After the deluge, a palaeogeographical reconstruction of bronze age West-Frisia (2000-800 BC)

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6 Bronze Age sites are everywhere! Predictive modelling in eastern West-Frisia

6.1. Introduction

In the previous chapter it was argued that the natural landscape is more complex than previously thought. The geomorphogenesis of local heights turned out to differ in time-depth and genesis. Furthermore, Late Neolithic, Early Bronze Age and Middle to Late Bronze Age sites can occur in one, two or three stratigraphical layers, depending on the geomorphogenesis (§ 3.5.6). In chapter 4 it was argued that factors like hydrology, relief and soil properties and their influence on vegetation are thought to be of importance during the different archaeological periods. In chapter 5 it was argued that sites dating to the Late Neolithic and Early Bronze Age do have a strong relationship with the relief of the natural landscape. These sites appear to be situated on high levees and creek ridges in close proximity to tidal creeks. Contrary to these two periods, sites dating to the Middle Bronze Age seem to have no relationship with the natural relief at all, but appear to have a relationship with the lithology of the subsoil as was demonstrated in chapter 4 and 5. In the same chapters it was argued that in the Late Bronze Age sites probably show a relationship between relief and site-location, although this relationship cannot be attested due to differential subsidence, as was discussed in chapter 4.

A geomorphogenetical model combined with site-location factors, such as described above, can be used for predictive modelling in eastern West-Frisia. Not only these site-location factors have to be taken into account but also historic and modern land-use are of importance. In this chapter these factors are the subject of research. First the standing practice of predictive modelling in the Netherlands and in particular West-Frisia is introduced.

6.2. Archaeology in the Netherlands

In the past, archaeological research was often carried out in research led projects in order to answer a wide variety of research questions (§ 2.8). Sometimes excavations led coincidentally to unexpected finds. This is for example well illustrated by the excavation *Medemblik-Schuitenvoerderslaan,* which was carried out to learn more about the development of this small town in the Early Medieval period (Besteman 1977; De Boer 2013). During the excavation it turned out that the remains of a Middle Bronze Age settlement site were present in the subsurface (§ 5.4.4). Nowadays, most archaeological research is carried out in development led projects in advance of spatial planning projects (§ 2.8). The archaeological research, carried out in these development led projects, is structured conform the

Dutch Archaeology Quality Standard, KNA (Willems and Brandt 2004). Each project follows, in theory, the same route, starting with a desk-based assessment. This research process will be described in § 6.2.1.

Predictive modelling plays an important role in this research process. The first step in predictive modelling is to consult the indicative map of archaeological values (IKAW) and, if available, a local predictive model. The first is described in detail in § 6.2.2, the second for eastern West-Frisia is described in detail in § 6.2.3. The second step, the actual prospecting of sites in the Netherlands and West-Frisia in particular, is described in § 6.2.4. In § 6.2.5 the process of predictive modelling for West-Frisia is evaluated.

6.2.1. The AMZ cycle and the Dutch Archaeology Quality Standard (KNA)

Willems (1997, 4) introduced the Archaeological Heritage Management cycle ("AMZ-cyclus") in Dutch archaeology (figure 6.1). This simple scheme visualizes the archaeological research process and its relation to the public and legislation. In 1997 the Dutch government ratified the Valletta treaty, which led to a new Archaeological Heritage Management Act (WAMZ) in 2007 (Keers *et al.* 2011, 3). The main goal of the new legislation is to preserve archaeological remains *in situ*. When *in situ* preservation is not possible the site has to be investigated, valued and if necessary preserved or as a last resource excavated. The developer is charged for the costs of the archaeological research including the report(s), filing and stabilization of the finds and data. Only certified organizations are allowed to perform this archaeological research. The research has to be executed conform the Dutch Archaeology Quality Standard. A research brief for the archaeological research is written by a certified organization and has to be authorized by local authorities. Local authorities are responsible for laying down and maintaining a policy on archaeological heritage (Keers *et al.* 2011, 4). Since 2007 municipalities are obliged to develop a policy on archaeological heritage management, which is often based on a local or regional predictive model. In 2011 slightly less than half of the municipalities had developed such a framework (Keers *et al.* 2011). In areas lacking such a framework, provincial predictive models or the national model (IKAW) are used. Smaller municipalities joint forces in regional organizations to develop and maintain a predictive model and policy. Several of these organizations are

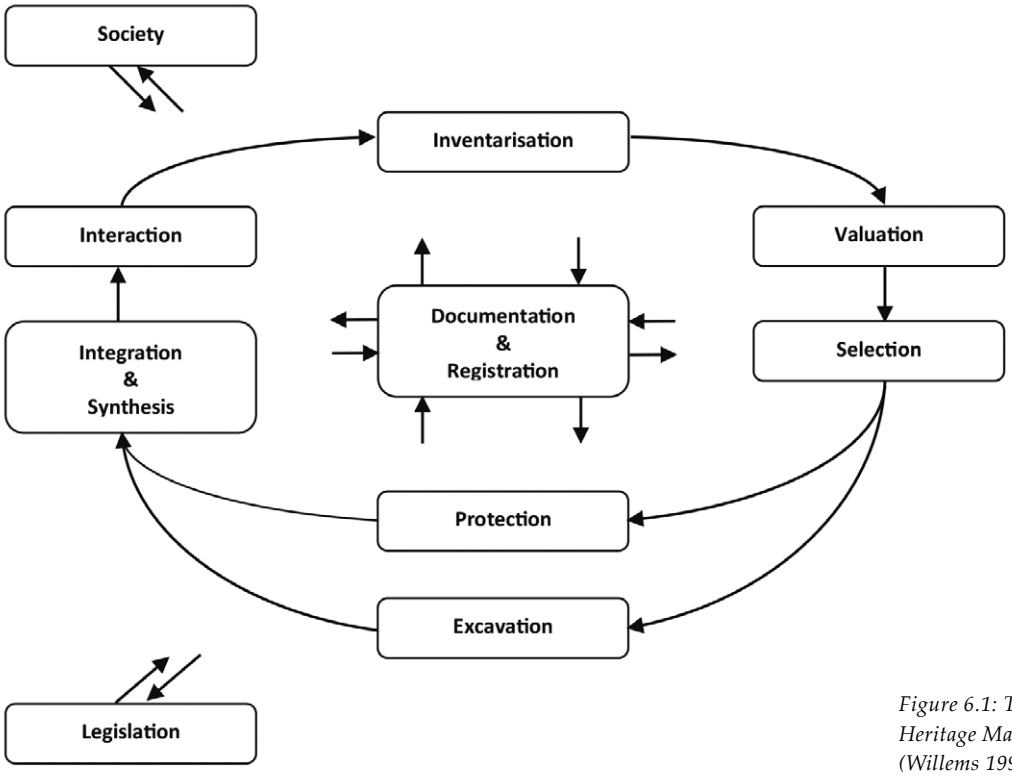

Figure 6.1: The Archaeological Heritage Management cycle (Willems 1997, 4, figure 1).

also certified to perform archaeological research like *Archeologie West-Friesland*, which at the moment represents the municipalities of Drechterland, Enkhuizen, Hoorn, Koggenland, Medemblik, Opmeer and Stede Broec. Besides regulation, policy and sometimes research, these organizations are also involved in public outreach.

The Archaeological Heritage Management cycle is elaborated in the archaeological research process, as described in the Dutch Archaeology Quality Standard, KNA (figure 6.2). According to the KNA all archaeological research starts with a desk-based assessment. The objective of such an assessment is to acquire information, using existing sources, concerning known or expected archaeological values within a defined area (Willems and Brandt 2004, 27). The result of the assessment is a specified and substantiated predictive model of the expected archaeological values, based on existing archaeological, landscape and historical information. This existing information is combined with newly acquired information (including earth science data) concerning the defined area (Willems and Brandt 2004, 35). The assessment results in a report which contains recommendations, in accordance with the prevailing policy, for the follow-up process.

Often a desk-based assessment is followed by an archaeological field evaluation. The objective of the archaeological field evaluation is to supplement and verify the specified predictive model that resulted from the desk-based assessment (Willems and Brandt 2004, 45). During the field evaluation a distinction is made into three successive phases, an exploratory, a mapping and an evaluation phase. The objective of the exploratory phase is to gain insight into the geomorphology in relation to location factors in order to distinguish between high- and low-potential zones. In the mapping phase the area is systematically mapped for archaeological finds and/or features. During the evaluation phase the nature, size, conservation and relative quality of sites are investigated.

The methods used during the archaeological field evaluation depend on the local conditions and the phase in the evaluation process. In the exploratory phase coring, often in section lines or grids, is widely used as a research method in Dutch archaeology.

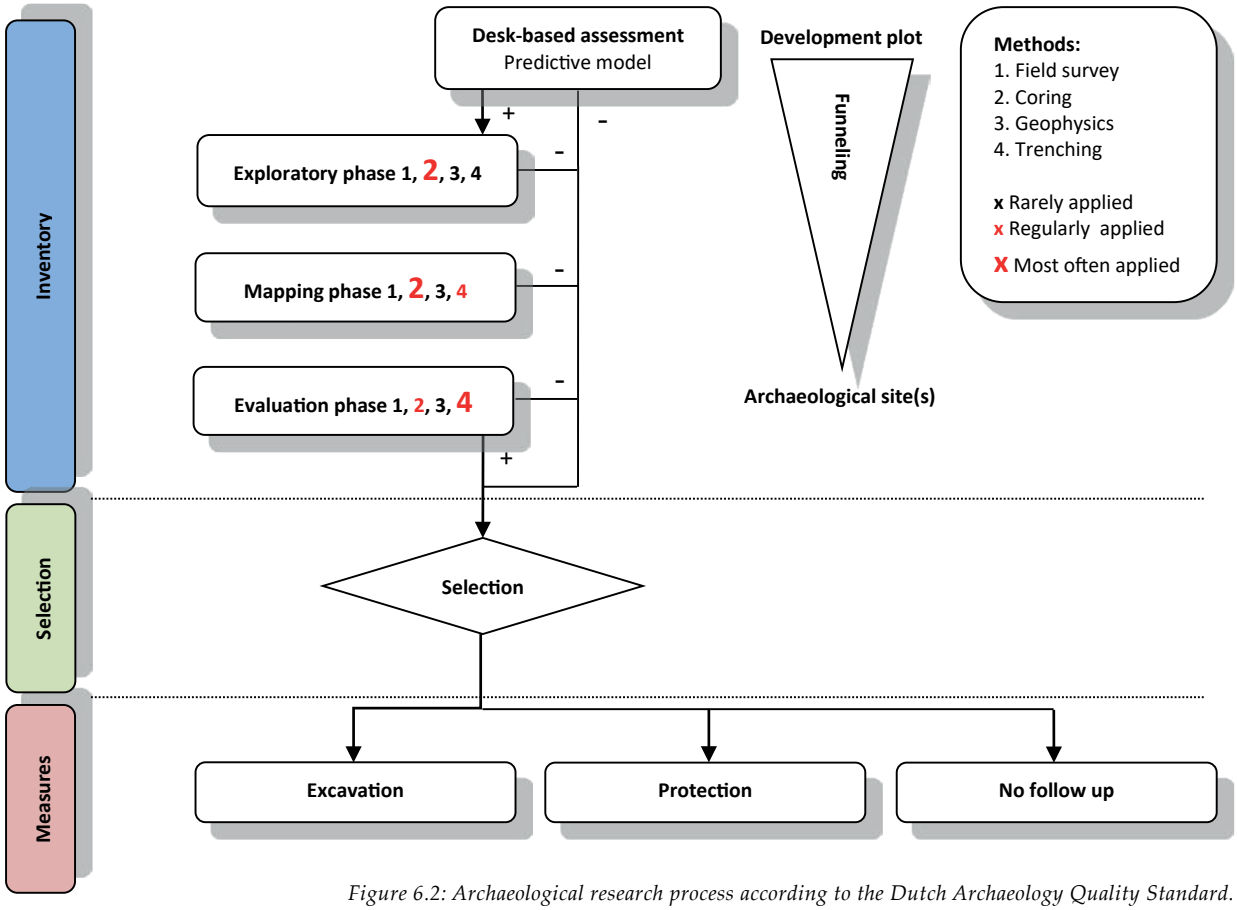

Figure 6.2: Archaeological research process according to the Dutch Archaeology Quality Standard.

During the mapping phase, coring in grids is most often applied in the Netherlands especially for sites in or covered by Holocene sediments. There has been a lively debate about the effectiveness of this method (Tol *et al.* 2004; Fokkens 2007; Wilbers 2007; Tol 2008). The outcome of this debate is a guideline for coring (Tol *et al.* 2006; Tol *et al.* 2012) and a guideline for trenching methods (Borsboom and Verhagen 2009; Borsboom *et al.* 2012). Contrary to other countries in North-Western Europe, field surveys are rarely used in the Netherlands during the mapping and evaluation phase and never during the exploratory phase. This is partly due to the small time windows with suitable conditions for field survey caused by the intensive and varied use of the fields. Geophysical methods are also seldom used during archaeological field evaluation in the Netherlands, despite the positive results in various studies (Kattenberg 2008). Recently a study on the prospection methods for Mesolithic sites with a Holocene cover has been published (Hamburg *et al.* 2014). This study proved a greater value for geophysical methods over corings in the exploratory phase. Studies by Verschoof-Van der Vaart (in prep.) in West-Frisia demonstrate the great value of geophysical research during the mapping phase (§ 6.4.4). Although in other European countries the use of geophysical methods is routine, in Dutch Archaeology these techniques are still experimental (Hamburg *et al.* 2013, 57). Anticipating a changed attitude towards geophysical methods the "*Guidelines geophysical survey in archaeological field evaluation*" of English Heritage have been made available for Dutch archaeologists (Kattenberg and Hessing 2013).

Several comments have to be made on this archaeological research process. Depending on the results of each step in the research process the next step(s) can be skipped. For example, if during the desk-based assessment absence of archaeological remains in the defined area can be argued, the defined area can be deselected for further archeological research by the local authorities. Furthermore, it is important to note that the area under investigation tends to become smaller and smaller during the research process. In the desk-based assessment the complete development area is subject to research. Based on this desk-based assessment often part(s) of the development area is (are) deselected. The exploratory phase is explicitly designed for selecting low- and high-potential zones. It is good practice to do a follow-up with a mapping phase solely in the high-potential zones. During the next phase in the research process it is also good practice to valuate only the locations mapped as an archaeological site. This process of studying progressively smaller areas with increasing research intensity is called funneling (Gehasse 2009, 59). Funneling can easily lead to tunnel vision. In addition, predictive models determine the used field methods. The risk of a self fulfilling prophecy is great with this combination of funneling and selection of methods, especially when the validity of the selection is not randomly tested, which is often not imposed by legislation.

6.2.2. Indicative map of archaeological values (IKAW)

In the field of predictive modelling it is widely accepted that there is a relationship between the natural landscape and locations for specific human activities (Verhagen 2007, 13). The nature of these relationships depends on the landscape characteristics and its use for man. This relationship can be studied in two ways, inductive or deductive. This dichotomy is also described as data-driven or theory-driven (Wheatley and Gillings 2002, 149), though it is not always as clear as is often thought. The data used in data-driven models is often (partially) assembled in a theoretical context and therefore theory-laden (Wheatley and Gillings 2002, 149). Conversely it is also true that theories are often (partially) based on empirical observations. In the Netherlands there is a strong data-driven tradition in predictive modelling (Verhagen 2007, 18-19). In 1997 a data-driven map at a national scale was published. This map presented the relationship between the nature of the soil and the presence of archaeological sites (Deeben *et al.* 1997). This indicative map of archaeological values (IKAW) was developed for use in spatial planning projects in order to obtain a basic idea of the possible presence of archaeological sites.

The first edition of the IKAW is a classic example of a data-driven approach. The first IKAW presented a simple relationship between soil units, groundwater classes and the number of sites in the national database for archaeological finds (ArchIS). Each archaeo-region, a region with more or less comparable archaeological and environmental characteristics, was analyzed for the available data (soil map 1:50.000 and ArchIS). Based on these analyses, for each region three classes were defined: a low, middle high and high indicative value (Deeben *et al.* 2002, 12). Therefore

the boundaries between the different classes are not uniform across the map. For example, the boundary between a low and middle high indicative value in one region can be defined on 3 finds per km^2 of a certain soil unit, whereas in another region this boundary is defined by 1 find per km^2 of the same soil unit.

During the compilation of this map, the authors were well aware of the limited depth of the soil units (Deeben 2008, 8). Therefore, the map is not applicable for sites at deeper levels in the Holocene parts of the Netherlands. Furthermore, the authors observed different correlations with soil units for different types of sites. For example, the correlation between the preferred soil unit for Late Neolithic barrows is not the same as for Late Neolithic settlement sites (Van Zijverden and De Moor 2014, 136). A last important observation is that sites dating to different periods sometimes correlate with different soil units. Apparently this goes especially for Late Palaeolithic sites, because sites dating to this period occur mostly in units with a low indicative value on the IKAW. What has not been taken into account are the post-depositional and research processes, which are of large influence on the 'map formation processes' as it is called by Fokkens (1998). Fokkens (1998, 57-60) argues that, amongst others, site visibility, research strategy and the interest of local archaeologists are of great influence on the site distribution. In the explanation of the third edition of the IKAW (Deeben 2009, 6) this problem is explicitly mentioned.

The second and third edition of the IKAW are not solely based on the previously described simple data-driven relationship. Parts of the map have been adjusted with theory-driven models. For example the second edition of the IKAW has been adjusted for the central river area (Deeben *et al.* 2002). For this part of the IKAW the map of meander belts (Berendsen and Stouthamer 2001, addendum 1) and the available geological maps (1:50.000) have been used. In order to comprise the levees and larger parts of the crevasse splays into the IKAW as areas with a high indicative value, a buffer zone along the meander belts has been used (Deeben *et al.* 2002, 25). The idea behind this adjustment is that stream ridges, levees and crevasse splays have been attractive to man, whereas basin areas have been less attractive to man. This adjustment has many implications. In this part of the IKAW there is no established relationship between the map units and the number of known sites. Furthermore, the depth of the map is considerably increased, although it must be noted that the core density used to map the older meander belts is considerably less compared to the core density used to map younger meander belts (Berendsen and Stouthamer 2001). Therefore the older units are mapped with less accuracy compared to the younger units, which implies a difference in reliability of the presented units.

The process of the compilation of the IKAW and its use in spatial planning were and are criticized and debated (Verhagen 2007, 18-19; Van Zijverden and De Moor 2014, 136-139). Nevertheless, the impact of this map and the developed methods for predictive modelling has been of great influence on the present day predictive modelling practice in Dutch archaeology.

6.2.3. The policy document for eastern West-Frisia

The changed legislation after the Valletta Treaty led to the development of detailed maps for heritage management and policy documents by municipalities. In West-Frisia, several municipalities joined forces to develop their own map of archaeological values and a policy document (De Boer and Molenaar 2006). The methodology used in this publication combines a data-driven and theory-driven strategy, like the previously described IKAW.

The starting-point for the construction of the map is the idea that soil and geological characteristics have been important location factors for man in the past. It is thought that, especially farmers, chose locations based on specific soil properties like fertility and available water capacity (De Boer and Molenaar 2006, 42). They argue that the soil map of Ente (1963) not only represents the soil properties for the Bronze Age landscape very well, but also presents information on the morphogenesis. They discuss the relationship between soil classes, site location and site visibility at length. Based on this discussion, they present an important constraint on the analysis of find patterns in relation to the soil map. They state that sites covered by later sediments are less visible during field surveys and therefore under represented in the site database of their inventory, which contains a considerable number of sites found during field surveys. Despite this constraint De Boer and Molenaar (2006) present the number of sites per soil unit and compute the gain for each soil unit by subtracting the relative surface area of each soil unit from the relative number of

Soil unit	ha	%	N sites	% sites	gain	Archaeological value
Sandy loam to loam soils	1.480	23,9	137	38,4	14,4	high
Loamy sand to sandy loam soils	377	6,1	51	14,3	8,2	high
Ancient settlement soils	10	0,2	11	3,1	2,9	high
Thin (silty) clay loam soils overlying loam to loamy sand	41	0,7	6	1,7	1,0	middle
Sandy loam to loam soils mostly overlying (silty) clay loam	805	13,0	44	12,3	-0,7	middle
Thick clay loam soils overlying sandy loam to loam.	360	5,8	17	4,8	-1,1	middle
Transitional soils	99	1,6	0	0	-1,6	middle
Deeply humose soils	225	3,6	8	2,2	-1,4	low
Peat soils	230	3,7	3	0,8	-2,9	low
"Kiek clay"	330	5,3	0	0	-5,3	low
(Silty) clay loam soils	2.047	33,1	76	21,3	-11,8	low
Water	31	0,5	1	0,3	-0,2	none
Raised soils	29	0,5	1	0,3	-0,2	-
No data	119	1,9	2	0,6	-1,4	-

Table 6.1: Archaeological value per soil unit (After: De Boer and Molenaar 2006, 45-46).

sites (table 6.1).[80] Based on the gain the soil units are classified in three classes regarding the archaeological value analogous to the classification of the IKAW: high, medium high and low. Remarkable is the classification of the deeply humose soils as the class with low archaeological values. These soils represent Medieval settlement sites and are supposedly heavily worked (De Boer and Molenaar 2006, 47). Although not explicitly described by De Boer and Molenaar (2006) it is often thought that this land use resulted in destruction of Bronze Age sites, this is probably the reason for this classification.

For each of the archaeological value classes a policy advice is presented by De Boer and Molenaar (2006). For the high and middle high classes archaeological research in advance of disturbance of the soil should be obligatory in their opinion. During the desk top phase and inventory phase for these classes it is advised to focus on disturbances of the subsoil caused by modern land use, like levelling. It is advised to exclude locations which are heavily influenced by this type of modern land use from further archaeological research. At locations with a low archaeological value it is recommended to do some additional coring in order to check the validity of the used soil map. For development projects of 2500 m^2 and upwards it is advised to execute a watching brief during excavation work. This last advice is specifically added in order to prevent a self-fulfilling prophecy for the class "low archaeological value".

De Boer and Molenaar (2006) end their publication of the policy document with three important notes. First they state that the find layer of most of the Bronze Age sites in West-Frisia is characterized by a very small density of finds (De Boer and Molenaar 2006, 54). Furthermore the find layers are often incorporated in the plough zone (De Boer and Molenaar 2006, 54). Therefore these sites are difficult to map with coring, the standard method for exploring sites in the Netherlands. Second they state that the model is solely based on a relation between known sites and soil classes (De Boer and Molenaar 2006, 57). Besides the soil many other site location factors may have mattered to the Bronze Age inhabitants, not in the least social factors, which have not been taken into account in the model (De Boer and Molenaar 2006, 57). Third the model is only based on settlement sites and therefore not applicable to sanctuaries, burials and other types of sites. These notes restrict the applicability of the presented model by De Boer and Molenaar (2006) to a considerable degree; solely settlement sites with a proven positive

80 An evaluation of different methods of the computation of the gain is given by Verhagen (2009, 76). The gain can be used for choosing high and low probability classes (Verhagen 2009, 81).

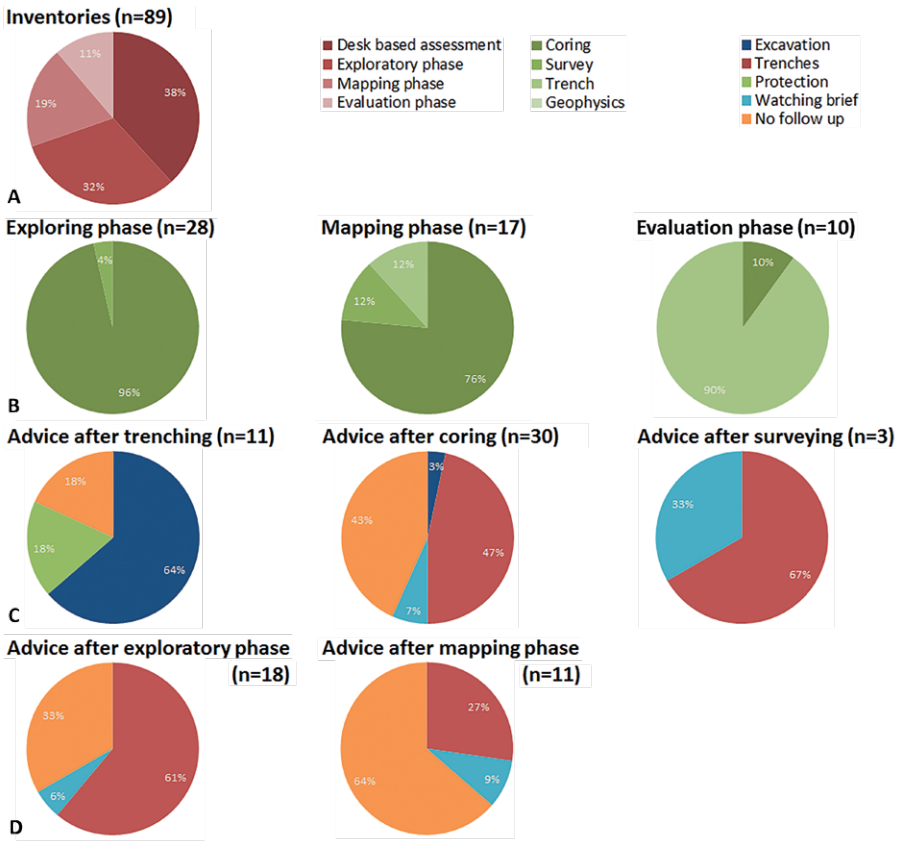

Figure 6.3: Result of an analysis of 89 reports on inventories for Bronze Age sites in eastern West-Frisia. A Number of inventories per phase, B Used methods per phase, C Advice for method per phase, D Advice for method per phase after coring (see appendix 3 for an overview of all used reports).

relationship to several soil units of the soil map of Ente (1963).

6.2.4. Predictive modelling: theory and practice

Since the publication of the policy document for eastern West-Frisia in 2006, many reports on inventories concerning development sites have been published. In the digital database EDNA (Electronic Depot for Archaeology in the Netherlands) 54 publications on inventories of possible Bronze Age sites are available,[81] dating to the period after the publication of this policy document. These 54 publications cover 89 reports on different inventory phases. It is important to note that the EDNA database is, despite the obligation of uploading the publications in the KNA, far from complete. An analysis of these uploaded publications is presented below.

The process of funneling is clearly visible in the amount of reports for the different phases in the inventory process (figure 6.3A). The number of investigations decreases during the process, at the same time the research intensity increases. Thirty-four desk-based assessments were published since the publication of this policy document in 2006. In the same period eight recommendations for an excavation, three recommendations for a watching brief and two recommendations for preservation were given. The methods used in the different phases of the inventory (figure 6.3B) show a focus on coring during the exploratory and mapping phase. Trenching is the main method used during the evaluation phase. Geophysical methods are not applied at all. Surveying is only used during the mapping phase. According to the local policy document, mapping of Bronze Age settlement sites is nearly impossible with coring. Therefore the focus on coring as the main technique during the mapping phase is, at the least, remarkable.

Interesting is the advice given in the publications in relation to the used techniques (figure 6.3C). Surveying and trenching lead to different types of advice. With a few exceptions, both types of research always lead to a follow up. After trenching often an excavation or protection is advised. After a field survey trenching or a watching brief is advised. The

81 Checked at April 25th, 2016.

differences in advice can be explained by the phase in the inventory process in which these techniques have been used. Trenches are mostly used during the evaluation phase and surveys during the mapping phase, which logically leads to a different advice during the next phase of the inventory. The small number of surveys hinders a generalization of this conclusion. Coring leads in almost 50 % of the cases to a negative advice for a follow up (figure 6.3B). This is remarkable given the reservations by De Boer and Molenaar (2006, 57) on the applicability of coring as a method for mapping Bronze Age sites in this area.

Given the results and the applicability of coring as a method in the mapping phase it is interesting to have a better look at the advice after inventories based on corings. In figure 6.3C an overview of the given advice after an inventory based on corings, is presented per phase. For the negative advice after coring in the exploratory and mapping phase, three different motives or a combination of motives have been used:

1. During the inventory finds were absent (n=10).
2. The top soil dating to the Bronze Age is no longer intact (n=7).
3. The subsoil is unsuitable for habitation (n=2).

It is obvious that the first motive is invalid, the soil horizon dating to the Middle Bronze Age contains very little archaeological indicators, like charcoal, bone, burned clay, pottery and so on. This is even the case in settlement sites (De Boer and Molenaar 2006, 57; Van Zijverden 2006, 8). The absence of finds in this horizon during an inventory with coring equipment cannot be used as an argument for the absence of archaeological remains dating to the Bronze Age. The second motive is questionable. A natural top soil (A-horizon) in this type of sediments varies in thickness between several centimeters and 15 centimeters. The soil sections of Bronze Age settlement sites, as presented in the previous chapter, prove that the absence of such a top soil is not at all an indication for the absence of a settlement site! Therefore, if the top soil is incorporated in the modern plough zone it does not imply that features are absent. It definitely means that the information value of a site is smaller. Of course it is possible that only the deeper features like water pits are present when the top soil is absent, but this information cannot be derived from corings. The third motive is also dubious. In one case it is noted that man only lived at the sandy creek ridges. Due to the absence of such a creek ridge at the investigated plot, habitation in the Bronze Age has been impossible (Warning 2006, 6). Based on the results of sites like *Enkhuizen-Kadijken* this argument is obvious invalid. In the second case it is noted that the soil is not consolidated and therefore unsuitable for exploitation (Brokke 2008), which is a reasonable argument.

In conclusion: despite the well-argued methodology for the prospection of settlement sites by De Boer and Molenaar (2006), despite a well-informed and well-organized local government (Archeologie West-Friesland) and despite a plain policy document, this analysis demonstrates that since the introduction of this policy in 2006 at over 50% of the investigated locations this policy is not put into practice. The implication is that Bronze Age sites are probably destroyed unseen despite the good intentions and effort of archaeological companies and the local government. This is quite clearly illustrated by several watching briefs carried out by Archeologie West-Friesland, where features of Bronze Age settlement sites were found at locations with a low archaeological expectation, based on an inventory (mapping phase) carried out with hand auger equipment (Gerritsen 2014).

6.2.5. Asking the right question

In addition to this discouraging practice in eastern West-Frisia, one should bear in mind that the document of De Boer and Molenaar (2006, 48) explicitly states that their model is developed for the prospection of Bronze Age settlement sites. Are settlement sites the only types of sites the archaeological community wants to explore? For example, West-Frisia is not only known for its well preserved settlement sites, but also for a large number of well-preserved burials and burial mounds (Steffens 2013). Steffens (2013, 100) demonstrates that burial mounds are located differently compared to settlement sites in respect to soil units of the soil map of Ente (1963). A focus on locations preferred for settlement sites will lead to an under representation of burial sites. Furthermore, we now believe that hunting, fishing and gathering still played a significant role in Bronze Age West-Frisia (Van Amerongen 2014, 92). The find of a fyke in the settlement site of *Enkhuizen-Kadijken* demonstrates the actual existence of fishing spots. The absence of sites with weirs and fykes forms a contrast to the large

number of settlement sites and burial mounds.[82] We also do know there has been contact with communities in other areas of the Netherlands for the exchange of cattle and goat/sheep (Brusgaard 2014, 64). Distances which probably have been bridged by boat or canoe. Given the wet environment, boats or canoes must have been important for transport in West-Frisia. Apart from the find of one paddle in a settlement site and a blade of a paddle in a residual gully, any finds associated with transport by water are absent (Roessingh in prep.; Cordfunke 1972, 18).

The current policy is focused on the selection of locations favored for Bronze Age settlement sites. Based on the existing model, it is thought that these sites are situated at the relatively high and sandy creek ridges. Therefore, research is focused on these ridges. Focusing on these ridges implies you will have little chance finding a canoe, fishing camp and so on. Based on the previous, a series of important question arises: "Should predictive modelling in Bronze Age West-Frisia solely focus on settlement sites or are these other types also relevant to investigate? What are the "right" questions to ask? And in addition: What is the "right" methodology in order to answer these questions? Which techniques are applicable in West-Frisia? What kind of results are achievable?

These questions are not easy to answer. In the next paragraph, the research carried out at *De Rikkert* is presented as a case-study for the possibilities in predictive modelling in eastern West-Frisia.

6.3. Predictive modelling: De Rikkert

It is believed that Bronze Age settlement sites in West-Frisia are represented by surface finds, as is described in the policy document for the municipality of Enkhuizen.[83] The reverse is also thought to be true. The absence of surface finds indicates the absence of settlement sites (IJzereef and Van Regteren Altena 1991, 65). Several excavations prove that this is, at least partly, untrue. For example, during the survey in the seventies only three sherds of Bronze Age pottery were found close to the northern border of the development plot *Enkhuizen-Kadijken* (Lohof 2006, 5). Therefore, it was a surprise that the entire development plot (over 13 hectares) turned out to be part of a Bronze Age settlement site (Roessingh and Lohof 2011). During the same survey a large number of Late Bronze Age pottery was found, which led to the excavation in Andijk in 1973 (IJzereef and Van Regteren Altena 1991, 61). During the excavation only features dating to the Middle Bronze Age were found (Roessingh in prep.). Both examples illustrate that the distribution map of finds cannot be the only source for the mapping of Bronze Age sites in West-Frisia. Therefore additional prospection techniques are needed. For each technique additional knowledge is needed about the influence of factors like soil type, (pre)historic land use and so on. Questions like: what determines the presence of archaeological remains at the surface of arable land and when is the absence of these remains an indication for the absence of features in the subsoil? have to be answered. This was the starting point for the research at *De Rikkert*.

The research at *De Rikkert* (see also § 5.5) was carried out within the scope of a field school in surveying techniques for MA-students in Field Archaeology of Leiden University. Great was the disappointment of the students that only in a small part of the surveyed area, material dating to the Bronze Age was present at the surface. Did this imply that only in this small part a settlement site was situated and the remaining surveyed area was "empty"? During the successive field campaigns, the *De Rikkert* project focused on these "empty" areas. Various prospection techniques were tested at these supposedly "empty" areas. The results of the different techniques used are presented and discussed below.

6.3.1. Desk-based assessment

In figures 6.4 and 6.5 an overview is presented of the available archaeological information for the location of *De Rikkert*. An inventory of the information in ArchIS resulted in three find locations with Bronze Age finds, discovered during the survey in the seventies. At two locations flint sickles were found. Flint sickles, especially complete ones, are rarely found in settlement sites (Schinning 2012, 39). A third location yielded 6 fragments of Middle Bronze Age pottery. Despite the number of pottery fragments, this location is not indicated as a settlement site. According to the available information on the survey,

82 Roessingh and Van Zijverden (2011, 123) estimated the area covered by settlement sites in eastern West-Frisia at at least 730 hectares. Steffens (2013, 38) incorporated 176 burial mounds in his database of Westfrisian burial mounds.

83 Molenaar and Van Berkel 2013, 49 *"Over het algemeen wordt er vanuit gegaan dat de ligging en verspreiding van het archeologisch vondstmateriaal een weerspiegeling vormen van de eertijdse bewoningslocaties." Which can be translated like: "It is generally accepted that the location and distribution of archaeological finds represent the location of former settlement sites."*

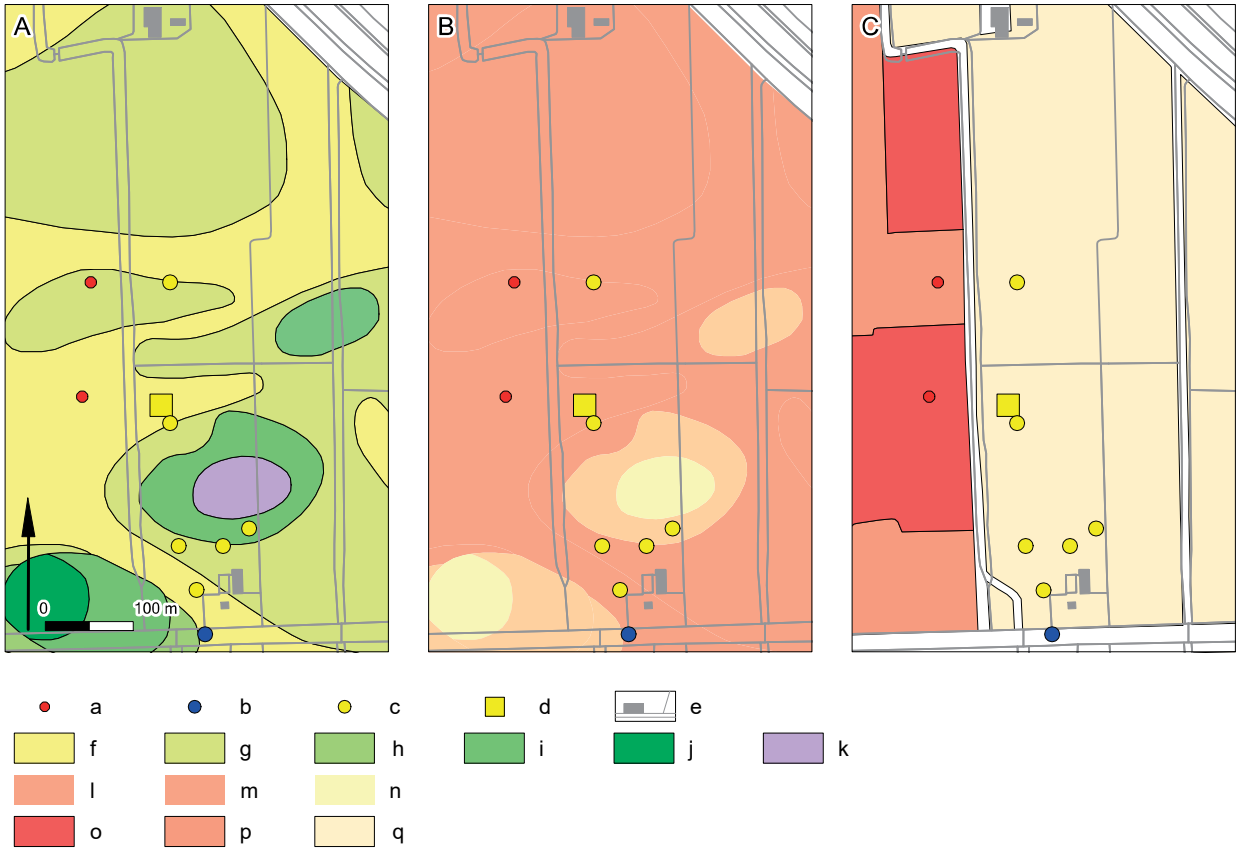

Figure 6.4: Archaeological finds and soil map (A), indicative archaeological values (B) and soil improvement measures (C) for research area De Rikkert. Legend: a flint sickle, b 6 fragments MBA pottery, c burial mound, d burial mound excavated by Lehman, e modern topography, f loamy sand to sandy loam, g sandy loam to loam, h sandy loam to loam overlying (silty) clay loam, i thick (25-60 cm) (silty) clay loam soils overlying (20-30 cm) sandy loam to loam, sometimes underlain by (silty) clay loam, j (silty) clay loam, k peat, l high archaeological value, m medium high archaeological value, n low archaeological value, o 80 cm ploughed, p 50 cm ploughed, q lightly ploughed.

the surveyed area was in use as an arable field. Based on this information it is assumed that the visibility during the survey of the seventies was average to good. In addition to these finds several burial mounds were recognized during the field survey in the seventies, based on small height differences. One of these mounds has been excavated by Lehman (1963).

In figure 6.4A the research location of *De Rikkert* is plotted on top of the detailed soil map of Ente (1963). Based on the analysis by De Boer and Molenaar (2006) the study area includes locations with a high, medium high and low archaeological value (figure 6.4B and table 6.1). An important source of information on the distortion degree of the top soil is the map of the planned soil improvements for the land consolidation projects.[84] This map shows three different zones with different soil improvement methods for *De Rikkert* (figure 6.4C). The western part of the research area had to be ploughed to a depth of 50 or even 80 centimeters. The eastern part of the research area had to be ploughed only lightly. It is assumed that these instructions have been followed. It is unknown in which way the fields have been worked by the farmers after the land consolidation projects.

A digital elevation model (DEM) based on a set of height measurements dating prior to the land consolidation project shows height differences of up to 80 cm with much variation (figure 6.5A).

84 These maps are available at the regional archives (Westfries Archief) but not yet registered. The following information is written on the map: Grontmij 1974, Bestek I, R.V.K. Het Grootslag, Blok 75, Blad II, Situatie wegen, waterlopen en kunstwerken.

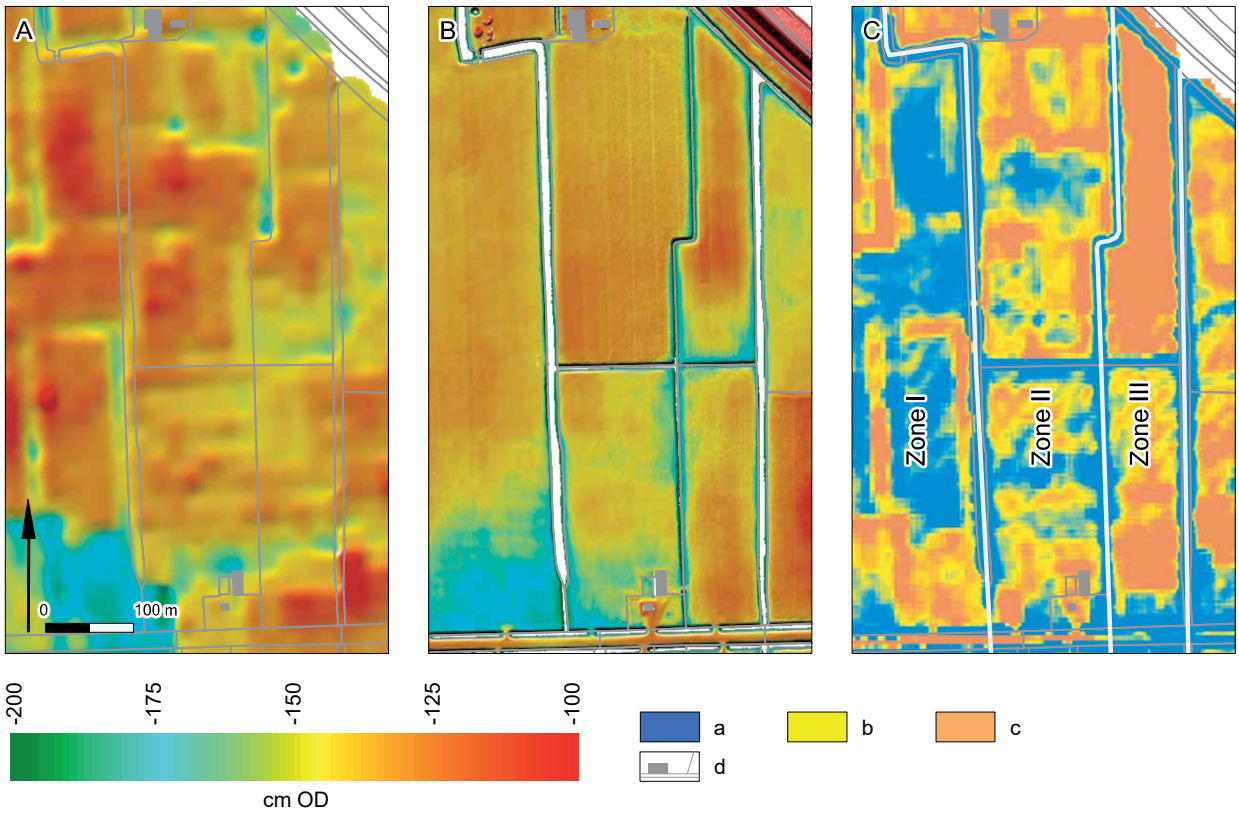

Figure 6.5: Comparison (C) of the relief of the surface before the land consolidation project (A) and the present day relief (B). Legend: a lowered, b unchanged, c raised, d modern topography.

The available LIDAR-image also displays relief differences up to 80 centimeters (figure 6.5B). In contrast with the DEM there is very little variation, which is characteristic for levelled fields. The burial mounds which have been mapped in the field, based on relief differences, are not visible as a raised area in the LIDAR-image and DEM nor in the field. A subtraction of this DEM from the LIDAR-image gives a rough estimation of the change in relief over time (figure 6.5C).

Based on the presented data *De Rikkert* can be divided into three zones (figure 6.5C). It can be argued that the top soil of the western parcel (zone I) is at least damaged and possibly completely disturbed. This parcel has probably been ploughed to a considerable depth (50-80 cm) and apparently part of the top soil has been removed. The eastern parcel (zone III) is considered to be well-preserved. This parcel has only been ploughed lightly and the parcel has been raised. The central parcels (zone II) have been ploughed lightly and are partly raised and partly lowered. Therefore the preservation of the top soil will differ from place to place in this zone. Archaeological finds correlate well with the expected archaeological values. Finds are absent in the areas with a low indicative archaeological value and only present in areas with a medium high and high archaeological value. It is important to note that the find complexes concern mainly burial monuments and not settlement sites for which the map has been developed. Based on the presence of burial mounds, the find of two complete sickles and the almost complete absence of pottery, the location probably cannot be characterized as a settlement site.

6.3.2. Exploratory phase

As described in § 6.2 the objective of the exploratory phase is to gain insight into the geomorphology in relation to location factors, in order to distinguish between high- and low-potential zones. In order to understand the nature of the subsoil, several corings were carried out. These corings have been used for the construction of figure 6.6. In this figure the nature of the topsoil, subsoil and the relief are displayed using the method presented in chapter 4. The entire research area is apparently suitable for habitation. In

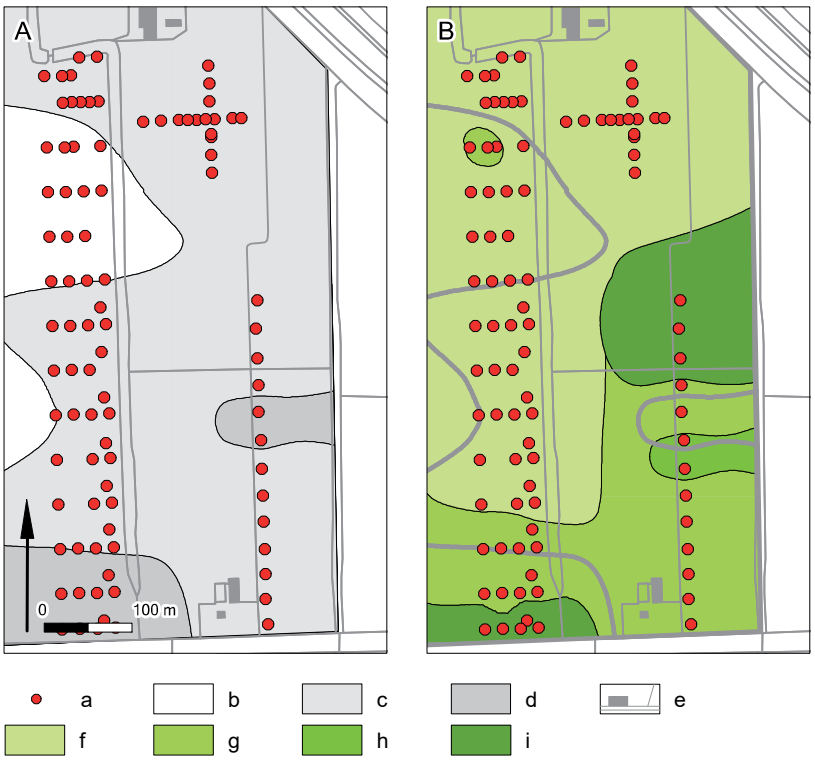

Figure 6.6: Reconstruction of relief (A) and the top soil and subsoil (B) of De Rikkert. Legend: a coring, b 160-120 cm -O.D., c 200- 160 cm -O.D., d 200-240 cm -O.D., e modern topography, f 8-25% lutum in top and subsoil, g >25% lutum in top soil and 8-25% in subsoil, h 8-25% lutum in top soil and >25% in subsoil, i >25% lutum in top and subsoil.

the south-eastern part the soil is slightly more clayey and the Bronze Age surface is a little lower compared to the northern part of *De Rikkert*. In addition to the nature of the soil the intactness of the stratigraphy is also the subject of research during the exploratory phase. In figure 6.7 the distribution of locations with a (partially) intact soil horizon dating to the Bronze Age is shown. It appears there is no relation between the plough depth and the (partial) intactness of the Bronze Age soil (figure 6.7A). Especially in the northern part of zone I the Bronze Age top soil is remarkably well-preserved in light of the plough depth. The reverse is true in the southern part of zone III. The Bronze Age top soil in this zone is poorly preserved despite the shallow plough depth. Apparently there is also no obvious relationship between the intactness of the Bronze Age soil horizon and former relief nor the lowering or raising of the sampled locations (figure 6.7B and 6.7C).

6.3.3. Mapping phase

The objective of the mapping phase is a systematic mapping of the research area for archaeological finds and/or features. Based on the previously presented data it is assumed that the Bronze Age top soil is only partly intact and therefore the find layer should be incorporated in the modern plough zone. Most parcels in the area are in use as arable land and therefore suitable for an archaeological survey. Therefore a field survey is suggested as the ideal strategy for mapping settlement sites at *De Rikkert*.

For part of the research area a field survey was carried out, assembling material in squares of 100 m^2 and partly in squares of 400 m^2. The squares have been walked in lines with a distance of approximately 5 m in between (Roessing and Valentijn inprep.). Some parts have been surveyed twice. The success of field surveys depends for a large part on the circumstances during the survey. During the 2012 field survey the circumstances were ideal. The weather was good, the fields were easily walkable and the parcels were recently ploughed. Therefore, the visibility at the parcels was very good. During the field survey in 2013 it was rainy, the fields were difficult to walk and although the crops had been harvested, the fields were not yet ploughed. Therefore the visibility on the parcels was considered to be poor.

Several indicators can be used for an estimation of the visibility: the relative number of finds, the fragmentation degree and the distribution of find categories (Verhagen 2007, 103-104). The number of finds in both field surveys is comparable, 253 finds per hectare in 2012 and 334 finds per hectare in 2013 (table 6.2; figure 6.8). The fragmentation degree

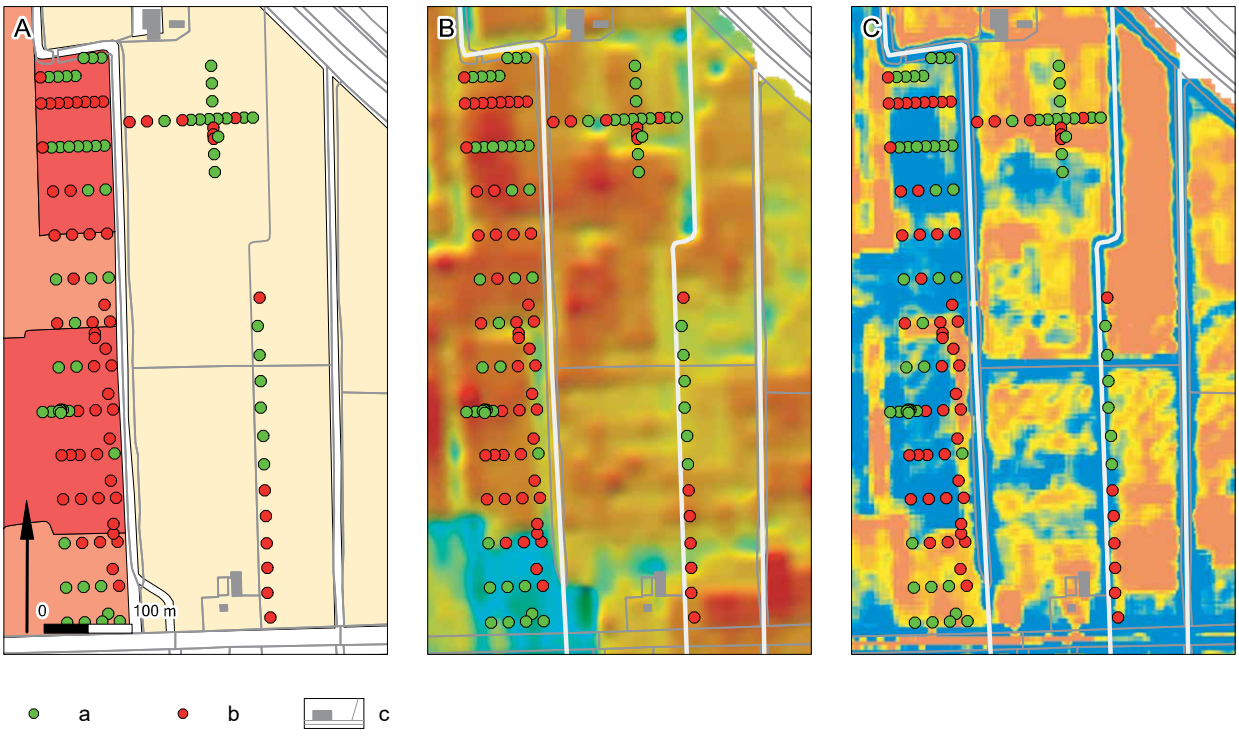

Figure 6.7: Intactness of Bronze Age soils in relation to plough depth (A), relief (B) and change in relief (C). Legend: a Bronze Age soil (partially) intact, b Bronze Age soil disturbed, c modern topography; see further figure 6.4 and 6.5.

is more or less comparable for both surveys. Late Bronze Age pottery has a higher fragmentation grade compared to Middle Bronze Age pottery. Therefore, Late Bronze Age pottery is apparently better visible compared to Middle Bronze Age pottery. The fact that only relatively large fragments of Late Bronze Age pottery were found in the 2013 field survey suggests a poor visibility, although the total number of finds of Bronze Age pottery is very low and therefore not significant. Only the relatively high number of pottery dating to the Late Medieval and modern times (30% in 2012 versus 70% in 2013) is an indicator for a poor visibility. Due to the red colour and glaze of this pottery, it is easily spotted during a field survey compared to the grayish Bronze Age pottery, bone, stone and flint. In conclusion, the expected poor visibility in the 2013 field survey is not clearly reflected in the analysis of the finds.

The distribution of the different find classes shows a comparable pattern. A large number of Bronze Age pottery finds cluster in the southern part of zone III (figure 6.8C). The other classes like stone, flint and bone show a comparable distribution pattern (a.o. figure 6.8B). Zone I shows very few finds compared to zone II and III. Based on the assumed disturbance of the top soil the highest number of surface finds would have been expected in zone I if *De Rikkert* has a homogeneous archaeological expectation. Based on this field survey zone II and III are expected to be part of a settlement site. Zone I is categorized as an "off site" location, an interpretation which is in agreement with the find of the two flint sickles in the past.

Although the suggested ideal mapping technique is a field survey, the most popular technique for the mapping of settlement sites in the Netherlands and West-Frisia is coring. Despite the poor results with coring in West-Frisia during the mapping phase, a large number of corings were executed in order to test the possibilities of coring during the mapping phase. In 50% of the corings the Bronze Age top soil was found (partially) intact. Despite this relatively well-preserved Bronze Age landscape, the mapping phase resulted in only one single archaeological indicator (pottery) on a total number of 136 corings. This result is comparable to the number of finds in the exploratory phase of the settlement site of *Enkhuizen-Kadijken* (Van Zijverden 2006). This minimal number of finds compared to the large number of finds during the field survey demonstrates once again

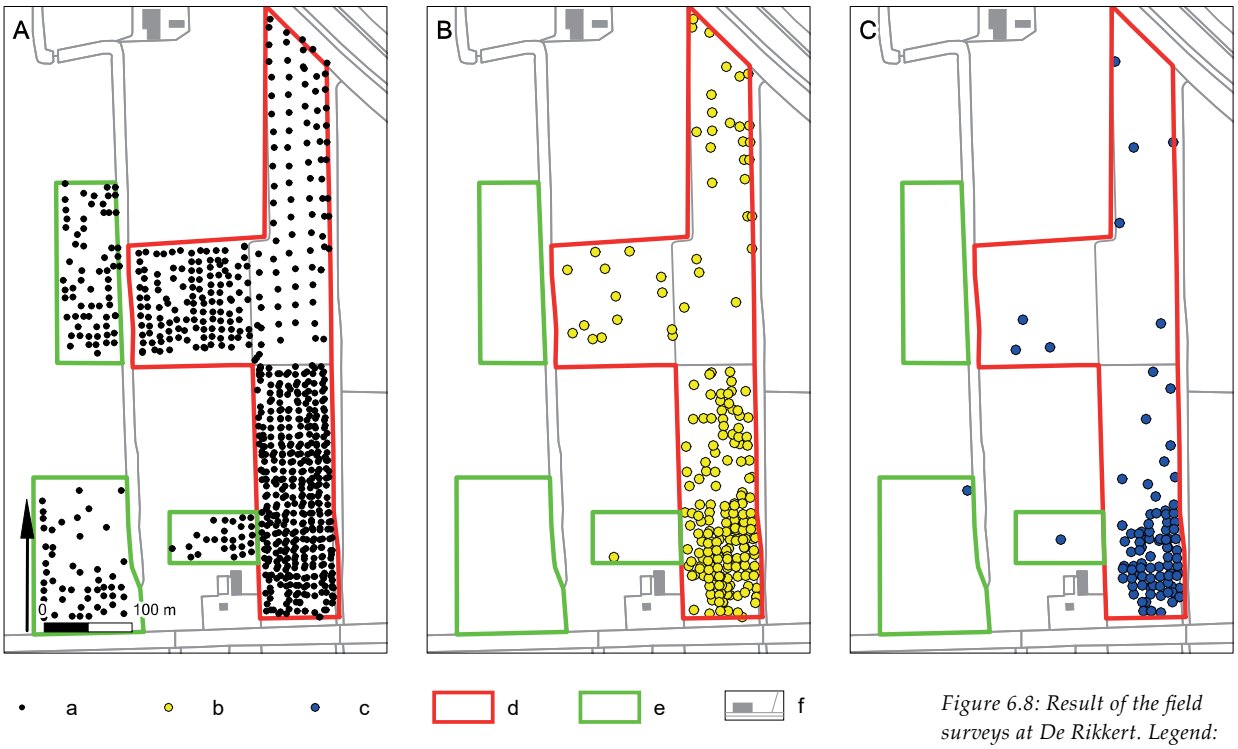

Figure 6.8: Result of the field surveys at De Rikkert. Legend: a finds, b bone, c Bronze Age pottery, d field survey 2012, e field survey 2013, f modern topography.

Field survey 2012 (7,4 ha)	N	Weight (gr)	Fragmentation (gr/N)	% (N)	% (gr)
MBA pottery	5	34,4	6,9	0,3	0,2
LBA pottery	84	191,4	2,3	4,6	1,0
Flint	159	2901,0	18,2	8,7	14,6
Stone	545	10646,4	19,5	29,7	53,5
Bone	528	2359,7	4,5	28,8	11,9
Medieval and modern pottery	562	3751,4	6,7	30,7	18,9

Field survey 2013 (4,0 ha)	N	Weight (gr)	Fragmentation (gr/N)	% (N)	% (gr)
MBA pottery	0	0,0	-	-	-
LBA pottery	3	24,8	8,3	0,2	0,2
Flint	107	1452,3	13,6	8,0	9,5
Stone	275	9141,9	33,2	20,4	59,7
Bone	20	85,9	4,3	1,5	0,6
Medieval and modern pottery	940	4601,0	4,9	69,9	30,1

Table 6.2: Summarized results of the field surveys at De Rikkert of 2012 and 2013.

the inadequacy of this method for mapping sites in West-Frisia.

In addition to the field surveys and corings, "*sondages*" have been used as a mapping method (figure 6.9). A *sondage* is a small test trench of one to four square meters. The advantage of *sondages* over corings is on the one hand the substantial amount of material for sieving for small finds like microdebitage, pottery fragments and small bones. On the other hand it is possible to study the soil section in much greater detail compared to a core. This method was developed in the late seventies amongst others for the construction of a 3D-model of the layered multi-period site of *De Horden* in the Dutch central river area (Hessing and Steenbeek 1990, 9). At this 14 ha site, 350 of these *sondages* have been carried out, which helped to understand the stratigraphy of the site in detail in advance of an excavation. In West-Frisia this mapping method is easy to apply due to the

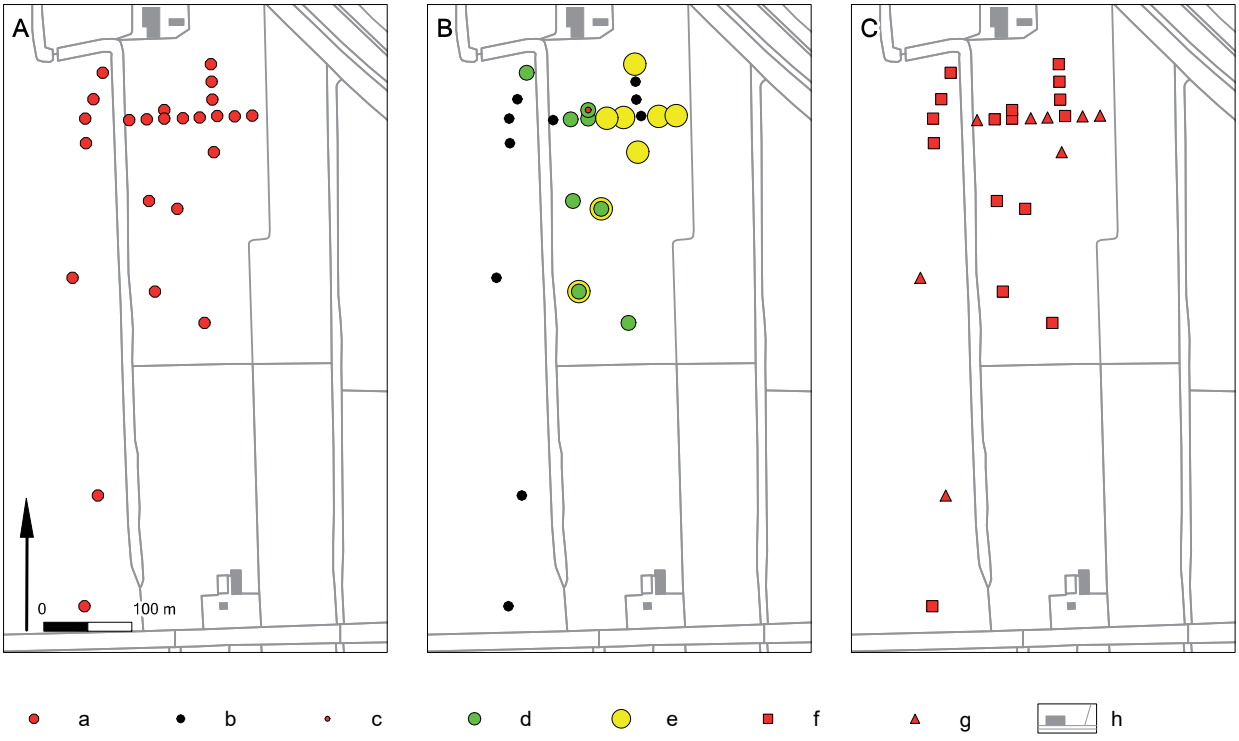

Figure 6.9: Result of the sondages at De Rikkert. Legend: a sondages, b no features, c Bronze Age pit, d Bronze Age ard marks, e Bronze Age ditch, f Bronze Age top soil (partially) intact, g Bronze Age top soil disturbed, h modern topography.

relatively shallow depth of the occurrence of Bronze Age remains. The *sondages* can even been dug by hand.

In three successive years, *sondages* have been made in the research area of *De Rikkert*. During the first (2013) and second (2014) field period a mini excavator was used for digging *sondages* and small test trenches. In the 2015 field period the *sondages* were dug by hand. An overview of the *sondages* is presented in figure 6.9A. For every *sondage* the interpretation of the archaeological features, post holes, ard marks and ditches are schematically presented (figure 6.9B). Next to the presence of archaeological features the intactness of the Bronze Age top soil could be attested also (figure 6.9C). Based on the *sondages* the variability in the intactness of the Bronze Age top soil derived from the corings could be confirmed. Locations with a Bronze Age ditch in the subsoil were, during the corings, often interpreted as a disturbed Bronze Age topsoil. Most of the *sondages* in zone I turned out to be "empty" as expected, based on the results of the field survey. The features in the *sondages* of zone II, mainly ditches which are characteristic for settlement sites, confirmed the interpretation as settlement site.

In addition to the research by *sondages*, a geophysical survey was conducted (figure 6.10). This type of method is not often used in the Netherlands (§ 6.2.1). In this project electrical conductivity was measured (Verschoof-Van der Vaart in prep.), using a RM15-D resistance meter with a PA20 frame in a Twin Probe configuration (0,75 m mobile probe separation). Electrical conductivity reveals contrasts in resistivity or conductivity of the soil. These contrasts are largely dependent on the moisture retaining properties of the soil. Grain size and organic matter content mainly define the moisture retaining properties of a soil. Soils with a high moisture content show a smaller resistivity compared to soils with a low moisture content (Kattenberg 2008, 56). The idea by Verschoof-Van der Vaart (in prep.) is that ditches contain a more clayey material and have a higher organic matter content compared to the surrounding natural landscape. Verschoof-Van der Vaart (in prep.) was indeed successful in mapping ditches, revealing amongst others the location of the circular ditch of a burial mound (figure 6.10B). The images of zone I and zone II reveal ditch systems with a pattern comparable to the ditch patterns of Bronze Age settlement sites like *Enkhuizen-Kadijken*, *Hoogkarspel*, *Medemblik-*

Figure 6.10: Interpretation of the geophysical images of the research carried out by Verschoof-Van der Vaart (in prep.). Legend: a sondages, b trenches, c geophysical research 2013, d geophysical research 2014, e geophysical research 2015, f supposed Bronze Age ditch systems, g modern topography.

Schepenwijk, etcetera (figure 6.10B). The quality and patterns in the images produced by Verschoof-Van der Vaart (in prep.) are very consistent over the years (2014-2015). The method used by Verschoof-Van der Vaart (in prep.) is very promising when it comes to mapping the outlines of the parcelled landscape of the Bronze Age and also the Medieval and modern period. In combination with well-chosen *sondages* the geophysical image produced, can be valuated with little effort. The combination of *sondages* with a geophysical survey changed the interpretation for the northern part of zone I from an offsite location into a settlement site. Zone II can also be characterized as a settlement site by the combination of these two methods, an interpretation that fits with the results of the field survey. The presence of at least one burial mound, which is nowadays hardly visible in the field, in zone II could be confirmed with the results of the geophysical survey.

The final used method in the mapping phase was trenching. Trenching is a technique which is often used for a combination of mapping and evaluating in development-led projects. In the Netherlands a guideline is available for the design of an excavating plan in this particular research phase (Borsboom and Verhagen 2009). Usually trenching of 10 % of the entire surface is recommended for the mapping of a site (Borsboom and Verhagen 2009, 42). For an optimal strategy it is advised to use a grid (Borsboom and Verhagen 2009, 37). The advice for such a grid is entirely based on a statistical model and valuated by several simulations (Borsboom and Verhagen 2009, 26-31). An important precondition for the design of a plan for surveying with trenches is expert knowledge on the expected feature density and distribution (Borsboom and Verhagen 2009, 53-54). Based on these characteristics the optimal grid can be established. The authors of the guideline explicitly define a site as a clustering of features (Borsboom and Verhagen 2009, 14). Due to this focus on clusters of features in the mapping phase, it is often forgotten that archaeologists study the cultural landscape and not only clusters of features (Fokkens 2007, 60). A nice example of a broader strategy designed for mapping the cultural landscape is the trenching strategy developed by Brandt and Bakker for the site of *Hoogkarspel*. They developed a trenching strategy for mapping the Bronze Age field system of this complex and later on the burial landscape (Bakker *et al.* 1977, 189).

At *De Rikkert* the mapping phase with trenches (figure 6.11) was focussed on characterizing the nature of the site. Based on the absence of finds in the survey and the find of two complete flint sickles in the

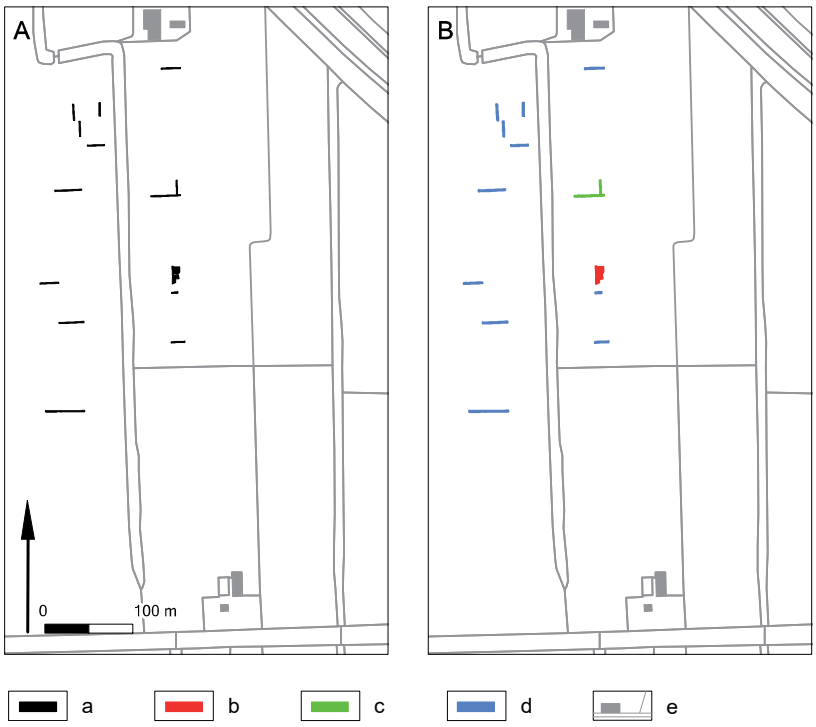

Figure 6.11: Result of the trenches at De Rikkert. Legend: a trenches, b burial mound, c house plan, d features common for settlement sites like pits, postholes, post circles, ard marks, ring ditches and ditches.

past, zone I was characterized as an off-site location. The *sondages* did not contradict this interpretation. The geophysical survey on the other hand revealed in the northern part of this zone a pattern of ditches, which is typical for Bronze Age settlement sites. Test trenches in this part of zone I were planned using the results of the geophysical research. The results of these test trenches were in line with the results of the geophysical survey. Features like ditches, pits, postholes and ard marks led to an interpretation as a settlement site! The features in the other trenches in zone I do not differ from the ditches in the northern part. Therefore the entire zone I is interpreted as settlement site (figure 6.11B). In all trenches features dating to the Middle Bronze Age are present. Only the southernmost trench contained also features dating to the Late Bronze Age.

Zone II contains at least one burial mound and possibly more according to the desk-based assessment. Based on the number and type of finds in the field survey this zone could be interpreted as a settlement site. In the central part of zone II a very small part of a burial mound and part of the accompanying ring ditch were excavated. The ring ditch is clearly visible in the geophysical image. All other trenches contained features like ditches, pits, postholes and ard marks which are typical for settlement sites. Even a part of a house plan could be recognized in one of the trenches (figure 6.11B). Therefore zone II is also interpreted as part of a settlement site. A total of 0,05 ha was excavated in a research area of approximately 22 ha, which is 0.2%.

6.3.4. Evaluation phase

The objective of the evaluation phase is to investigate the nature, size, conservation and relative quality of a site. Based on the previously presented information the entire research area can be characterized as a Bronze Age settlement site. Despite the supposed destructive soil improvement techniques, the site turned out to be well-preserved. Based on an analysis of pollen, macrobotanical remains, phytoliths and a thin section presented in § 5.5, the conservation of the site is comparable with recently excavated sites like *Enkhuizen-Kadijken* and *Medemblik-Schepenwijk*.

6.3.5. Lessons learned

As was presented in the previous chapter (§ 5.5), the genesis of the landscape at *De Rikkert* is, in general, comparable to sites like *Hoogkarspel*, *Enkhuizen-Kadijken* and *Andijk*. Therefore the location of *De Rikkert* is representative for Bronze Age sites in West-Frisia. A difference with these sites is the presence of all soil units distinguished by Ente (1963), according to his soil map. Therefore, this research area is ideal for testing the hypotheses on low, medium high and

high indicative archaeological values presented in the publication by De Boer and Molenaar (2006). The research area was also ideal for a study on the effects of the supposedly different applied soil improvement techniques during the land consolidation project and by individual farmers after the period of land consolidation projects. The large difference in numbers of finds in the field surveys made it also possible to test general hypotheses on the value and interpretation of surface finds as described by Molenaar and Van Berkel (2013).

Several conclusions can be drawn based on this case-study:

- The analysis of the top soil and subsoil based on corings, *sondages* and trenches, using the method described in chapter 4, shows that the entire area was suitable for habitation during the Bronze Age. This analysis can be easily done with corings.

- Bronze Age ditches are usually not recognized in corings and are often interpreted as a disturbance of the Bronze Age top soil.

- Although the land consolidation projects have changed the appearance of the landscape drastically, the soil at this specific location is not disturbed to the degree as was supposed in advance of the project. The case of *De Rikkert* shows that corings and *sondages* can be used to check if a top soil is intact or not. These methods cannot be applied for estimating the degree of disturbance. The degree of disturbance can only be checked with trenches and not by coring, which is a regular practice in West-Frisia (§ 6.2.4). *Sondages* are not that useful for this purpose due to the small number of features present in the *sondages*.

- The geophysical research turned out to be extremely valuable. With this method it is possible to map larger ditches revealing the outlines of the cultural landscape. This information was very useful for the strategic planning of trenches for evaluation purposes. It is important to note that at this moment, with this type of equipment, it is not possible to identify individual features like post holes or structures like house plans. However, burial mounds with a ring ditch can be mapped very well.[85]

- The results of field surveys are difficult to interpret. The absence of finds does not mean anything with regard to the presence of settlement sites. This is not only the case at locations where the soil is intact and therefore finds in the modern plough zone are absent but also at locations where the Bronze Age top soil is incorporated in the present day plough zone. Surprisingly the distribution pattern of bone matches the distribution pattern of pottery. Due to the high numbers of bone, it reflects the presence of a settlement site possibly better.

After the analysis of settlement sites in chapter 5 and this case-study one conclusion is obvious: there is no relationship between the presence of archaeological sites and the soil units on the available detailed soil maps. The use of these maps puts one on the wrong track, therefore one ***should not use*** the map of Ente (or any other detailed soil map) in any way in a predictive model for West-Frisia.

6.4. A new policy document?

Based on the analysis in the previous chapters it is clear that the theory of relief inversion is not applicable in West-Frisia (§ 2.5.1) and the genesis of the landscape is far more complex than previously thought (§ 5.4.6). Therefore, the generally accepted relationship between the natural landscape, translated into soil units of detailed soil maps, and the location of settlement sites in West-Frisia is untrue. This implicates that the existing policy document, which is based on these relationships, is useless. In this last paragraph a new predictive model is described, a suggestion for the use of prospection techniques is given and a new idea for a policy document is suggested.

6.4.1. Predictive model

Site locations dating to the Late Neolithic and Early Bronze Age are strongly related to creeks and creek ridges. Not only settlement sites are to be expected

85 See also unpublished results by Van der Heijden and Feiken for the burial mounds of the site *De Eendenkooi* in Wervershoof and the unpublished results by Verschoof-Van der Vaart of the same site.

in close proximity to these geomorphogenetical units, but also special activity areas like fishing and fowling sites. Little is known about the location and depth of these types of units. The focus in inventories and especially during the exploratory phase for sites dating to this period should be the mapping of these units. Sites like *Noorderboekert* and *Rijweg* prove that these types of sites are not only present in western West-Frisia, but also present in eastern West-Frisia (Knippenberg in prep.).

All known settlement sites dating to the Middle Bronze Age are situated on top of tidal marsh deposits or creek deposits. These sites do have a relationship with the lithology. Settlement sites as well as burial sites are situated on top of consolidated clay, loam or sand surfaces. These types of sites are not situated on top of (partly) unconsolidated sediments or peat. The region covered by tidal marsh deposits in West-Frisia is a well-known, but intimidatingly vast area. Although the strong wish to differentiate within this vast area is understandable, it is hard to achieve. The method presented in chapter 4 can be applied easily on large uniformly described coring databases like the databases of STIBOKA and RAAP, but is of limited use in small development plots. Other types of sites like fishing and fowling sites may be expected in close proximity to creeks and lakes. Probably sites like *De Druppels*, *De Hoep* and *Emmeloord J97* can be interpreted in this way. Little or no research has been done on this type of landscape due to the focus on burial and settlement sites.

Late Bronze Age settlement sites are thought to be situated at the higher parts of the former tidal marsh landscape and creek ridges. Due to differential subsidence it is not possible to identify these higher parts in the present landscape. Only the large (Neolithic/Early Bronze Age) creek ridges of *Bovenkarspel* and *Opperdoes* have been, without any doubt, relatively high locations during this period.

6.4.2. Prospection techniques

The inventory process always starts with a desk-based assessment. Three questions are central in a desk-based assessment. These questions concern the intactness of the (Bronze Age) surface, the presence of finds and sites and the palaeogeographical development of the landscape.

The soil improvement map of the period of land consolidation projects is thought to be a valuable document to solve the first question. Also the use of old height measurements in relation to modern LIDAR-data are thought to be helpful in understanding the intactness of the landscape. The research at *De Rikkert* proved otherwise. It is important to note this research concerns only a relatively small (22 hectares) case and therefore cannot be uncritically extrapolated to the entire region of West-Frisia. The second question, concerning the presence of finds and sites in the research area, can be answered with information from the national archaeological database (ArchIS), the results of the surveys from the seventies and available databases with aerial photographs (for example the databases of Metz and the Water Board). It appears that the presence of archaeological finds is evidence for the presence of archaeological remains. The analysis of *De Rikkert* proves the reverse to be incorrect. Interpretation of this archaeological data in terms of archaeological expectations appears to be difficult. For example the ideas on the occurrence of the distribution of complete flint sickles outside settlement sites (Schinning 2012, 39) did not apply for the site of *De Rikkert*. The third question is usually answered with the use of detailed soil maps. Enough is said about this practice. It would be wise to use uniform described coring databases for this purpose if available.

The exploratory phase focuses on two questions: is the landscape as intact as suggested in the desk-based assessment and which geomorphogenetic units are present within the research area? The first question is usually thought to be answered by the use of corings. The research at *De Rikkert* confirmed the reservations about this technique by Archeologie West-Friesland (Gerritsen 2014, 35). Sondages and particularly small trenches provided good results concerning this question at *De Rikkert*. Corings are a good technique for answering the second question. Although experience with the description methods of sediments and a considerable depth (3-4 m) of the corings are defining for the success of this method.

The mapping phase focuses on the question: what type of sites at which location are present in the research area? The field survey at *De Rikkert* was a great success, with regard to the high numbers of finds. However, the location and nature of the site could not be established. Coring in West-Frisia is a technique that does not provide no answers to this question and needs no more explication. Sondages and trenches are useful to a certain extent. The same disadvantage of a field survey applies to trenching, absence of features cannot be translated into the absence of a site unless the sample is large enough,

approximately 10 % of the surface (Borsboom and Verhagen 2009, 42). The only technique which provided consistent information in three successive years was the geophysical research. This method in combination with small trenches for ground truthing turned out to be a very powerful technique at *De Rikkert*. It is thought that this combination of methods is applicable in large parts of West-Frisia. Several tests at known sites in West-Frisia by Verschoof-Van der Vaart appeared to be successful.[86]

During the evaluation phase the nature, size, conservation and relative quality of sites are investigated. Trenching is the method of choice for answering these topics (figure 3.6). For example, at *De Rikkert,* trenching in the evaluation phase could have been focused on the nature, conservation and date of the burial mound. Topics for which samples and a clear section are needed. The geophysical data can be used to find the location of the burial mound and formulate an idea on the structure of the mound prior to trenching. This information can be used during the trenching in order to decrease the minimum surface area which is necessary for answering the research questions.

6.4.3. Policy document

The change in focus from research-led excavations into development-led excavations in the recent past resulted in finds of sites at unexpected locations. For Bronze Age West-Frisia it resulted, amongst others, in the observation that settlement sites are apparently not restricted to creek ridges (Van Zijverden 2013, 168). In relation to the formulation of a policy document this is an "awkward" observation. It implies that the familiar framework is no longer applicable and has to be adjusted. In the Dutch system these policy documents are usually developed for a 10 years period (Wro-article 3.1-2).[87] The idea of the settlement sites situated on creek ridges and use of the detailed soil maps, turns out to be incorrect. New sources are needed to build a new framework. What are these sources and how can these be incorporated into a new policy document for eastern West-Frisia and most importantly, should it be presented as a fixed map?

Four sources of information can be obtained and used easily. First of all information on the type and quality of the subsurface can be obtained relatively easily from large uniformly described databases, like the STIBOKA and RAAP databases. A second source is the large database with aerial photographs by De Vries-Metz (1993). This formidable database is only a useful start compared with the promising archived dataset of the Water Board. Soil marks and crop marks are directly related to land use and well-preserved sites. Important to note is that site locations with a (thin) sediment cover are not visible with this method. Therefore aerial pictures can only be used for a positive identification of archaeological sites and not for the absence of sites. A third source are the available results of field surveys in West-Frisia. This source is highly influenced by land use, surveying circumstances and research history. This last point is clearly visible in figure 4.5. A fourth source of information is the ArchIS database with known and sometimes valuated sites.

This type of information, corings, aerial pictures, field surveys and known sites is easily stored, labeled and kept up-to date in a GIS. New data and sources can easily be incorporated. Different layers for different periods are also easy to add. In the Netherlands this type of information is usually obtained from soil maps and the ArchIS database and translated into a fixed map of archaeological values. A disadvantage in this process is the lack of information on the quality and detail of the used data. In Bergen (Norway) a completely different strategy is used for determining the archaeological value. In the World Heritage site of Bryggen, a flexible GIS is used for determining the archaeological value of development sites (De Beer *et al.* 2011). In this GIS-model amongst others hydrological information is incorporated and can be used to provide detailed information on the conservation within this World Heritage site. A great advantage of this approach is that the reliability of the expected value can be visualized by the density and quality of records used to determine the expected value. Furthermore new subsurface data can be added easily and influences the expected value. For the Westwoud land consolidation area a dataset with the previously mentioned data is compiled and incorporated in a GIS and translated into maps for different purposes (chapter 4). For each mapped unit the data density and quality can be visualized in a manner comparable to the Bryggen GIS. It would be a challenge to develop this GIS for a larger part of West-Frisia in the future.

86 Amongst others research at Wervershoof Eendenkooi, personal communication.

87 Wro is the Dutch law on spatial planning.

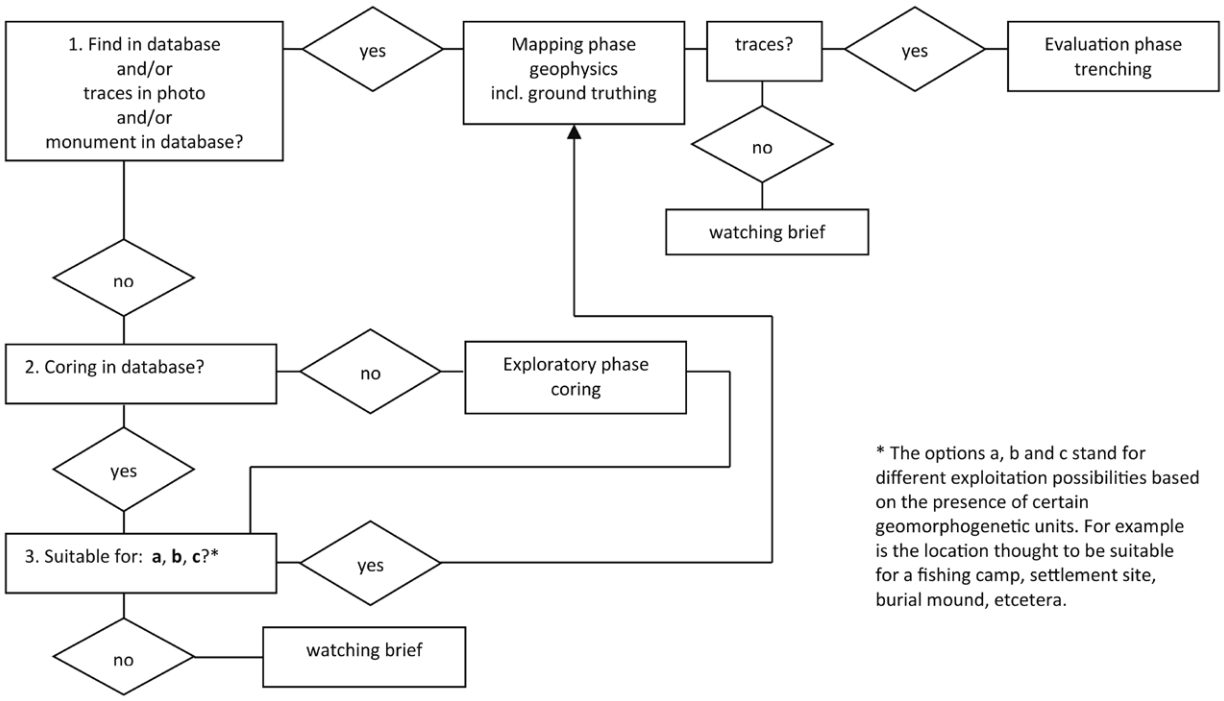

Figure 6.12: Suggested flow chart for archaeological inventories for Bronze Age sites in eastern West-Frisia.

The last ingredient needed for a policy map besides a predictive model and a "map" of archaeological values, is a policy for research. Based on the results of *De Rikkert* an ideal flow chart for research in eastern West-Frisia is designed (figure 6.12). In this chart the suggestion by De Boer and Molenaar (2006) for a systematic check of deselected locations, is formalized. This check is important in order to validate the assumptions constantly and keep the model up to date. In the chart geophysical researchs play an important role. This choice has been made, based on the consistent results in successive years at *De Rikkert* and comparable results at other site locations in West-Frisia, for example at *Wervershoof Eendenkooi*.

6.4.4. New legislation

The proposed model, with a flexible digital information system for archaeological values, fits very well with the new legislation (*Omgevingswet*) which will be effectuated from 2018 onwards. At this moment the policy map in combination with a map of archaeological values is used by municipalities to fill a zoning map with do's and don'ts regarding archaeology. These zones are usually defined for a period of 10 years. After 10 years a new zoning map is defined for a new period of ten years. Under the current legislation each new spatial initiative is assessed by the municipality for its influence in the particular zone. This way of regulation results in a fixed policy with little or no flexibility, a policy that can only be evaluated and changed every 10 years. New insights in archaeological values regarding preservation, site location and so on cannot be implemented during this 10 year period. The new legislation (*Omgevingswet*) is based on co-creation with more responsibility for citizens and enterprises and a more transparent local government. This way of spatial planning will result in more freedom of action for both the developer(s) and council. In order to realize this new way of spatial planning, up-to-date and transparent information is needed which cannot be realized in a traditional zoning map. A flexible GIS with a compact transparent flow chart as sketched in figure 6.12 can be a helpful tool in the realization of this new legislation.

6.5. Concluding remarks

Since the introduction of development-led archaeology in the Netherlands, a number of publications have been written on the topic of predictive modelling. These publications culminated in guides for best

practices, as described in § 6.2.1. These guidelines are uncritically applied in West-Frisia. After the publication of the policy document for eastern West-Frisia by De Boer and Molenaar (2006) this situation did not change, despite the clear, well-argued guidelines and constraints presented by the authors. Large areas have been deselected through incorrect argumentation (for example Gerritsen 2014, 9-11). In the policy document by De Boer and Molenaar (2006), choices have been made which were in line with the ideas on habitation and settlement sites of West-Frisia and ideas on the way predictive maps should be made in that period. In this respect it is probably one of the best substantiated maps. Shortly after the publication of this document the settlement site of *Enkhuizen-Kadijken* was discovered at a location with a low archaeological value. The find of this site led to the "*Farmers of the Coast*" project and eventually to the research at *De Rikkert*.

The project of *De Rikkert* was fun, a playground for testing different prospection techniques.[88] In Dutch archaeology there are little opportunities for this type of research. Nevertheless this kind of research is important to understand the often experienced mismatch between archaeological expectation and archaeological reality. The proposed flexible digital information system for archaeological values works manually very well within the study area of Westwoud. Within the scope of the "*Farmers of the Coast*" project there was simply not enough time to develop this idea into a fully automated prototype. The changing legislation will probably stimulate other archaeologists to explore this idea (and probably many other ideas) into a policy document 2.0.

88 It was only possible to write this chapter based on the fieldwork carried out by Richard Jansen, Wouter Roessingh, Patrick Valentijn, Renate de Boer, Bastiaan Steffens, Wouter Verschoof-Van der Vaart (RAAP), Kees Kiestra (volunteer) and a large number of students. The project *De Rikkert* was only possible through the efforts of Carla Soonius (Archeologie West-Friesland), Liesbeth Theunissen (RCE) and of course the land owner J. Hovenier.