955; Cnossen 1958; Elzinga 1962; Bruinsma 1968; Janssen 1989; Taayke 1996 IV, 132–140; Waldus 2000; De Langen 2000, 2007, 2011; Tuinstra 2005; Gerrets 2010; Bakker 2013; Nieuwhof et al. 2019, 81, 85). The main reason that these early settlements on the peat have thus far received less attention than those of the former salt marsh area is their poor visibility. In most cases, these peat settlements consisted of small, low *terps* (artificial dwelling mounds) that had room for only one dwelling. This is in strong contrast with the terps of the former salt marsh area, which sometimes can be up to several hectares in size. Together with their small size and relatively low height, another important reason for their lack of visibility

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is that the peat lands that were reclaimed early on, as well as the settlements that were built on them, have since become silted up with marine clay deposits. In some parts of the northern Netherlands, these clay deposits are so thick that no traces of the terps are visible at the surface (Aalbersberg 2006; De Langen 2011; Bakker & De Langen in prep.).

Until recently, fieldwork aimed at investigating early peat reclamations in the northern Netherlands was limited to coring surveys and a couple of small-scale excavations, resulting in short site reports and only a few publications with synthesizing research on the topic (Gerrets 2010; De Langen 2011). However, over the past decade, new archaeological research in the Dutch province of Friesland (Bakker 2013, 2018; Bakker & De Langen 2018), which took the form of fieldwork and various methods of prospecting, has revealed that during the Pre-Roman Iron Age and the Roman Iron Age, substantial parts of the peat area were intensively drained and settled (Bakker & De Langen in prep.). Trench excavations by the Groningen Institute of Archaeology (GIA) of the University of Groningen, at the sites of Tjerkwerd-Arkum (2012), Wartena-Noord (2013), Sneek-Harinxmaland (2014) and Leeuwarden-Bullepolder (2015), targeting the settlements and parts of their surroundings, provided additional information about the way these reclamations were carried out (Bakker and de Langen 2017, 2019, 2020; Bakker, de Langen, and Sibma 2018).

Until a decade ago, the coastal peat area was, in general, seen as a marginal environment that was only fit for limited seasonal activities (see for instance: Waldus 2000; Gerrets 2010, 77–104). Therefore the finding that the early peat reclamations were densely populated and comprised large networks of ditches to drain the reclaimed lands is of great significance, because it means that the reclamations were of much greater importance than had previously been assumed (Bakker & De Langen in prep.). However, of all of the types of wetland, peat soils are especially vulnerable to artificial influences, and drained peat land is by definition not a durable landscape. In fact, the recent research made clear that the current complications resulting from the subsidence of drained peat land in the Netherlands and other parts of the world are not a modern problem but were already encountered by the first peat reclamation settlers, more than 2000 years ago, albeit on a smaller scale.

These early Frisian peat reclamations are too comprehensive and multi-faceted a topic to be covered in a single paper. Therefore the focus here will be on the settlements themselves and in particular their dynamic nature. Other papers are prepared that deal with additional aspects of the early peat reclamations, such as the former drainage and settlement systems (Bakker & De Langen in prep.) or human activities (Bakker & Schepers in prep). The dynamic nature of the settlements is closely linked to the way the coastal peat area was used and how the settlers adapted to the environmental changes that were set off by the reclamations. In this context, the newly demonstrated temporariness of these reclamations and their settlements is of great importance. Following an introduction to the research area, an explanation and discussion of this 'temporariness' will provide a framework for the rest of the paper, which will focus on the shape and nature of the reclamation settlements by making a distinction between what the settlements looked like and how they functioned during the initial habitation phase, on the one hand, and the way in which they changed over the course of time, on the other hand. It will be made clear that the previously held view that the early peat reclamations were merely a peripheral phenomenon should be reconsidered. It is argued here that it is

more likely that, especially during the initial habitation phase, the reclaimed peat lands functioned as a self-sustaining area of settlement.

The Research Area and Site Terminology

The soil patterns in Friesland are quite different today from what they were in the Iron Age, resulting from a huge transformation of the landscape over the past millennia. The salt marsh area did not extend as far to the north, whereas the peat area originally extended much farther north (Vos and de Vries 2013; Vos in press). This former northern extension of the peat area became evident to archaeologists searching for the remains of the early reclamation settlements, as most of these sites are situated in what is today the clay and clay-on-peat soil region (Figure 1). Distinguishing between the settlements originally founded on peat land and those originally founded on the salt marshes is complicated by that fact that, even though the term *peat reclamation settlement* implies that such settlements are clearly distinguishable from the salt marsh settlements based on their subsoil, in reality this is not always the case. Specialized soil maps show that there are a number of transitional soils between the pure peat and pure clay soils in the top 80 cm of the soil (Cnossen 1971).

To deal with this variation in soil types, which also existed in the Iron Age (De Langen 2011; Bakker 2013; Vos in press), in this study a distinction is made based upon the proportion of peat in the old topsoil. In general, when the old topsoil consists of pure peat or consists mostly of peat with less than 40 cm of marine clay layers, it has been defined here as a peat soil. It is argued that the local appearance and hydrology of the environment and the effect of the peat oxidation that sooner or later occurred make these soils distinct enough from those of a salt marsh. The settlements that started initially in such circumstances are the topic of the rest of the paper. Settlements that began in an area where the majority of the former topsoil consisted of marine clay layers are treated as salt marsh sites. The hydrology and appearance are mostly that of a salt marsh, and the effect of subsidence caused by oxidation of possibly present peat layers is minimal at such sites.

To prevent confusion around the usage of the terms *site*, *settlement* and *terp*, in this paper any habitation site is, in general, termed a settlement, regardless of whether it is a solitary farmstead, a hamlet or a larger village. This follows common usage in Dutch archaeology and takes into account that the number of houses could have differed over time at some of the sites. For artificial dwelling mounds, the term *terps* will be used (singular: *terp*). However, because not every settlement started out as a terp, the more general term 'reclamation settlement' will also be used throughout the paper. None of the researched settlements were founded on unreclaimed peat land.

The Temporariness of the Early Peat Reclamations

One of the most important new insights gained during the recent fieldwork is the temporariness of Iron Age peat reclamations and their settlements. The possibility of this 'temporariness' was first mentioned only a decade ago, by De Langen (2011, 76–77). Until then it had been generally assumed that a site with pottery types spanning various time periods within a period of multiple centuries, without any significant gaps would have been inhabited or at least actively used by people during that entire time (see

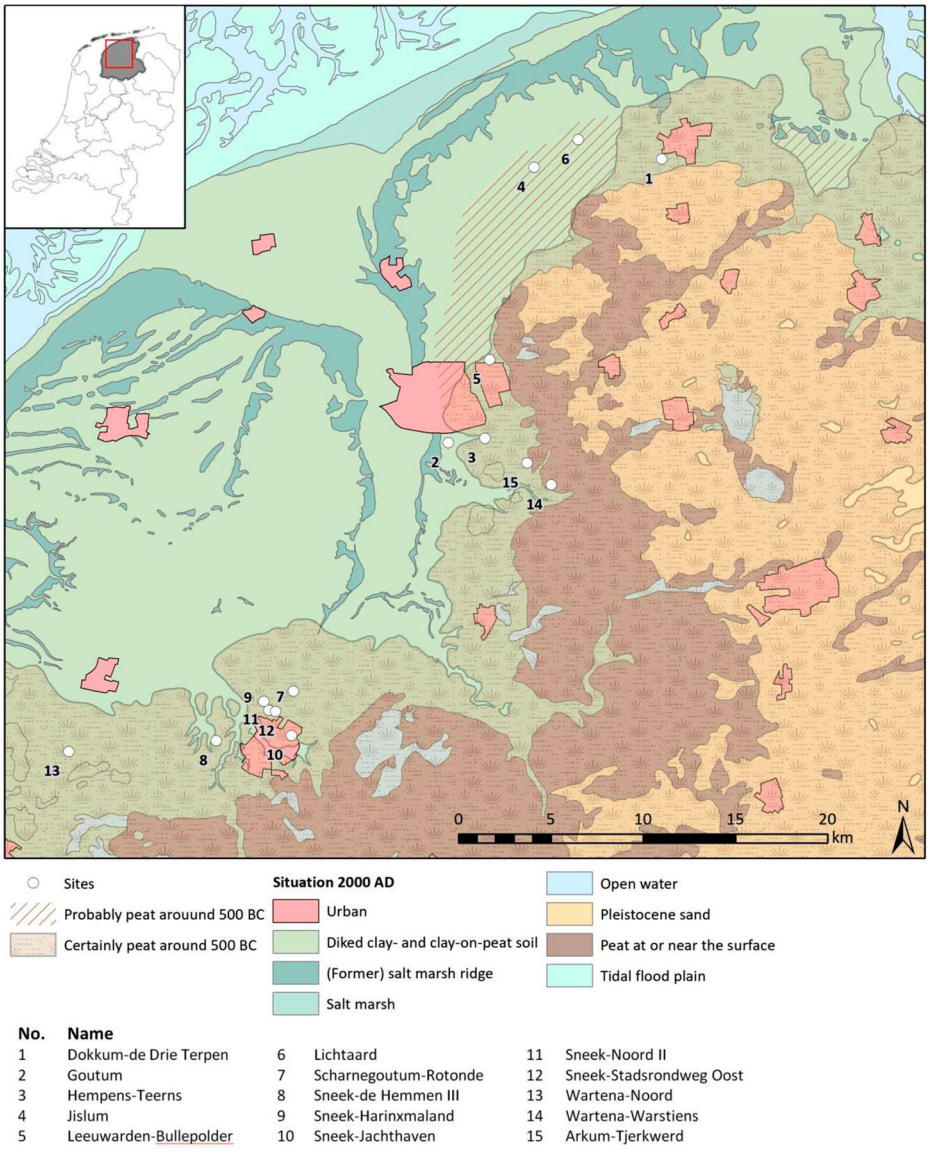

Figure 1. Locations mentioned in the text and the original extent of the peat area around 500 BC plotted on a palaeo-geographical map of 2000 AD of the province of Friesland (based on Vos in prep.; modified by the author).

also Figure 4). Based on the assumption that the youngest peat reclamations were positioned the farthest land inwards, which had not yet been tested at the time, and based on the assumption that the reclamation settlers were practising mixed farming on drained peat land, which was seen as impossible at the time because peat land was considered too wet and marginal for agriculture (see Gerrets 2010, 77–104), De Langen (2011, 76) hypothesized that the oldest peat reclamations – those located closest to the old salt marshes – over time would have become too wet for mixed farming. He claimed that to continue this kind of use, the settlers would eventually have been forced to reclaim

new stretches of peat land, extending deeper into the peat area. According to him, the old reclamations could afterwards still have been used for raising livestock, as this practice was less dependent on a stable low water table (De Langen 2011, 77), but if water problems persisted or increased, the use of these wetlands would in time become more extensive and possibly even seasonal in character.

Tjerkwerd-Arkum

During the excavation of a reclamation site near Arkum, in 2012, the ideas about the temporary character of the early peat reclamations were helpful in understanding the field observations. Because this site was the first where this kind of temporality was observed, it will be covered in more detail here. Habitation started in this location in the 2nd century BC, in the form of a settlement on an artificial layer of clay with a thickness of approximately 10 cm on drained fen peat. On top of the artificial clay layer, a hearth was found, surrounded by a sequence of floor layers (Figure 2; Bakker 2019a, 98). This is interesting because until this excavation, it had been generally assumed that habitation in the peat area occurred only on terps (see for instance: Gerrets 2010, 102–103; De Langen 2011). In the 1st century BC, the settlement site was elevated with clay sods and can be considered a low terp. During the second habitation phase, this low terp eventually reached a height of 0.5–0.6 m (Bakker 2019a, 99–100). In the first half of the 1st century AD, the location was abandoned. This abandonment phase was visible in the form of thin layers of marine clay and newly formed peat covering the layers of the second habitation phase (Bakker 2019a, 102). Apparently, the area flooded several times, and eventually new layers of peat started to form, thereby restoring the balance between water table and surface level.

In the latter half of the 1st century AD, the location Tjerkwerd-Arkum was re-occupied (Bakker 2019a, 102–104). This should be considered a second reclamation phase, as the area had to be prepared again to make human activity possible. Human activity around the terp was visible in the form of a homogenized, dark grey layer of organic clay containing remains of pottery, charcoal and other waste (Figure 3). Where this layer is the thickest, the layers of the previous phases are either very thin or absent (Bakker 2019a, 102), a clear indication that the dark organic clay layer consists for a large part of older layers mixed with younger sediments and household waste from the third habitation phase. The terp was also made a little higher during this period, and its surface area was increased (Bakker 2019a, 102).

Around 100 AD, the location was once more abandoned (Bakker 2019a, 104). On top of the dark organic clay layer, a thin, black horizon was visible that consisted of a layer of clayey oxidized peat (Figure 3). It should be noted that there is no direct proof that the environment becoming wetter was the direct cause for the abandonment of this site, but it seems very likely. There were certainly problems with the rising water table, otherwise the settlers could have continued living in their low-lying settlement instead of going to the effort of making it higher over time. However, abandonment would also have contributed to a wetter environment because the drainage ditches would not have been maintained after abandonment. This, in turn, would have enhanced such processes as the formation of new peat. That peat growth was limited in the second abandonment phase was due to a growing marine influence

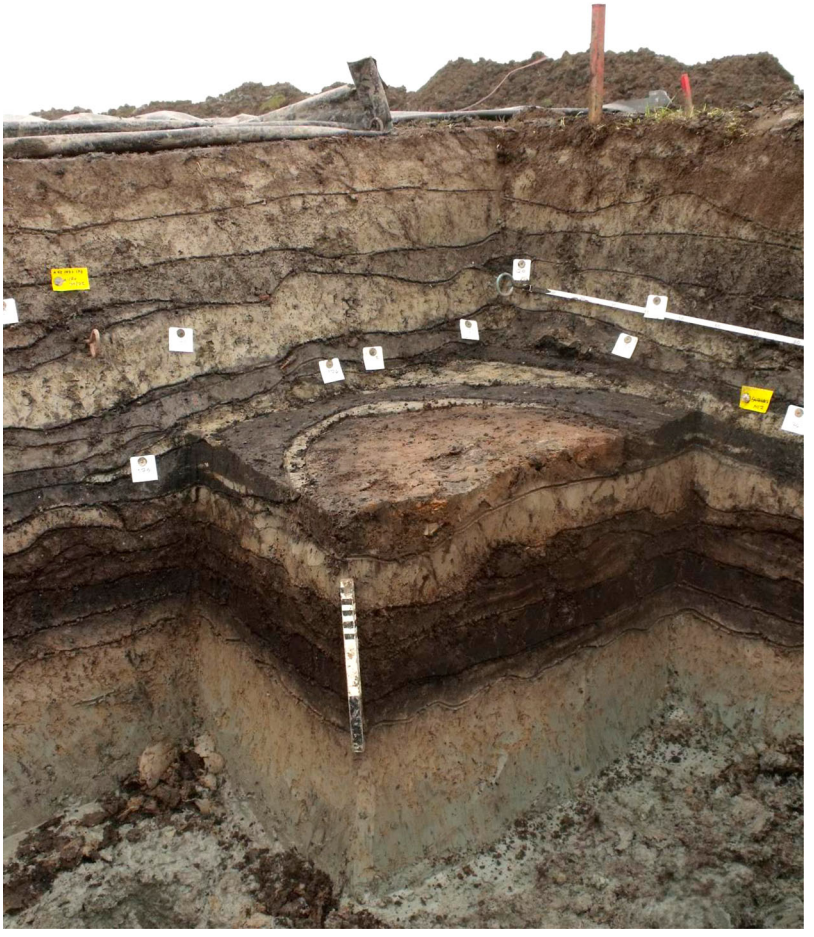

Figure 2. A section through the oldest hearth at Tjerkwerd-Arkum (source: Bakker 2019a, Figure 3.3). The feature is located on top of an artificial clay layer that lies on top of the remains of (compressed) peat layers. The hearth is surrounded by a sequence of floor layers. Overlying the hearth were various terp layers belonging to later habitation phases.

in the area: the clayey peat layer was found covered by about 20 cm of fine marine clay deposits, which had effectively turned the local area into a salt marsh (Bakker 2019a, 103).

It is not certain when exactly the site was inhabited for the fourth time. The best estimate is at the end of the 2nd century AD (Bakker 2019a, 105–106; Bakker and Varwijk 2019). Of the few remaining features from this fourth habitation phase, the ditches surrounding the terp are especially noteworthy, because they contain multiple fills, including natural layers. It appears therefore that, over time, these ditches were partly dug out again.

There is no real trace of further heightening of the terp, with the exception of a couple of thin, dirty layers that are more likely to be old ground surfaces than true heightening layers. At one of the flanks of the terp, these thin, dirty layers were found to alternate with thin, natural clay layers, indicating that the silting up continued

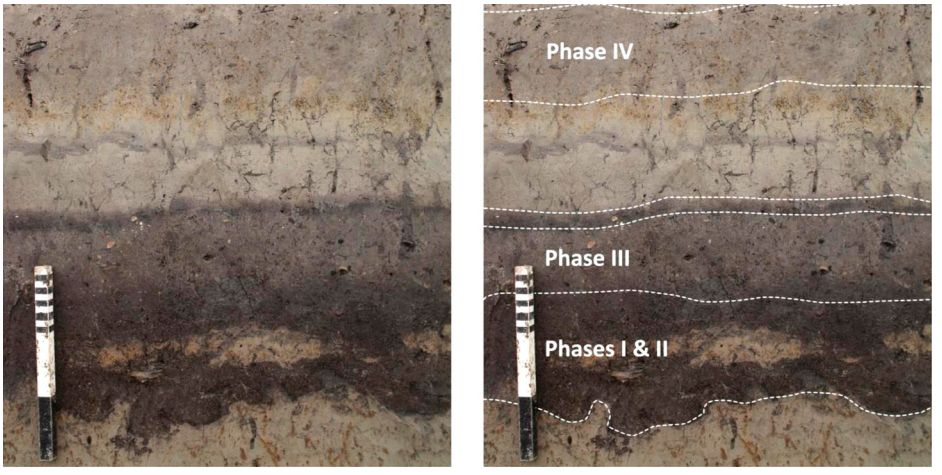

Figure 3. Part of the section in one of the trenches directly outside the settlement of Tjerkwerd-Arkum, showing the sequence of old ground surfaces (cultivation layers) of each habitation phase (source: Bakker 2019a, Figure 3.14). The original peat layers on top of the old clay subsoil were only intact beneath the oldest core of the settlement. Outside the oldest core, the peat was either eroded of ploughed in with clay from the old clay subsoil. Following habitation phase II, the area became silted up with marine clay, after which peat started to form. During habitation phase III, these natural layers were mostly reworked with the top of the older peaty soil of habitation phases I and II, into a dark grey layer of organic clay. Only in some parts of the trenches were intact remains of these natural layers visible (for instance in the fill of ditches that were in active use in habitation phase II). The layers of habitation phases III and IV are separated by a thin black layer of clayey oxidized peat followed by marine clay and thin swamp deposits. After habitation phase IV, the area became silted up again with marine clay deposits.

during this fourth phase of human activity. In the surroundings of the terp, a slightly darker clay layer was observed that contained some pottery sherds and other household waste (Bakker 2019a, 108). After the end of this phase, marine clay was once again deposited. Only much later, in the latter half of the Middle Ages, was the location re-occupied (Bakker 2019a, 108). These later layers were heavily disturbed by modern human activity.

Signs of Habitation Phases Alternating With Phases of Abandonment in Other Sites

The complexity of Tjerkwerd-Arkum's habitation history was an eye opener, especially the phases of abandonment, during which nature again took its course by depositing clay and enabling renewed peat formation. De Langen (2011) was right about many of the adjustments the settlers made, but the phases of (temporary) abandonment required an addition to his model. And as would be proven by subsequent excavations at Sneek-Harinxmaland, in 2014, and Leeuwarden-Bullepolder, in 2015, such phases of abandonment were not unique to Tjerkwerd-Arkum. These other two sites also started out on a thin floor layer, although on bog peat instead of fen peat, had multiple habitation phases, and were periodically abandoned (Bakker 2018, 2020a).

Of the settlements excavated by the GIA, only Wartena-Noord was inhabited during just a single phase, in the Roman Iron Age (Bakker and de Langen 2017; Bakker in prep.-a). This site was located much farther inland than the sites mentioned above. It was founded around 75 AD, on drained fen peat at the lower flank of a vast raised bog, and was abandoned in the second half of the 2nd century AD (Bakker in prep.-a). Instead of exhibiting a floor layer near ground level, Wartena-Noord started right away as a small terp that was raised with peat sods and clay sods. The nearby site of Wartena-Warstiens, which was excavated in 1965 by Elzinga (Bruinsma 1968; see also below) was of similar age and appearance. The reason for these settlements starting as terps must be sought in the accumulated experience of the reclamation settlers with such environments: the occupants must have realised that periodic inundation of the area was a risk, especially during autumn and winter, and that it would be wiser to raise a small mound from the start.

It is interesting that during earlier excavations of similar reclamation settlements, no signs of periodic abandonment were recorded (Figure 4). Yet of the four sites excavated by the GIA over the past decade, three had multiple habitation phases separated by multiple periods of abandonment. It is therefore very unlikely that the sites researched prior to 2012 all had continuous human habitation or activity. There are several reasons why this phenomenon of temporary abandonment was recognized only recently. The first is that the GIA excavations placed a strong emphasis on sections, as profiles of deep and wide sections are the best way to figure out the stratigraphy of terps and their off-site area, including the identification of layers that signal a period of abandonment. The second reason, especially in the case of the earliest of the earliest excavations, is that researchers had different research interests back then. By emphasizing such topics as the formation of large sea inlets (see for instance: Halbertsma 1955; Cnossen 1958; Bruinsma 1968), they placed less emphasis on the nature of these sites; establishing their presence was often considered enough. The third reason is that a number of sites were found to be heavily disturbed, sometimes by later human activities and sometimes, like at Scharnegoutum-Rotonde (Waldus, Vos, and van der Heijden 2005), by erosion by

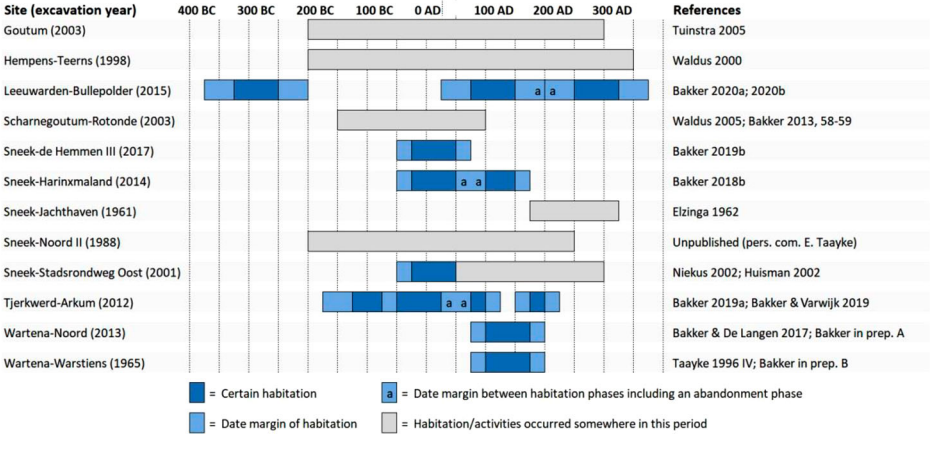

Figure 4. Timeline with dates of the occupation periods of sites mentioned in the text. The stratigraphic phases were dated by a combination of ceramic seriation and radiocarbon dates. For this overview, the timeline is subdivided into periods of 25 years.

the sea to such an extent that only the deepest features remained, like water wells and the lower parts of ditches. The fourth reason is that, especially in modern-day contract archaeology, the excavation area is often demarcated by the borders of the land that is slated for development. This means that it is often not possible to dig a trench outside the official excavation area in order to try to reveal more about a site that will be only partly impacted by project development. This makes most of these excavations less suited to understanding the nature and dynamics of these settlements. For instance, at the site of Hempens-Teerns, often referred to in the literature (see Gerrets 2010; De Langen 2011), only the off-site area and the northwestern flanks of the settlement were excavated, while the centre was left untouched (Waldus 2000, 6–7).

Another example of the information benefits of additional excavation trenches is Leeuwarden-Bullepolder (see further below). In 2002, a commercial company (ARC) excavated the southern part of this site because of residential development plans (Koopstra 2002). They discovered that in the 1st century BC, the location consisted of peat bog covered by marine clay deposits through which peat extraction pits had been dug (Koopstra 2002, 9–16). After these activities, the local area became silted up again with marine clay. On top of this clay-on-peat soil, they found terp layers that were associated with the raising of a terp in the 1st century AD (Koopstra 2002, 16). Based on the orientation of a number of terp ditches, the centre of the terp was assumed to lie farther to the north, outside the excavation area (Koopstra 2002, 18). In 2015, the northern part was researched by the GIA to investigate why a cushion bog was found covered by marine clay deposits predating the supposed earliest human activities. It was suspected that the bog had been drained by humans prior to the deposition of these marine deposits, thereby making the area vulnerable to flooding by the sea (Top and Bakker 2015). During the GIA research, it became clear that the first habitation had indeed taken place on top of artificially drained cushion bog (Bakker 2020a, 68–70). Interestingly, this settlement had started in the Middle Pre-Roman Iron Age, around 350 BC, and was abandoned between 250 and 200 BC (Bakker 2020a, 70–73). An important find because until the 2015 excavation, there were no confirmed peat reclamations in the northern Netherlands predating the Late Pre-Roman Iron Age (250 BC–0 AD) (Bakker 2020b, 108–109).

The Initial Habitation Phase

Based on the temporal character of the early peat reclamations, a distinction can be made between the initial and later habitation phases of the settlements at a number of these sites (Figure 4). In this part of the paper, a case will be made that during the initial habitation phase, the settlements were occupied year round and the settlers were involved in mixed farming and could sustain themselves. Before going into the nature of this habitation phase, first the shape of the early settlements will be discussed, as well as the habitation features encountered within them.

The Shape and Size of the Early Settlements

A number of excavations provide information about the shape and size of the original settlements during the initial habitation phase(s). However, in the past, sometimes mistakes were made that had far-ranging consequences. This is the case with the article

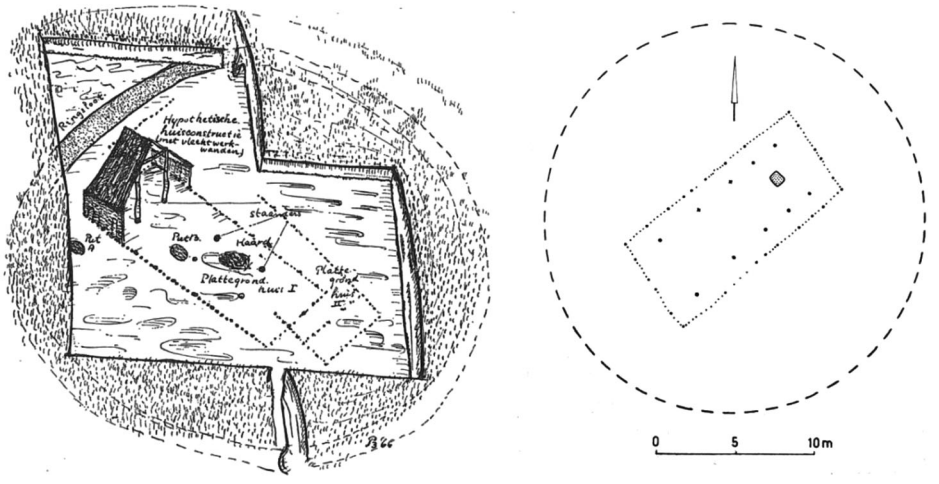

Figure 5. Left: The reconstruction of the terp site of Wartena-Warstiens drawn by Bruinsma (1968, Figure B, 169). Right: A schematic representation of Wartena-Warstiens drawn by Elzinga based on Bruinsma's reconstruction (Boersma et al. 1972, 67). A recent re-examination of the field drawings has revealed that this reconstruction does not resemble the reality of what was excavated (see also Figure 7).

by Bruinsma (1968) about the site of Wartena-Warstiens. Bruinsma likely did not have all the excavation documentation at his disposal when he was preparing the article, because he did not mention much about either the finds or the measurements of the excavated houses. Despite this, his publication has been much cited, especially a sketch by Bruinsma (1968, Figure B) showing a reconstruction of the site as a small, round terp with a house in the middle, surrounded by a circular ditch (Figure 5). This reconstruction has been used in various forms in Dutch archaeology as a basic example of a house terp (see Boersma et al. 1972; Waldus 2000, Figure 27, 63; Huisman 2002, Figure 10.2, 113; Gerrets 2010, Figure 4.4, 82). Unfortunately, this reconstruction does not resemble what was excavated (Bakker in prep.-b).

While excavating the nearby site of Wartena-Noord, in 2013, it was noted that although the present terp is round in plan view, the original terp was rectangular in plan view and only slightly larger than the house that was built on it (Figures 6 and 7; Bakker in prep.-a). They confirmed that during the habitation phase, the terp was expanded laterally, making it less angular, but that the round outline of today was definitely caused by the later silting up of the area (Bakker in prep.-a). Instead of being surrounded by a circular ditch, the original terp proved to have been surrounded by straight ditches that connected to the larger drainage ditch system of the peat reclamation (Bakker in prep.-a). Because this contrasted with what had been published about Wartena-Warstiens, the original excavation drawings and photographs of Wartena-Warstiens were re-examined (Bakker in prep.-b). It then became clear that the terp of Wartena-Warstiens was also originally rectangular in shape and surrounded by straight ditches (Figure 7; Bakker in prep.-b). Most likely, Bruinsma and many of the later researchers were under the (mistaken) impression that the original settlement had the same shape as the now-silted-over terp has in the current landscape.

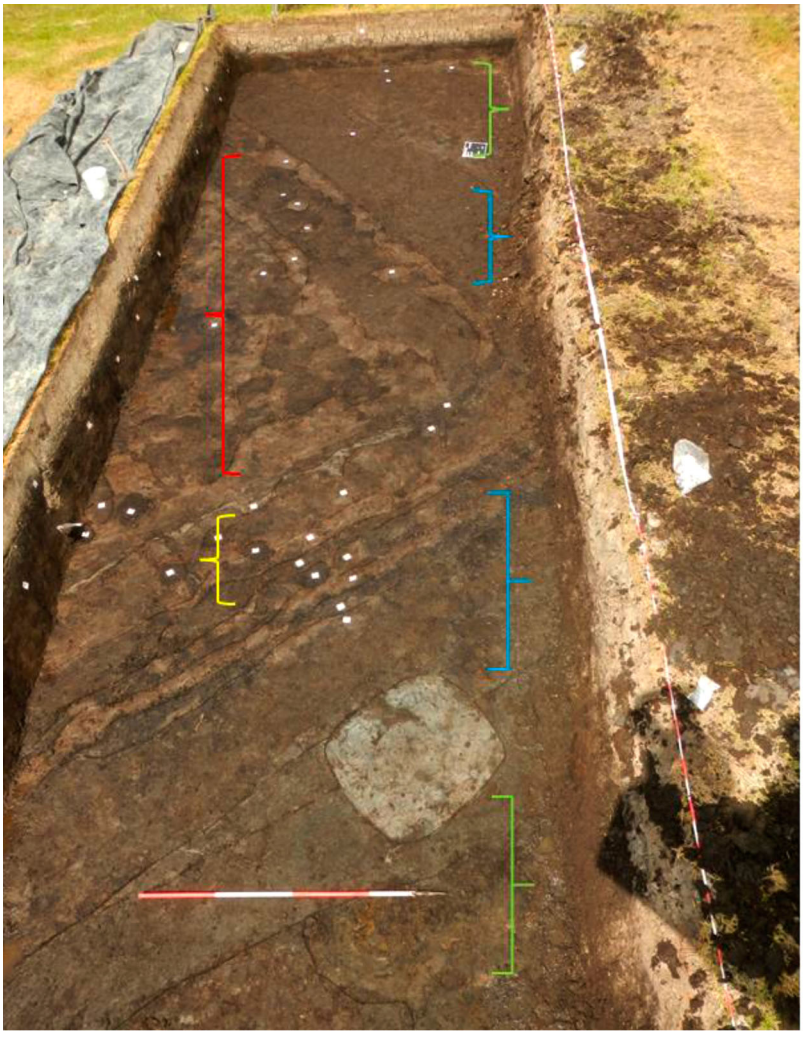

Figure 6. Overview of the northwestern part of the eastern trench of the site of Wartena-Noord (source: Bakker in prep.-a, Figure 3.20). The coloured brackets indicate the features of the different subphases of the terp phase (2a: red; 2b: yellow; 2c: blue; 2d: green).

In the case of the two sites at Wartena, it is certain that their original terp mounds were rectangular in shape. Even though these sites have not been excavated in their entirety, their original starting size can be fairly accurately estimated. The original mound of Wartena-Warstiens measured at least 11 by 18 m (about 190 m^2) and was oriented NE–SW (Figure 4; Bakker in prep.-b). During the habitation period, the terp was expanded in southerly and westerly direction (whether it was expanded in other directions is not known, as these parts lay outside the excavated area). The original mound of Wartena-Noord was found to measure 9 by 16.5 m (about 160 m^2) and was also oriented NE–SW (Figure 4; Bakker in prep.-a). During the habitation period, this mound was also expanded, and eventually it measured at least 240 m^2

Figure 7. Top: The terp features of the site of Wartena-Noord at the third excavation level (source: Bakker in prep.-a). Bottom: The terp features of Wartena-Warstiens at the second excavation level (source: Bakker in prep.-b.) The habitation phase is equivalent to phase 2 and dates to 75–175 AD. Its subphases could only be relatively dated, based on stratigraphy (the formation of natural peat beneath the terp was grouped in phase 1).

Figure 8. Two sections through water wells at the site of Leeuwarden-Bullepolder (source: Bakker 2020a, Figures 3.6 and 3.7). Top: A large, irregular-shaped water well dating to habitation phase I (around 350–250 BC). Bottom: A smaller, regular-shaped water well dating to habitation phase II (around 50–150 AD).

(Figure 4; Bakker in prep.-a). Both of the Wartena terps were originally at least 0.6 m high and constructed of peat sods and clay sods (Bakker and de Langen 2017, Figure 14.1, 43; Bakker in prep.-a, in prep.-b).

For the settlement of Sneek-Stadsrondweg Oost, a size of 11.5 by 18 m is reported (Niekus 2002, 17–18). With a height of 0.3 m at the centre and 0.1 m at the margins, the height of this NNE–SSW-oriented mound is very low when compared with that of the Wartena sites but roughly comparable to that of the mounds of Tjerkwerd-Arkum and Sneek-Harinxmaland at the end of their first habitation phases (Bakker 2019a, 2020b). Both of these latter sites started near ground level and gradually transformed into low terps. It cannot be excluded that this was also the case for the settlement of Sneek-Stadsrondweg Oost, which lies near that of Sneek-Harinxmaland and was founded in the same period (Figure 4).

For settlements that started with a floor layer near ground level, there is, in general, less information available about their measurements, because remains of the original surface have frequently been disturbed and, unlike is the case with a terp, it is not always clear what can be regarded as the settlement's outer boundary. Only in the case of

Tjerkwerd-Arkum could this be determined, because the original settlement seems to have been enclosed by a narrow ditch (Bakker 2019a, 108–109). The width of this NNE–SSW-oriented settlement would then have been between 9.5 and 10 m, and the length would have been at least 15 m (it was probably more than that, because it extended outside the excavation area) (Bakker 2019a, Figure 3.16).

Remains of Houses and Other Features Related to Habitation

Based on the fact that all of the above-mentioned sites contained features, in the form of hearths, and yielded the remains of wooden posts and finds of (burned) clay fragments of former wattle and daub walls and sometimes the associated remains of twigs, it is safe to assume that all of them accommodated houses. Filled-in post holes are rare, though. This is an acknowledged problem for terp excavations in general (see also Waterbolk 2009, 2). In the soft peat or clay soils, most likely many of the holes simply disappeared after being trampled once posts were removed, instead of being filled in, as was the custom on sandy soils. In the case of Leeuwarden-Bullepolder, parts of (successive) NNE–SSW-oriented, probable three-aisled house plans were visible because clay had seeped into the peat fissures that aligned with the original walls of the houses (Bakker 2020a, Figure 3.9, 69). At Wartena-Warstiens and Sneek-Stadrondweg Oost, (almost) complete three-aisled house plans were uncovered (Bruinsma 1968; Niekus 2002; Bakker in prep.-b). Three-aisled houses are typical for the northern Netherlands in this time period (Waterbolk 2009), and the house plans at Wartena-Warstiens are among the best preserved ever found. The footprint of the first house at Wartena-Warstiens fits perfectly within the outline of the original terp, as does the possible north-eastern expansion of that house. The successor to this house was longer, but by that time the terp had already been expanded so it could accommodate this increased length (Figure 7).

Most, though not all, of the excavated house plans had an orientation ranging from NE–SW to NNE–SSW (Niekus 2002; Bakker 2018, Figure 5.19, 89–92, 2020a, Figure 3.9, 69, in prep.-a, in prep.-b). This orientation is very common for solitary farmsteads in the northern Netherlands during this time period. In the Netherlands, the prevailing wind direction is from the southwest, but it is not certain whether this is the reason the houses are oriented the way they are. In cases where the houses started on a mound, such as the Wartena sites, the planned orientation of the house, rather than the orientation of the surrounding drainage ditches, seemed to have dictated the orientation of the mound. The orientation of these ditches could differ from the orientation of the mound because the ditches were dug in the direction of the waterway that was used for drainage. For instance, at Wartena-Warstiens, the drainage ditches were dug towards a large waterway in south-westerly direction (Bakker in prep.-b), while at Leeuwarden-Bullepolder, the orientation of the individual drainage ditches differed from each other because they were part of a large-scale radial system a few kilometres in circumference intended to drain the local bog peat cushion (Bakker 2020, Figure 3.20).

In addition to the remains of houses, many (successive) water wells were encountered within the settlement borders of each excavated site. Those dating to the Late Pre-Roman Iron Age and the Roman Iron Age have a relatively narrow, straight shaft usually no more than 1 m wide (the top of the well is often broader) and are usually dug down to the level

of the Pleistocene sand (see: Niekus 2002, 20; Bakker 2018, 77–81, 2019a, 87–90, 2020a, 62–65; in prep.-a). In the case of Leeuwarden-Bullepolder, water wells dating from the habitation phase of the late Middle Iron Age were larger and more irregular in shape and looked more like pits (Figure 8; Bakker 2020a, 62–65). This difference in water well construction has also been observed in recently excavated settlements in the former salt marsh area (T.W. Varwijk, personal communication, 11 August 2021). No traces of granaries could be identified at any of the excavated reclamation settlements, and such traces are also rare in the terps of the salt marsh area. It is possible that food was stored inside the houses, although it cannot be excluded that there were granaries and that these cannot be identified because (most of) the post holes are no longer detectable archaeologically (as noted above).

The Nature of the Initial Habitation Phase

It has been argued in the past that the peat reclamations were only seasonally inhabited, their use limited to peat cutting and grazing some cattle because of their wet and supposed marginal soils (Gerrets 2010, 77–104). However, especially during the initial habitation phase, it is most likely that the settlements were occupied year round. The (gradual) raising of the settlements and the labour this would have required provide the first indication for this. Similar to the situation on the salt marshes, a raised settlement enabled the occupants to live in dry circumstances even when the surrounding lands (seasonally) lay inundated. The construction of three-aisled houses – similar in size to those of the salt marsh terps – provides further substantiation for this statement. These houses had sufficient space not only to accommodate livestock during the winter season, when grass had stopped growing and fields could become inundated, but also to store fodder and other goods. There would be no need for the reclamation settlers to retreat to the terps on the salt marsh area at the end of each summer, as has been argued in the literature (Gerrets 2010, 104). Further support for this argument is the number of archaeological finds, including the vast amount and variety of ceramics, found in layers belonging to the first habitation phases, as these numbers are similar to those encountered in terps in the salt marsh area around that period (compare: Varwijk, Bakker, and Blok 2015; Bakker and Varwijk 2016; Bakker and van Sambeek 2018; Bakker and Varwijk 2019; Bakker 2019b, 58–59, 2020b).

One of the other arguments brought forward in support of seasonal habitation is the light construction and hence assumed short lifespan of the houses (Gerrets 2010, 100). Most of the remains of wooden posts encountered during excavations were indeed made of alder and birch, but posts made of hardwood such as oak, also occur frequently (Waldus 2000, 87; De Roller 2002a, 2002b; Van der Laan 2017, 2018, 2019, 2020; in prep.). The use of alder and birch may in fact even indicate that the structures were intended to be durable, as posts made of these wood types are relatively light, which reduces the chances of their sinking into the peat soil. More important perhaps was the fact that these kinds of wood would be readily available along the streams in the peat area, while hardwood had to be imported over distances, as it does not grow in waterlogged fens and bogs. This means that unlike the settlers of the tree-less salt marsh, those of the peat reclamations had plenty of wood at their disposal, not only for construction, but also for repairs.

Although a discussion of the surroundings of the settlements is outside the scope of this article, it cannot be fully neglected in this discussion of the character of the settlements. Recent research offers a valuable contribution to this discussion because it makes clear that during the first habitation phases, the reclaimed peat lands had a very high settlement density and were drained by a vast network of ditches (Bakker & De Langen in prep.). A systematic GIS analysis based on elevation maps and old aerial photographs for the area around Wartena indicated an average of five homesteads per square km (Bakker & De Langen in prep.). Based on coring surveys (see for instance: Aalbersberg 2006) and further GIS analysis (Scholte Lubberink, Bakker, and Sibma 2016; Bakker & De Langen in prep.), there is no reason to believe the density was any less in other parts of the early peat reclamations in Friesland. Similar density figures are also given for early reclamations in the western Netherlands (Van den Broeke 1993, 74–76). The labour required to dig these ditches and the effort to maintain this drainage system makes it much more likely that farming, rather than mere seasonal exploitation, was the primary aim.

The composition and appearance of the (cultivation) layers that made up the old ground surface around the settlements also strongly point to an agricultural purpose for the reclamations during the first habitation phases (Bakker & Schepers in prep.). Depending upon the dominant type of topsoil, these layers consisted of a 20–40 cm thick layer of sapric peat or very organic (peaty) clay that was mixed to some degree with household waste (Bakker 2018, 74–77, 2019c, 268–269, 2020a, 60–62; in prep.-a).

A final, but more indirect, argument for year-round occupation is that in most of the well-dated sites, the habitation phase associated with the primary reclamation lasted, on average, only 75–100 years (Figure 4). This duration, of roughly three to four generations, is short when compared with the duration of habitation on most of the terps in the salt marsh area. The explanation for this discrepancy could very well be the vulnerability of peat lands to subsidence after being drained. It is not impossible that, in a timeframe of roughly 75–100 years, the land surface had subsided to a level that approached or was at groundwater level during large parts of the year. In such waterlogged conditions, there might still be possibilities for seasonal exploitation, but no longer for mixed farming. The fact that habitation in these reclamation settlements only lasted for a couple of generations is therefore a strong indication not only that the aim of the first peat reclamations was indeed agricultural self-sustainability, but also that seasonal occupation was unlikely, as not only the location, but also the local environment, met all the requirements during that first habitation period to enable year-round habitation at the site.

Abandonment and Re-occupation

After locations were abandoned, human activity did not always cease in their surroundings. Those activities, like the previously mentioned peat cutting at Leeuwarden-Bullepolder (Koopstra 2002; Bakker 2020a, 70–73), were, however, definitely seasonal in nature. The traces of renewed peat formation that have been encountered at many sites also contradict a strong human presence in the area of abandoned sites for one or more generations (Bakker 2018, 2019a; in prep.-a).

Some sites were re-occupied after having been abandoned for a while (Figure 4). Less is known about these habitation phases than about the initial habitation phases. The features that remain of these later phases are often found to be disturbed, either by sea erosion or by medieval and modern human activity. Most of the times only the deeper features, such as water wells and ditches, remain, and sometimes a couple of terp layers, especially on the margins. Although these features and the associated finds of pottery and other materials represent clear signs of habitation, they seldom offer enough evidence to allow for statements about the nature of the habitation.

In the case of the re-occupation of the site of Tjerkwerd-Arkum in the second half of the 1st century AD, the dark, organic clay layer that surrounds the terp provided additional information about the nature of the site during this phase. Interestingly, many of the off-site drainage ditches of the earlier reclamation remained filled in during this phase (Bakker 2019a, 112–113). This seems to point to a secondary reclamation of the local area as new ditches were dug for drainage, and the appearance of the organic clay layer also seems to hint at renewed agricultural use of the surroundings of the terp. In combination with heightening of the terp, this is an indication for renewed year-round habitation of the site. The relatively short habitation period and the results of $\delta^{13}C$ and $\delta^{15}N$ isotopic analyses on cattle bone also hint at permanent occupation (Bakker 2019c, 277–278; Bakker & Schepers in prep.). The isotopic analysis showed that the cow grew up in the peat lands and did not periodically visit the salt marsh area (Bakker 2019c, 277–278; Bakker & Schepers in prep.).

Neither the last habitation phase of Tjerkwerd-Arkum (Bakker 2019b, 277) nor the later habitation phase of Sneek-Harinxmaland, in the 2nd century AD, provides clues to determine whether habitation was seasonal or year round. Traces of hoof marks found on the flanks of the latter terp do indicate cattle were kept there (Bakker 2018, 99) and the fact that the terp flanks were raised during this phase and contained remains of pottery and other archaeological material can be viewed as evidence that the location was re-occupied. However, whether the location was used seasonally or year round cannot be determined, since the top of the terp is now missing due to erosion by the sea (Bakker 2018, 99–100).

Leeuwarden-Bullepolder developed differently from the other sites discussed in this paper. After an abandonment of about 200 years, a terp was raised here in the 1st century AD. It was gradually expanded in size and then, around the end of the 2nd century, abandoned again, only to be re-occupied in the beginning of the 3rd century. When the location was abandoned for good in the beginning of the 4th century, the terp had reached a surface area of approximately 2 ha (Bakker 2020a, 75, 82). Because during the 4th century the rest of the terp area also became largely depopulated (Bazelmans 2000; Nieuwhof 2011, 2016), it seems more likely that this abandonment was due to socio-economic reasons rather than renewed problems with the water table. Based on its size, it is thought the terp would have had space for several houses. However, the number of houses will remain unknown because no house plans could be positively identified along the excavated southern flanks of the terp, and the centre of the terp is mostly missing, due to commercial quarrying for terp soil midway the twentieth century (Bakker 2020a).

The terp itself had a radial allotment and was surrounded by a large ditch that was shifted outwards with each terp expansion (Bakker 2020a). Remains of silted-up ditches

in the surroundings of Leeuwarden-Bullepolder that were visible on old aerial photographs could be matched up to excavated features of ditches dating to the Pre-Roman Iron Age (Bakker 2020a, 81–83). Interestingly, the large ditch surrounding the terp seems to connect with these silted-up ditches. This shows that at least part of the old drainage system was re-used in the Roman Iron Age, which, in its turn, is a strong indication that the land surrounding the terp was in agricultural use. Whether these parcels were used for mixed farming is not certain. However, within the plots on the terp, arable farming would have surely been possible.

Radial allotments are a common feature of the larger terps of the salt marsh area (see De Langen and Mol 2016). However, even though the area around Leeuwarden-Bullepolder did silt up over time, it was not yet a full salt marsh environment in the Roman Iron Age: when it was abandoned, the thickness of the clay deposits varied from 0.5 m in the southern part to only 0.1 m in the northern part (Koopstra 2002; Bakker 2020a, 73). It is still unclear how unique Leeuwarden-Bullepolder is. On old aerial photographs, a couple of other partly quarried-out terp sites of similar size are visible nearby (Bakker 2020a, 80–82). Whether these terps were already of that size during the Roman Iron Age can no longer be established. Over the past decades, residential neighbourhoods have been developed in that area, and these former terps can be considered destroyed. There are other large terps in Friesland situated in areas that were originally part of the peat zone. Some of them are medieval in origin or reached this large size in the medieval period, but it is likely that there are others that had a similar development as Leeuwarden-Bullepolder.

Why large terps like Leeuwarden-Bullepolder emerged in the transitional zone in the Roman Iron Age is a topic for future research. It could be that when the area was again reclaimed, the population of settlers was much smaller than it had been during the first reclamation and that therefore only a couple of the former reclamation sites, which were probable still visible as slight elevations in the landscape or because of their different vegetation, were re-occupied. When the local population grew over the next generations and the reclaimed land provided enough sustenance to feed them, the descendants did not spread out over the other old sites but instead increased the area of their terp to accommodate the increasing number of households. A radial allotment of the terp would in that case also be beneficial to divide the available space among the households equally, in much the same way as has been shown for the Middle Ages (De Langen and Mol 2016).

Conclusion

Recent research into the peat reclamations of the Pre-Roman Iron Age and Roman Iron Age has yielded many new insights. Especially the recent excavations by the GIA, during which the emphasis was on documenting profiles of sections, proved to be informative and made it possible to test various earlier claims and theories about these reclamations at the settlement level. For instance, it became clear that the reclaimed peat lands were drained to such an extent that it was often possible to live almost directly on the peat surface. This is interesting because it means that the newly created, artificial circumstances were much more favourable initially than assumed in earlier research. Earlier it was thought that all settlements in the peat area must have started on terps,

because it was believed that peat land, also in drained form, would have been too wet to enable much human activity. Nevertheless, over the course of their occupation, the sites that started almost at ground level were eventually all raised to the level of a low terp. Drained peat lands are vulnerable to subsidence; it is therefore likely that it were growing problems with the water table that forced the settlers to raise (low) terps after a while. Settlements in younger reclamations, at least those on fen peat, seem to have started on terps right away.

The temporal character of the early peat reclamations is one of the most important new insights. Unlike the terps on the salt marshes, which were continuously occupied for many centuries, the settlements of the early peat reclamations were often only habited for three to four generations before being (temporary) abandoned (Figure 4). The most likely cause for abandonment was the local environment becoming increasingly wetter due to peat subsidence. When this happened, the settlers abandoned the reclamation to move deeper into the peat area and reclaim new land. After abandonment, the local area was subject to sedimentation of marine clay deposits, and in some cases new peat started to form. This effectively raised the previously subsided surface of the reclaimed peat lands, eventually making them once again of interest to people looking to settle. It became clear that many of these former reclamations were eventually re-occupied. In some cases, such as at Tjerkwerd-Arkum and Leeuwarden-Bullepolder, this process of abandonment and re-occupation happened more than once. In the case of the younger reclamations, such as those around Wartena, re-occupation did not occur until the Middle Ages.

The excavated features and the archaeological finds make it likely that during the initial habitation phase, these sites were occupied year round instead of seasonally. The relatively short period of permanent habitation, in combination with the draining activities, makes mixed farming more likely than mere seasonal use for the initial reclamations. By further raising their terps, the settlers were able to prolong their occupation, but the rise in water table due to peat subsidence must have made the local surroundings increasingly less suited for mixed farming. Because of this, the settlements were eventually no longer self-sustaining, thereby forcing the settlers to move elsewhere to reclaim new stretches of peat land.

During the later habitation phases the settlements seem to have differed in character from each other some cases, for example at Leeuwarden-Bullepolder, year-round habitation seems most likely. This site also steadily transformed into a large terp that was comparable in size with those of the salt marsh area. In other cases, the settlement character remains poorly understood, not least because the more recent features of these sites were often found to have been eroded by the sea or disturbed by later human activities. Hopefully in future it will be possible to investigate sites with better preserved features of later habitation phases.

Disclosure statement

There are no competing interests to declare.

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