When the Shore becomes the Sea

van Popta, Yftinus

DOI:
10.33612/diss.135931299

When the Shore becomes the Sea

New maritime archaeological insights on the dynamic development of the northeastern Zuyder Zee region (AD 1100 – 1400), the Netherlands

Het sluitgat van de Afsluitdijk, een dag voor het einde van de Zuiderzee (27 mei 1932). Bron: Zuiderzeecollectie Zuiderzeemuseum Enkhuizen, objectnummer DV00212.

als de akkers overstromen
en de gaten gaan niet dicht
wil geen mens eraan geloven
morgen wordt het toch weer licht

Opgedragen aan de polderpioniers Gerrit D. van der Heide en Albert J. Wiggers.
Ze waren hun tijd vér vooruit...

Quote on the previous page: final verse of 'Als het Golft' by 'De Dijk', text written by Ruud Musman, 2000.

Cover design: Roelf Barkhuis
Front cover: "Long exposure of the sea" (Martin Falbisoner / CC BY-SA 4.0);
https://commons.wikimedia.org/wiki/File:Caribbean_Sea_-_Long_Exposure.jpg
Book design: Hannie Steegstra

DOI: 10.33612/diss.135931299

This work is part of the research programme 'PHDs in Humanities' with project number 322-60-006, which is funded by the Dutch Research Council (NWO).

rijksuniversiteit
groningen

When the Shore becomes the Sea

New maritime archaeological insights on the dynamic development of the northeastern Zuyder Zee region (AD 1100 – 1400), the Netherlands

Proefschrift

ter verkrijging van de graad van doctor aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus prof. dr. C. Wijmenga
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

donderdag 29 oktober 2020 om 12.45 uur

door

Yftinus Taeke van Popta

geboren op 30 augustus 1986
te Sneek

Promotores
Prof. dr. A.F.L. van Holk
Prof. dr. D.C.M. Raemaekers
Prof. dr. M. Spek

Copromotor
Dr. K.M. Cohen

Beoordelingscommissie
Prof. dr. G.J. de Langen
Prof. dr. J.H.G. Gawronski
Prof. dr. J. Renes

Contents

List of illustrations

List of tables

1 General introduction

The dichotomous relation between the Dutch and the sea

The landscape and inhabitants of the Netherlands have been inextricably connected to water from the past until today. The country's name 'Netherlands', meaning 'Lowlands', refers to the vulnerable position of the land with respect to the sea. A large part of the country lies several meters below sea level and would submerge if reached by the sea. However, the Dutch consider themselves relatively safe as they rely upon an impressive coastal defense system of dikes, dams, sluices and floodgates as well as a highly developed inland water management system. About a thousand years ago defense of Dutch inhabitants against the sea made use of elevated natural phenomena like coastal dunes, tidal barriers, peat domes and boulder clay outcrops, as well as of man-made dwelling mounds (Dutch *terpen* and *wierden*).

In the Dutch coastal plain, systematic construction of longer coastal dikes started in the 11th and 12th century. In the sector of the coastal plain that is the study area of this thesis, however, they did not constitute an efficient barrier against the force of the North Sea, breaching inland and creating the Zuyder Zee (*e.g.* Rienks & Walther 1954; Van Buijtenen & Obreen 1956). In the High and Late Middle Ages marine erosion and flooding resulted in large-scale land loss, submerged settlements, swarms of shipwrecks and repeated loss of many lives. While it is true that the Dutch kept a clear association in mind between 'death' and 'danger' on the one hand and 'water' and 'storms' on the other hand, also because they could not afford to give up use of the coastal land as the population kept growing and reclaimed acres were needed for food production, they also developed a specific bond with the inland and outland water systems (Fig. 1.1). The delta and coastal position of the Dutch territory turned out to be ideal for maritime trade, as major European rivers like the Rhine and Meuse worked their ways through the lands towards the North Sea. Furthermore, the long North Sea coastal

Figure 1.1. A heavy storm on the Zuyder Zee near the island of Schokland. 19th century painting by Hermanus Koekkoek (Zuiderzeecollectie, Enkhuizen).

zone, Wadden Sea shores and Zuyder Zee tidal lagoon rim provided good opportunities for coastal settlements to focus on trade and fishing. Maritime trade (*i.e.* the Hanseatic League, the Dutch East India Company, the Dutch West India Company and the Early Modern Baltic trade) brought the Dutch great wealth and power. The love and hate for water is also tangible for the theme of this PhD study, which is the late medieval Zuyder Zee ingressions that destroyed lands and settlements in the heart of the country, but that also opened up new maritime trade routes that brought wealth and prosperity.

State of the art

The most import research discipline in this thesis is Maritime Archaeology. There has always been a strong connection between maritime archaeology as a discipline and shipwrecks as its objects of study. Excavating shipwrecks is and will always be part of maritime archaeology, but maritime archaeologists should target than shipwrecks only. This section intends to clarify the origin, development and purpose of maritime archaeology as a research discipline.[1]

Until the 19th century, interest in shipwrecks and their content was largely driven by curiosity and for economic/salvage reasons. In the first half of the 20th century, technological innovations enabled archaeologists to systematically examine shipwrecks under water (Tuddenham 2010: 6). An article of George Bass (1966) was the starting point for a new archaeological approach. Bass claimed that wrecks should be studied in their entirety and within their broader context, not just from a materialistic point of view, regardless of the complexity / simplicity of the sites or activities (Bass 1966: 15-22; Gibbins & Adams 2001: 284). These ideas were the starting point for a new and more integral archaeological discipline, based on a new contextual methodology (Kuhn 1970: 10; Meide 2013: 7). By that time, there was still a lack of any coherent body of theory and practice, caused by the paucity of theoretically based underwater archaeologists and scholars conversant with archaeological methodology. As a result, the work conducted was defined as a primitive form of underwater archaeology where many practitioners came from other disciplines (*e.g.* historians, engineers and geologists) (Gibbins 1990: 383; Meide 2013: 7). The 1960s proved to be a very successful period for the development of a new discipline due to the underwater excavations of (nowadays) famous wrecks like the *Cape Gelidonya*, *Yassi Ada*, *Batavia, the Bremen* Cog and *the Vasa* (see *e.g.*: Bass *et al.* 1961; Bass & Van Doornick 1982; Lahn 1992; Crumlin-Pedersen 2000; Hocker 2011; Van Duivenvoorde 2015). These excavations, in combination with the 'method centered' approach that was developed at the excavation of the *Mary Rose*, would eventually lead to maritime archaeology becoming an academic discipline (Adams 2002: 6).

Soon a revolution was caused by archaeologist Keith Muckelroy. Instead of applying the traditional cultural-historical approach, Muckelroy was influenced by 'New Archaeology'. His book, *Maritime Archaeology* (1978), is considered as the most important single statement of maritime archaeological method and theory (Gibbins & Adams 2001: 284). He showed the academic world that the definition of maritime archaeology is a holistic one: "*the scientific study of the material remains of man and his activity on the sea*" (Muckelroy 1978: 4, 160-165; Tuddenham 2010: 7). Other terms like underwater archaeology, marine archaeology and nautical archaeology were replaced by this broader concept. Despite the great work done by Muckelroy, focus laid too much on ships and shipboard communities, therefore excluding the terrestrial and inland (e.g. shores, lakes and rivers). The solution to that problem turned out to be the concept of the 'maritime cultural landscape', formulated by maritime archaeologist Christer Westerdahl: "*the whole network of sailing routes, with ports, havens and harbours along the coast, and its related constructions and other remains of human activity, underwater as well as terrestrial.*" (Westerdahl 1992: 6). This concept embeds both maritime and terrestrial counterparts and moved towards a holistic and interdisciplinary approach, no longer solely focusing on shipwrecks and the seabed.

The development of maritime archaeology exposes the difficulty of definitions that are related to it as a research discipline. Does maritime archaeology imply a wider definition than for instance nautical archaeology? As Bass states in his introductory article in the Oxford Handbook on Maritime Archaeology: "*in a sense, maritime archaeology is so new it is still defining itself*" (Bass 2013: 4). Maritime archaeology, according to the still appropriate definition of Muckelroy, is "*the archaeological study of humans and their interactions with the sea and can include sites that are not underwater but that are related to maritime activities such as lighthouses, port constructions or shore-based whaling stations*" (Muckelroy 1978: 4; Delgado & Staniforth 2009: 228). It is considered to be the main discipline, as defined by Muckelroy, in which this study is conducted. Nautical archaeology, marine archaeology and underwater archaeology are nowadays considered all to be sub-disciplines of maritime archaeology, but they tend to overlap. This overlap is framed by Muckelroy as he mentions for example that nautical archaeology is a specialty within maritime archaeology (Muckelroy 1978: 4). Furthermore, he and Bass agree that underwater archaeology is not so much a discipline or sub-discipline, but rather a way of archaeology in practice, with different methodological approaches (Bass 1966:

15; Muckelroy 1978: 248). This study intends not to further question the contextual realms and definitions of these sub-disciplines, as it already has been done by others elsewhere. This study primarily addresses the maritime cultural landscape in the sense of Westerdahl (1992), and therefore is independent of other definitions (see *e.g.* Delgado & Staniforth 2009: 228).

The international development of maritime archaeology differs from the Dutch development. In the Netherlands, many wrecks were accidentally discovered and studied in the 19th and 20th century from a purely antiquarian interest (Maarleveld 1998: 41). This lasted until the large reclamations of the former seabed of the *Zuyder Zee* (AD 1927-1968). The wholesale discovery of a vast amount of ship remains led to dozens of archaeological excavations (Van der Heide 1965a). The emphasis at the time was on quick reconnaissance and routine removal of shipwrecks. At first, scientific explanatory questions were limited, but the integration of geological data for examining the proto-historic development of the Flevoland polders could be considered a first step into multidisciplinary research (Maarleveld 1998: 46). In the years after the reclamation of the Zuyder Zee polders, maritime research still lacked integrated research questions and the salvage of wrecks and a fascination for objects remained until the late 1970s (Maarleveld 1998: 44).

Growing appreciation of maritime archaeological research was stimulated eventually in a more integrative methodology and involvement of academic and engineering institutions in the Netherlands (see *e.g.* Reinders 1981; Van Holk 1991; Van Holk 1996). Nevertheless, the majority of Dutch maritime archaeological studies has been focused on shipwrecks only, being monographic and object-orientated, resulting in isolated and often technical publications on individual wrecks. Less has been done with other archaeological and contextual aspects of Dutch maritime culture (*e.g.* harbours, marine erosion, usage of the sea, drowned settlements, coastal life). The remains of ships could for example also be considered materials that can be used to study the societies that invented, built and exploited them (Flatman 2003). Nevertheless, as Van Holk (1991) justly states: (wooden) ships should be considered as the most complicated men-made structures before the invention of the steam engine and therefore deserve special attention within the research discipline of maritime archaeology. Landscape archaeology of the coastal plains surrounding the Zuyder Zee waters in the Netherlands has had a parallel development (see Chapter 3), and one way to step up the game of maritime archaeology could be to seek connection and integration with shoreline-oriented landscape archaeology (this thesis).

So far, The Zuyder Zee, rightfully considered the maritime heart of the Netherlands, has not often been studied from the concept of the maritime cultural landscape (*e.g.* Van Holk 2017a), leaving the history of the region partially unclear until present day. The region exhibits a plethora of maritime sites and relics aside from shipwrecks (see Materials). Thousands of archaeological objects related to drowned settlements, many historical maps and charters, spatial data and toponyms testify of a lost medieval maritime culture of the Zuyder Zee region, and could be used to further elucidate the complexity of maritime culture and socioeconomic use of this area.

Problem definition and research question

Despite the strong maritime character of the Netherlands, now and in the past, maritime archaeology is considered an understudied research specialism because the nature of archaeological studies is frequently too narrowly focused on terrestrial archaeology whereas the potential importance of maritime archaeology in part remains unrecognized. Archaeological studies that do target the maritime past are particularly focused on shipwrecks. There is no doubt that shipwrecks, of which many have been surveyed, are of great importance as archaeological sources, but they are too often documented as isolated objects, without considering historical, political, social and geographical context. Instead, these wrecks should be considered as part of the maritime landscape. However, in order to understand the latter, there is an urgent need for new interdisciplinary approaches in modern day maritime research. Much more should be done with the large amounts of data; maritime archaeological contexts should be assessed and synthesized and linked to output from terrestrial archaeology and other related research disciplines such as the various earth sciences, (landscape and socio-economic) history and historical geography. This would improve maritime archaeological explanation and theory and opens up ways to reconnect terrestrial and maritime archaeology.

The current study focuses on northeastern part one the most important Dutch maritime landscapes with its rich interdisciplinary datasets: the Zuyder Zee. The late medieval formation of the Zuyder Zee as a result of human landscape interference (land reclamation and cultivation), and the consequences for the inhabitants of the Zuyder Zee region, forms an underrepresented research theme. Previous palaeogeographical and archaeological studies (both national and regional) have to a large extent neglected the dynamic development of the region before the floodings, assuming that marine erosion has destroyed all relevant evidence of that previous

Figure 1.2. Topographical map of the main research area (inside red lines) and surroundings in the center of the Netherlands.

period. The aim of this study is to prove the opposite, by investigating the largely unknown maritime landscape of the northeastern part of the Zuyder Zee in the period of c. AD 1100–1400. It examines the interrelation between landscape development, human exploitation of land (reclamation, cultivation, habitation) and water (fishing, transport), including the reconstruction of its historical background (political and socio-economic actions), in other words: the reconstruction of the late medieval maritime (cultural) landscape of the northeastern Zuyder Zee. Essentially, it is a methodological study, as it intends to develop an interdisciplinary method to reconstruct eroded medieval landscapes before the times of their decay. A method not only applicable to the Zuyder Zee region, but also to other regions and/or countries. Furthermore, changing the focus from and beyond shipwreck-orientated maritime archaeological studies to more integrative studies on the dynamics of the maritime landscape forms a primary target of the present study.

The central research question underlies this: "*How can interdisciplinary and methodological research, using different research approaches, contribute to improved understanding of the developments shaping and altering the landscape and human usage of the northeastern Zuyder Zee between 1100 and 1400 AD*?" Five interrilated papers are designed to answer the central question, together making up the core of this study (see: Methodology).

Research area and research period

This study focuses on the northeastern part of the Zuyder Zee (*Zuiderzee*; Southern Sea) and its shores, a region which in the modern geography covers the *Noordoostpolder* and its surroundings (IJsseldelta, Kampen, polder Mastenbroek, Zwarte Meer, Vollenhove and Kuinre). The region is most suitable for an analysis of the maritime cultural landscape of the Zuyder Zee because of (1) its dynamic past (from land into sea into polder), (2) its submerged settlements and former islands, (3) its rich palaeogeographical record as its geology and geomorphology are known in detail (4) its land-based cultural archaeological surroundings that are well-known in a historical and terrestrial-archaeological perspective.

The research covers the Dutch Late Middle Ages and focuses on the period of AD 1100–1400, as that period embeds the processes of high medieval land reclamation and progressive late medieval peat erosion and the simultaneous Zuyder Zee formation. Furthermore, archaeological material (*i.e.* pottery sherds) that has been found in the Noordoostpolder and the neighbouring maritime areas, representing the first phase of habitation, corresponds to this period.

A complete overview of the late medieval landscape development and habitation can be found in Chapters 2 and 6. Here, a brief impression of the dynamic development of the region will be sufficient. During the Roman Era and Early Middle Ages, the region was characterized by vast peatlands and large bodies of fresh water, referred to as *Lacus Flevo* (Flevo Lake), which was succeeded by the *Almaere* (Omnipresent lakes; see: Chapter 2). At the dawn of the Late Middle Ages, reclamation, cultivation and heavy storms weakened the peatlands, which resulted in major floods and land erosion. In the 12th century AD, massive floods removed the final peat barrier between the North Sea and Almaere, which caused the formation of the Zuyder Zee. Although the name refers to a mass of water with marine characteristics, the Zuyder Zee should not be considered a separate individual sea but rather a southern extension of the North Sea that functioned as a tidal lagoon. Within three centuries, most of the peatland was taken by the sea, despite the presence of early coastal defenses.

The oldest historical maps of the Zuyder Zee, dating back to the 16th century AD, depict the region after the process of severe marine erosion. These maps provide a first glimpse of the main research area: it consists of a northeastern coastal zone, two former islands (Urk and Schokland) and the IJssel river mouth in the southeast (Fig. 1.2). It measures c. 1.160 km^2 with maximum cross-overs of c. 39 x 41 km and was relative densely inhabited with small coastal settlements in the northeast (*e.g.* Lemmer, Kuinre, Blokzijl and Vollenhove), on both islands (Urk, Emmeloord and Ens) and near the river IJssel (*e.g.* Kampen, IJsselmuiden and Grafhorst; Fig. 1.2). These historical maps depict the final product of marine development (landscape change was relatively limited in the following centuries), but the current study focuses on the path towards the formation of the Zuyder Zee, of which no palaeogeographical and historical maps exist.

Another 400 years would go by before it was decided to dam and reclaim the Zuyder Zee. In 1932, the construction of a 32 km long dam was finished that closed the Zuyder Zee from the North Sea. By 1942, the northeastern part of the former lagoon was reclaimed and cultivated (Noordoostpolder). Far stretching arable fields, large farms, modern settlements and a great number of windmills set the present scene of the region and are quite the opposite of the late medieval appearance of the region. The former islands Urk and Schokland are now embedded in the modern polder landscape whereas coastal towns like Kuinre, Blankenham and Blokzijl along the former northeastern shore of the Zuyder Zee transformed into inland settlements and lost their maritime functions.

Materials

Each of the research components deals with different datasets (materials). These datasets form a layer (*e.g.* soil maps, coring data, geological studies form the geological data layer), whereas the combination of layers leads to an understanding of the late medieval research area, as is illustrated in Figure 1.3. Data were assembled in a variety of formats, such as databases, spatial layers, books, field observations, articles, reports, photographs, maps, objects, notes and archival records. In some cases information of different layers corresponds, like for instance historical dike remains that could be visible on aerial photographs, LIDAR-data and geological maps. This overlap strengthens the methodology of the research as well as the reliability of the content of the datasets.

Chapters 2, 4 and 5 have a strong spatial character as they focus on the geological record and material remains that were left behind by the historical inhabitants and/or users of the Noordoostpolder region (*i.e.* shipwrecks, settlement remains, dikes, ditches). Therefore, the formats of many datasets were transformed into spatial layers and collated into a single project GIS. A short overview is provided below of the most important layers that were used for this study.

Geological and palaeogeographical maps

The subsoil of the Noordoostpolder region has been carefully studied in the past, even before the 20th century reclamations. Documentation of hundreds of soil profile pits and thousands of shallow corings resulted in accurate soil maps that appeared in the period of 1947-1956 (*Bodemkundige Code- en Profielenkaarten*). The doctoral thesis of Wiggers (1955), partially based on these maps, provided the first relevant geological maps of the research area. Although these datasets are over 60 years old, they are still considered as reliable, accurate and of importance for current research. Ever since Wiggers published his maps, they have been adopted (visible or less visible) in many palaeogeographical and geological studies. The maps of for example Zagwijn (1986), Gotjé (1993), Ten Anscher (2012) and Vos & De Vries (2013) all relate (partially) back to the interpretations of Wiggers (see Chapter 2).

Historical maps

Further important data comes from historical maps: Walsmit *et al.* (2009) created a clear overview of the available and known historical maps of the Zuyder Zee region. Most of the maps date to the 19th and 20th centuries and depict the Zuyder Zee in its final shape (the end product of marine erosion). The oldest maps in the overview date back to the middle of the 16th century and, although not being very spatially accurate, they contain valuable information on settlements (especially those that eventually drowned) and the layout of the landscape (division land/water, rivers, roads). It is important to keep in mind that they provide an overview of the Noordoostpolder region after the Late Middle Ages (Fig. 1.4). Within the research area the known settlements Vollenhove, Blokzijl, Baarlo, Blankenham, Kuinre, Slijkenburg, Emmeloord, Ens and Urk are marked. A more accurate historical map of the Zuyder Zee region was made by Christian Sgroten (*c.* AD 1570) and also depicts the same settlements as on the map from 1540, including the settlement Fenehuysen, several kilometers to the northwest of Kuinre.

Aerial photographs

Aerial photographs were already analysed for archaeological purposes in the late 19th century, although they were not primarily made for this purpose (Ceraudo 2013: 11; Cowley & Ferguson 2010: 97; Reeves 1936: 102). The techniques used and the quality of the photographs were however very basic in the early days. The quality of the images improved from the moment they were taken from planes. Especially during the Second World War, when Allied forces took hundreds of thousands photographs of Europe, the quality and quantity of the dataset drastically improved.

The first photographs of the Noordoostpolder region were taken during the Second World War by the Royal Air Force (RAF), shortly after the reclamation process was finished. They focused on the former islands Urk and Schokland and on the former east shore of the Zuyder Zee. More photographs were taken after the war (1947, 1949) and these series cover the whole Noordoostpolder region. They offer a unique view on the former seabed with very limited urban development yet. New series of aerial photographs were taken in 1960, 1971, 1981 and 1989, but their prospective value is more limited due to increased extent of urban areas, extensive and mechanized agriculture and altered vegetation cover (development of forests). The RAF-photographs of the Noordoostpolder depict the partially cultivated soil of the research area (the western part of the polder was not yet dry enough). Remains of dikes and terps are visible as a network of linear dark lines and circles in the direct surroundings of Schokland and Urk, although not very clear (Fig. 1.4; see also Chapters 2 and 4). The post-war photographs from especially 1949 and 1971 clearly show (1) networks of dike remains and terps, (2) medieval parceling in the northeastern coastal zone and near Urk and (3) the remains of the second castle of Kuinre (see De Boer & Geurts 2002). It is clear that specific soil conditions (*e.g.* dry and ploughed) can strongly influence the visible archaeological traces, as they are much clearer on some aerial photographs.

LiDAR data

Since 1997, LiDAR data has been collected at regional scale in the Netherlands for the construction of a nationwide Digital Elevation Model (DEM). Initially aiming at a resolution of one surface elevation point per 16m^2 (Lemmens 2011: 153). The first LiDAR DEM, called AHN1 (Actual Height database for the Netherlands) was finalized in 2003 and had a maximum resolution (depending on the region) of 1 surface elevation point per 1 m^2 (Van der Zon 2013: 6). This would prove to be insufficient for finding archaeological traces and sites in the Noordoostpolder region. As needs were created, the building of the AHN2 started in 2006 and the new nationwide coverage by LiDAR-data was finished in 2012. This new DEM had a resolution of 6-10 points per m^2, with the possibility to create a grid with cell sizes down to 0.5 m x 0.5 m (compared to the 100 m, 25 m and 5 m grids of the AHN1 data products). Detailed analyses of AHN2 data in a GIS have proven to be of high value in finding archaeological sites in the research area. Especially in those areas where aerial photography is of no use: the forests. Laser pulses that are shot from an aircraft towards the earth's surface result in several returns: the first return will be received from the first obstacle that is hit (this would be the top of a tree in a forest), while the last return in theory would come from the surface of the forest floor (Lim *et al.* 2003: 93). By separating the results from different returns, it is possible to make a DEM of the ground surface of a forest.

With the relative high resolution of the AHN2 and the possibility to make a DEM of the ground surface of forests, some interesting results can be gained from the Noordoostpolder region. The best example of the added value of LiDAR-data comes from the Kuinre Forest. This forest was planted in 1947-1953, which means that only aerial photographs until 1949 can be consulted. These photographs depict some vague traces of historical parceling to the northwest of Kuinre. Once a detailed LiDAR DEM of the same region is examined in a GIS, it becomes clear that a whole system of historic parceling is preserved in the forest soil (see Chapter 4). Unfortunately, most of the agricultural grounds in the Noordoostpolder have been ploughed so often that the ground surface is relatively flat and archaeological traces have become invisible on LiDAR-images. Some large natural features, like prehistoric creek systems and river dunes are still visible: this is caused by limited soil compaction of these sandy traces, compared to stronger compaction of the clayish or peaty surrounding soils.

Late medieval archaeological finds

Ever since the reclamation of the Noordoostpolder, thousands of archaeological objects (not being shipwrecks) have been found in the former seabed. Some of these finds are of prehistoric age (see *e.g.* Raemaekers 2010), but a substantial number of objects belongs to the Late Middle Ages. Many of these finds were found *ex situ*, for example during agricultural processes like ploughing. Until recently, no overview existed of these finds and an overall interpretation of the lost contexts lacked. The presence of medieval archaeological remains is in some cases interpreted as part of the inventory of wrecked ships, while others simply consider these materials as noise. Wiggers (1955) and Van der Heide (1965a) were the first scholars that interpreted the assemblage of archaeological materials as the remains of medieval settlements. Although their interpretations were put on paper, they were never thoroughly updated or expanded.

In order to find out whether the medieval archaeological material actually represents lost settlements, a reliable dataset had to be created. Therefore, information on relevant archaeological finds was assembled from all kinds of sources: the Dutch national archaeological database (ARCHIS), documentation of amateur archaeologists, archaeological reports, daily reports and distribution maps. Besides primary information on type, amount and age of the material, spatial information (coordinates) was provided. The whole set of information was transported to the new Medieval Settlement Database (MSD).[2] Spatial analyses on the archaeological objects of the MSD have shown distinct patterns in the distribution and density of material. Only those locations that contain a significantly larger amount of material than the average spread of objects in the region are expected to represent settlement remains (Van Popta 2016: 86). There are several locations in the Noordoostpolder that meet the requirement above mentioned. Besides the spread of objects, the composition of the archaeological material is of importance for recognizing settlement remains. Medieval pottery sherds are the most commonly found artefacts in the research area, but the assemblage of settlement remains should consist of more than only sherds (see Chapter 4).

Shipwrecks

Wrecks can be used to date specific maritime contexts and provide important information on specific periods (Westerdahl 1992: 7). In most cases, wrecks will be discovered underwater, but the present maritime archaeological situation in the province of Flevoland is quite the opposite: most wrecks have been found in the reclaimed soil of the former Zuyder Zee. Therefore, their presence in combination with their date of wreckage also provides information on the division of land-water and the age of specific (marine) soil layers (see Van Popta 2013). As information about the Zuyder Zee wrecks has been spread over several (outdated and/or inaccurate)

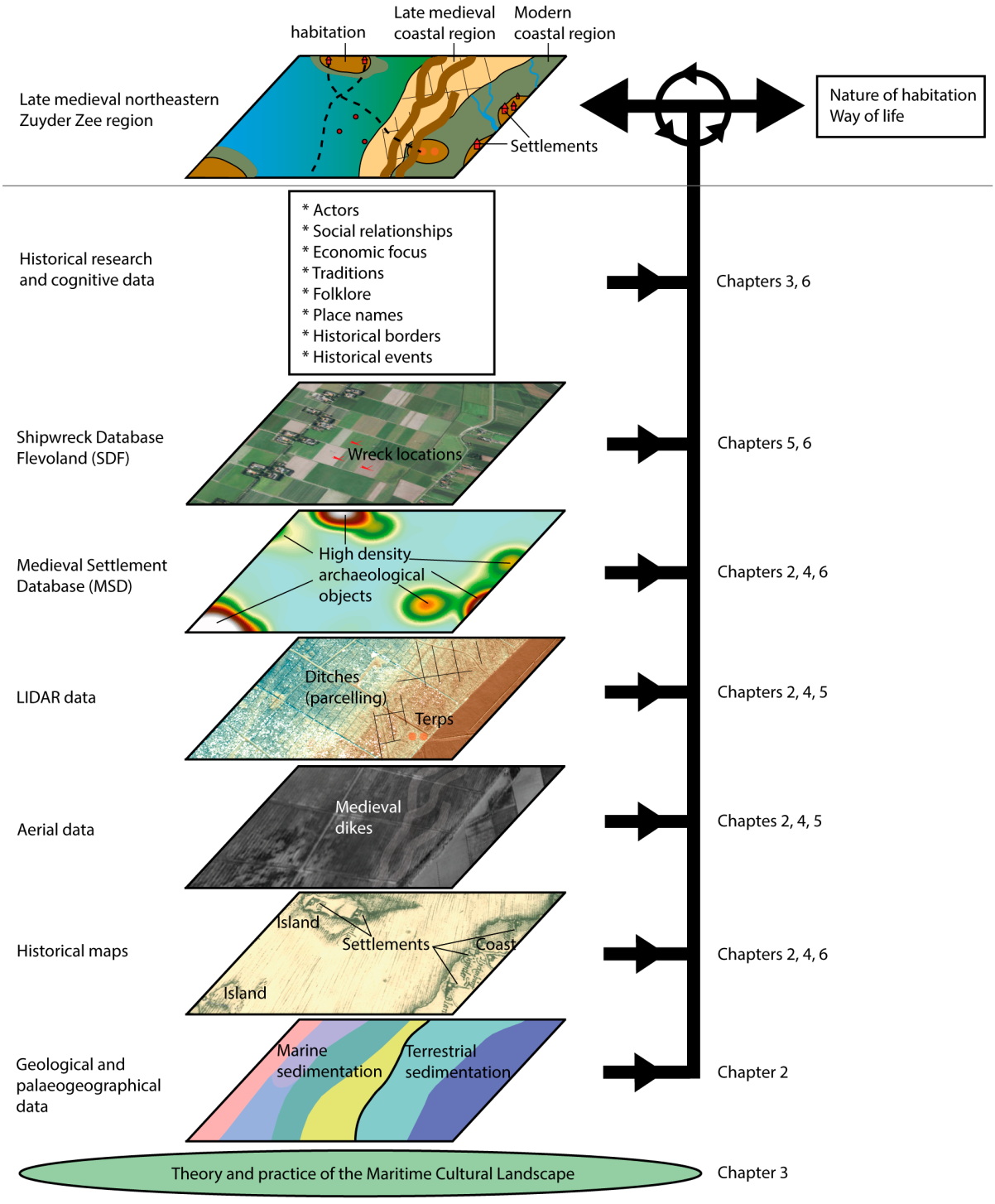


Figure 1.3. Overview of the interdisciplinary research methodology of the current study. Information from the different layers is transported to the top layer (reconstruction).

databases and archives, it was decided to build a new database first: Shipwreck Database Flevoland (SDF: Van Popta 2012a; 2017). The number of relevant shipwrecks for this research, namely those that wrecked in the Late Middle Ages, is however limited to 10. Their contribution to this research is therefore somewhat limited (see Chapter 5 and 6).

Human behavior

The above mentioned datasets depict to a large extent the maritime landscape with the leftovers its inhabitants (submerged settlements, shipwrecks, traces of land cultivation), but without human actors. Individual actions and thoughts of late medieval inhabitants of the study region are hard to recreate, but it is possible to

focus on their way of life (socio-economic, political), and the development and history of the settlements that they lived in from an archaeohistorical point-of-view. Therefore, historical studies have been used that target late medieval human behavior in the Low Countries (*e.g.* Geurts 2005; Weststrate 2008; Brand & Knol 2010; Van Bavel 2010; Mol 2011; Jager 2015). Combining their results with information from the before mentioned materials provides an overview of late medieval life in the northeastern Zuyder Zee region (see Chapter 6).

Methodology

Marine erosion and human landscape interference (reclamations, ploughing, construction) have drastically reduced the quantity and quality of relevant archaeological and geological sources, which makes a single-disciplinary study on the current topic unfeasible. Therefore, it was decided to use an interdisciplinary and spatial approach that integrates historical, geographical, geological and archaeological data sources from the Zuyder Zee region, and resulted in five interrelated research components, each one representing a single chapter (Fig. 1.1).

Due to the interdisciplinary nature of the current study, it is important to clarify the position of the research with regard to the research disciplines involved. As the research has been carried out by an archaeologist, the results, interpretations and conclusions are in the first place written from an archaeological point of view. It would be wrong to claim that incorporating and analyzing geological or historical data creates geological or historical studies. However, the datasets, results, interpretations and conclusions that are (partially) based on disciplines other than archaeology have been examined, discussed and reviewed by experts from those disciplines. Nevertheless, archaeology is in most chapters considered the most important discipline as can be seen in table 1.1.

As a result the research has a strong methodological character that suits its interdisciplinary nature. In general, three methodological approaches are used in order to tackle the research problems and to answer the research questions mentioned earlier. A palaeogeographical approach is used for analyzing the (eroded) late medieval physical landscape of the research area (Chapter 2). A maritime archaeological approach is undertaken for studying the material maritime culture from a theoretical (Chapter 3) and spatial (Chapter 5) point of view. Last but not least, a historical-geographical approach is used to understand the material and historical maritime remnants (Chapters 4 and 6). On paper, these methodological approaches might look like separate pillars, but their results are simultaneously used in other parts of the thesis as well. Chapter 2 describes for example the palaeogeographical approach for reconstructing the physical landscape of the research area, but important archaeological and historical datasets (part of Chapters 4 and 6) are used for the analysis. Therefore, it is best to state that the three methodological approaches use a layered model of datasets that are used in an interchangeable way.

Chapter 2 presents a physical reconstruction of the highly dynamic maritime landscape development of the Noordoostpolder region between AD 900 and AD 1600. Until recently, no late medieval palaeogeographical maps existed of the Zuyder Zee region due to the lack of relevant geological data, hence the particular appearance of the medieval landscape remained unad-

Table 1.1. Overview of the research approach(es) of the current study.

Part	Disciplines involved	Approach	Nature	Main product	Main content in
Ch. 2	Archaeology, geology, landscape history	Palaeogeographical	Spatial	Map series of the research area between AD 1100 -1400	J. of Landscape History
Ch. 3	Archaeology	Maritime archaeological	Theoretical	Implementation of the MCL concept as a theoretical framework for this study	Int. J. of Nautical Archaeology
Ch. 4	Archaeology, historical geography	Historical- geographical	Archaeological (material)	Case study on the study of archaeological remains from the area of research	European J. of Archaeology
Ch. 5	Archaeology	Maritime archaeological	Spatial	Critical review on the accuracy of wreck locations in the Zuyder Zee region	Palaeohistoria
Ch. 6	Archaeology, history, historical geography	Historical geographical	Historical (immaterial)	Identity of maritime inhabitants of the research area	Int. J. of Maritime Archaeology

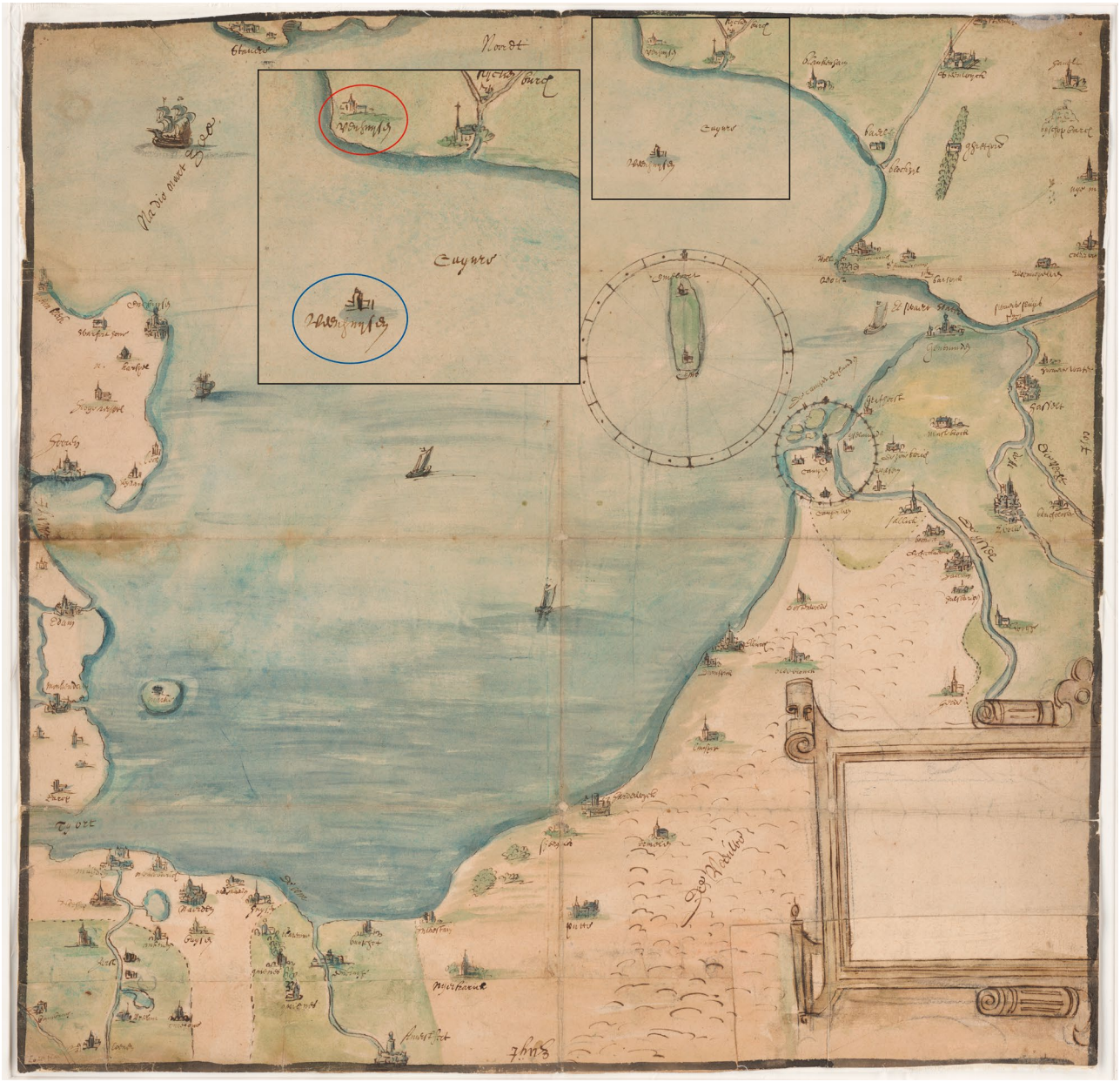


Figure 1.4. Historical map of the Zuyder Zee region for c. AD 1535 (Historisch Centrum Overijssel, map KD 000372).

dressed. It was decided to flip the order of disciplines for a palaeogeographical reconstruction: archaeological evidence was used to reconstruct former land surface areas whereas geological, historical and spatial datasets were used to complement the reconstructions. This layered approach resulted in a new time series of four reconstruction maps (AD 900, 1100, 1400 and 1600) that clarify physical landscape changes and, in contrast with true palaeogeographical maps, highlight traces of habitation and reclamation.

Chapter 3 examines theory and practice of the maritime cultural landscape in general and explores ways to project the concept on the region of study. It provides necessary theoretical background for Dutch maritime archaeology in general and functions as the theoretical framework of the current study (Table 1.1). Whereas Chapter 2 provides a general overview of late medieval habitation in the Noordoostpolder region, Chapter 4 focuses explicitly on these locations. It examines the spatial distribution and density of physical evidence (archaeological objects) and studies historical and remote sensing datasets in order to localize and characterize late medieval habitation in the research area. This layered approach, as a continuation of the approach of Chapter 3, resulted in the discovery of remains of the drowned settlement *Fenehuysen*. Chapter 5 focuses on the approximately 450 shipwrecks that were discovered in the reclaimed part of the Zuyder Zee (Province of Flevoland). Primary information of these shipwrecks was assembled from relevant datasets and stored in the

Shipwreck Database Flevoland (SDF). Part of the content of the SDF turned out to be inaccurate (especially concerning the location of wreck sites) and outdated. To improve the quality of data and accuracy of wreck site locations, several remote sensing techniques were successfully used. The SDF holds only 10 shipwrecks that date between AD 1100 and 1400 and wrecked in the Noordoostpolder. The locations of these late medieval wrecks are relevant for the study as they prove the presence of water, but provide a limited contribution to this research due to their small numbers. Their function (all being freighters) is relevant for the use of water in the Late Middle Ages and is therefore treated as a section of Chapter 6. The results of this chapter therefore provide not only a more reliable dataset for further maritime archaeological research, but also demonstrate to critically evaluate datasets before interpreting and including them. Chapter 6 examines the nature of habitation and way of life of the late medieval inhabitants. This part of the study is mainly based on historical and archaeological studies and examines 'who' the inhabitants of the research area were and 'how' they managed to live in such a dynamic environment. Four distinct settlements from the research area (Kuinre, Kampen, Urk and Nagele) and their inhabitants are studied in detail (development, economic focus). Whereas Chapters 2, 4 and 5 target the physical landscape and mainly material remains of late medieval habitation, Chapter 6 complements them by focusing on the actions of the inhabitants. Together, the six chapters provide a multiple understanding of the late medieval maritime (cultural) landscape of the northeastern Zuyder Zee region.

Outline of the thesis

The study consists of five interrelated research components (each one represents a peer-reviewed article) designed to answer the main research question (see also Methodology). Chapter 2 examines the late medieval palaeogeographical development of the study region based on an 'archaeology-first–geology-second' approach and presents a palaeogeographical reconstruction map series for AD 900, 1100, 1400 and 1600. Chapter 3 investigates theory and practice of the Maritime Cultural Landscape in general and examines how theoretical concepts and aspects of the MCL can be projected on the northeastern Zuyder Zee region. Chapter 4 focuses on the spatial distribution of late medieval archaeological objects in the Noordoostpolder and projects them on the maps that were constructed in Chapter 2 in order to interpret and characterize the materials. Chapter 5 consists of an in-depth study of shipwreck data of the entire Zuyder Zee region. The locations of many wreck sites in the province of Flevoland turned out to be highly inaccurate. Therefore, this part of the study delivers not so much a contribution with respect to the interpretation of the late medieval maritime cultural landscape, but demonstrates that, despite the strong maritime archaeological focus on shipwrecks, primary data is still not fully trustworthy. Chapter 6 is an archaeohistorical overview of late medieval life in the research area and focuses explicitly on the inhabitants of the research area and their actions. Chapter 7 contains the discussion and synthesis, answers the central research question and uses four themes to reflect upon the entire study.

Endnotes

1 A more detailed and extended overview on maritime archaeology as a discipline is provided in Chapter 3.

2 The content of this database is subject to change and therefore only made available online (www.easy.dans.knaw.nl).

2 Reconstructing medieval eroded landscapes of the Northeastern Zuyder Zee (The Netherlands)

A refined palaeogeographical time series of the Noordoostpolder between AD 1100 and 1400

*Yftinus T. van Popta, Kim M. Cohen, Theo Spek**

Abstract
This paper considers large scale erosion of late medieval peatland landscapes along the inland lagoon rims of the northeastern Zuyder Zee area (today: Noordoostpolder, The Netherlands) and integrates palaeogeographical reconstruction, material archaeological and spatial archaeohistorical research. The dynamic regional history of coeval loss of peaty coastal plains and boom of maritime activities is studied from archaeological, geological and historical data perspectives. In the first half of the Middle Ages (500-1000 AD), vast peatlands and interconnected lakes characterized the study area. During the Late Middle Ages (1000-1500 AD), increased stormsurges and tidal incursions allowed for extensive progressive erosion of inhabited peatlands, transforming the central Netherlands into the Zuyder Zee tidal lagoon. In the northeastern quadrant of the expanding water body, medieval terrestrial geological and archaeological records fell prey to erosion, reworking and uptake into lagoon floor deposits. These deposits were intensively surveyed since the 1940s when the quadrant was reclaimed and made into arable land, and are revealed to contain spatially clustered late medieval archaeological objects. Where lagoon floor reworking has hindered to make detailed palaeogeographical reconstruction based on geological data alone, including the mapping of archaeology helped resolve the pacing of lagoon expansion. The key to resolving the lost peat land palaeogeography for the time frames AD 1100 and AD 1400, was to put the archaeological data density patterns first and geological lagoon-floor facies descriptions second in process order, while for earlier periods or other regions the opposite order is the convenient choice. We present a map series beginning with an updated map for AD 900 (youngest geological reconstruction), introducing first detailed palaeogeographical maps for AD 1100 and AD 1400 (honoring the late medieval terrestrial and maritime archaeological evidence) and ending with a landscape reconstruction for AD 1600 (complying with the oldest historical maps of the lagoon), revealing the intertwined landscape history of land and sea as the backdrop of shifts in human use of both.

Keywords
Palaeogeographical mapping, maritime cultural landscape, archaeology, geology, Middle Ages, lost islands, drowned settlements, coastal erosion.

To be published in
2020, Landscape History 41.**

* We thank editor Della Hooke and one anonymous reviewer for constructive comments on the article manuscript. We thank Prof. Van Holk, Prof. Raemaekers and dr. Vos for constructive reviews of the thesis chapter manuscript.

** This chapter is an extended version of the article that has been accepted for publication in *Landscape History* published by Taylor & Francis, and is reproduced with permission. Extra paragraphs are included in the sections 'Setting', 'Results' and 'Discussion'.

Introduction

This paper presents a reconstruction of the highly dynamic maritime landscape development of the Noordoostpolder region, that is the northeastern part of the former Zuyder Zee in the central Netherlands, in the later part of the Middle Ages (Fig. 2.1). In 1942, the Noordoostpolder was reclaimed and transformed into modern agricultural landscape. The name Zuyder Zee ('Southern Sea') is connected to the late medieval greatly expanded central Netherlands' lagoon: a continuous inland water body resulting from the progressive erosion of medieval peatland landscapes connected to the North Sea via widened tidal inlets of the western Wadden Sea (*e.g.* Wiggers 1955; Vos 2015; Van den Biggelaar *et al.* 2014; Pierik *et al.* 2017; Van Popta 2017a). Before this Zuyder Zee tidal ingression and lagoon expansion came to be, the lost landscapes of the Dutch coastal plain consisted of extensive peat bogs, fens and local lakes, through which rivers ran. A substantial part of these wetland landscapes was lost to medieval ingressions, but an equally substantial part was reclaimed and inhabited at the time, caused by early medieval habitation on the boulder clay outcrops as well as large-scale agrarian peatland reclamations in the 10th–12th centuries (Wiggers 1955; Van der Heide 1965b; Geurts 2005; Mol 2011; Van Popta & Aalbersberg 2016). Hence, palaeogeographical research into the expansion of the Zuyder Zee and conditions of its wetland fringe from protohistoric into historic times is advised in order to cover the detailed investigation of natural as well as human landscape developments, and to include the way that former inhabitants adapted their physical environment, economy and social structures to these vigorous changes (Vos 2015; Pierik *et al.* 2017). Performing such research can provide relevant insights into the natural and cultural history of the lagoon landscape, and should be considered as a methodological case study in the archaeology of drowned and reclaimed lands.

From Zuyder Zee to Noordoostpolder

The expanding Zuyder Zee was a hazardous place in early modern times, despite the fact that it also played a crucial role as the main traffic square of the Low Countries in the Dutch Golden Age. In the shallow waters, with an average depth of no more than 4 meters, and a fetch length of over 100 km, winds could generate substantial waves. In case of strong onshore wind, water was pushed to levels up to 2 meters above the normal water level (De Gans & Bunnik 2005: 124). Due to the dangers of the sea and the many lives it took, the first plans to close off the Zuyder Zee from the North Sea were developed in the 17th century, but never executed.[1] Repeated heavy floods in the 19th and early 20th century, the loss of lives and economic damage convinced the Dutch that things had to change. It lasted until 1916 before action was undertaken, triggered by a major storm surge that year. The Netherlands decided to give up the Zuyder Zee as fishing ground and a backdoor harbor for Amsterdam by closing it off from the North Sea. In return, additional land could be created by reclaiming large parts of the sea. The reclamation plan of chief civil engineer Cornelis Lely was selected and in general realized from 1920 onwards (Fig. 2.4f; Van der Heide 1965b; Reh et al. 2005; Sintobin 2008; Meyer 2016: 95).

First, a dike was built between the mainland and the island Wieringen and completed in 1924. Then, a pilot polder was created near the town of Andijk and finished in 1927. In the same year, the construction of two major works started: the Afsluitdijk ('Closure Dam') and the Wieringermeer polder, reclaiming 20,000 ha in the northwestern part of the Zuyder Zee. The Afsluitdijk, finished at 1932, intended to permanently separate (i.e. 'closing off') the Zuyder Zee from the North Sea.[2] Subsequently, the Wieringermeer polder (dike closed in 1929, all water drained from the polder in 1930) was to provide new agricultural land. This was followed by the Noordoostpolder which was the second major reclamation of the former Zuyder Zee. Construction of dikes enclosing the polder started in 1936 and the final gap was closed in December 1940. Two years later, the Noordoostpolder was fully drained so that 48,000 ha of land could be brought into cultivation. Work on a third polder, Eastern Flevoland, started in 1950 and was completed in 1957, providing another 54,000 ha of land. The final polder, Southern Flevoland, was reclaimed in between 1959 and 1967 and brought in 43.000 ha of land. Between 1963 and 1975, a dam/dike was built between Enkhuizen and Lelystad preparing reclamation of a fifth polder (Markerwaard polder), but it was decided not to reclaim this part of the former Zuyder Zee (Waterhout et al. 2013: 12; Jongmans et al. 2013: 787).

State of research

The geology, history and archaeology of the Noordoostpolder have been closely examined in the past, especially at the time when the polder fell dry and was put into use in a time of post-World War II rationalism with a strong focus on agricultural optimization for food production, for which a detailed understanding of the soil and subsoil was wanted (Fig. 2.2.). The new and very diverse dataset developed in this period has been used by various scholars for answering questions on the origin and history of the Zuyder Zee region, leading to detailed studies on terrestrial and tidal-lagoonal palaeoenvironmental development (see *e.g.* Wiggers 1955; Van der Heide 1965b; Gotjé 1993; Ten Anscher 2012) to archaeological investigations of the first (prehistoric)

Figure 2.1. The Zuyder Zee region in the center part of the Netherlands. The modern settlements in the Province of Flevoland are labeled in grey italics.

Figure 2.2. Recent aerial photograph of the reclaimed northeastern Zuyder Zee region (photo by author and his drone).

inhabitants (Van der Heide 1965b; Ten Anscher 2012), besides many investigations regarding the rich maritime past of the region (see: De Boer & Geurts 2002; Geurts 2005; Van Hezel & Pol 2008; Van Popta & Aalbersberg 2016; Van Popta 2017a; Chapter 5).

The Noordoostpolder is also part of several detailed regional (see: Wiggers 1955; Ten Anscher 2012) and more general national palaeogeographical studies (see: Zagwijn 1986; De Mulder *et al.* 2003; Vos & De Vries 2013; Vos 2015). When connecting all these bodies of work, important changes in natural conditions and types of human presence throughout the history of the region become visible. Different ideas compete regarding the establishment of the Zuyder Zee as a large brackish tidal lagoon early in the second millennium AD. These differences especially consider the southern and southwestern sectors of the Zuyder Zee, where it followed up precursor lagoonal and lake water bodies. The commencement of the Zuyder Zee is seen as the culmination of a process, that began with expansion and growing interconnection 'Lake Flevo'/'*Lacus Flevo*' and 'Almere'/'*Almaere*' during the last centuries BC and the first millennium AD. Timing and mechanisms of successive phases are subject of ample discussion (recent exchanges of arguments found in Buitelaar & Borger 2015; Vos 2015; Vos *et al.* 2015; Pierik *et al.* 2017; Borger & Kluiving 2017; Van Zijverden 2017).

Our position here is that these debates primarily consider the timing and order of events in regions away from the Noordoostpolder. If we plan to investigate the Noordoostpolder area and consider its palaeogeography in Iron Age, Roman and early medieval times, it is fully accepted (see Results: reconstruction maps reconstructed) that the region at that time drained towards the Vlie tidal inlet. There is little debate that this inlet water body was gradually expanding south and southeast wards, turning inland waters from fresh to brackish and causing erosion and inundation of peat lands, already before the Zuyder Zee established (*i.e.* within the 1st millennium AD) and continuing during its commencement (*i.e.* at the turn to the 2nd millennium).

However, the time period when coastal land changed into inland sea, say the Late Middle Ages, remains a complicated and largely unknown period of study, not only for the Noordoostpolder, but for the whole Zuyder Zee region. National palaeogeographical studies have skipped this period by reconstructing the Zuyder Zee region centuries before marine erosion (800 AD) and the post-medieval landscape after marine erosion (1500 AD). Previous archaeological and historical studies do mention the loss of land in the Late Middle Ages and the presumed submergence of settlements in general but often lack the right amount of detail for an accurate reconstruction (see: Van der Heide 1958; Geurts 1991; Hogestijn 1992; Geurts 2005; Van den Biggelaar *et al.* 2014; Van Popta 2017a).

Problem definition

Given the landscape change described above, it is time to reconsider all data available for the Noordoostpolder region, in order to produce a new and independent palaeogeographical map times series for the medieval period. Depicting the symbiotic relationship between landscape development and human presence during the Late Middle Ages has been avoided, and hence remained neglected in national scale palaeogeographical reconstructions. Time series tend to skip the critical period, jumping from A.D. 900 to 1500 (Vos 2015). If we focus on the regional reconstructions made for the area in the Early Middle Ages (*e.g.* 900 AD) and periods before, considerable attention has been given to fragments of peatlands of that time, that survived in the former island Schokland and its immediate surroundings (*e.g.* Gotjé 1993; Van den Biggelaar *et al.* 2014). The rest of the Noordoostpolder area, however, in these maps does not hold any preserved peatland. Hence, although there are diverse scattered traces of medieval habitation, peatland reclamations, (lost) islands and former maritime relics in the Noordoostpolder, it remained unaddressed as to what particular medieval landscape was there originally.

Because of extensive erosion by the Zuyder Zee, the calved and re-worked areas lost direct *in situ* geological and archaeological records and therefore were considered unsuitable to inform palaeogeographical reconstructions. It is exactly dealing with surviving archaeological and geological signals of the eroded peatland landscape after Zuyder Zee flooding, calving and lagoon-floor re-working — notably in the period 1100 to 1400 — that is in the heart of the research problem addressed here. Data integrations and interdisciplinary interpretations, to be elaborated in new regional palaeogeographical reconstructions, visualised in a map time series, are necessary for exploring and explaining the late medieval developments of the Noordoostpolder and northeastern and south-eastern fringes in the 12th to 14th century, both natural and cultural, in a spatially explicit way. As this period spans the turnover from a 'landscape' to a 'seascape' for the area, balanced attention is to be given to indications of sea ingression and land persistence, both where archaeological and where geological data are considered. Furthermore, the period expands the dawn of historical records for the area. Written and map-drawn information on former land use, lost places and changed maritime practice for this area exists, so that the palaeogeographical reconstruction can connect to the 16th-century oldest topographic map depictions for the area.

The time period and research aimed at thus require an interdisciplinary approach, taking in archaeological, earth scientific, palaeoecological, historical-geographical and medieval historical sources and methods. This had already been noted and advocated in the first years of Noordoostpolder surveying by Van der Heide in 1951 (p. 192). Such research would allow the examination of the extension of the Zuyder Zee, the changes in human land exploitation and the influence of these changes to society from archaeological-historical biographical perspectives. As a result the central research question of this paper is: 'How did the natural and cultural landscape of the Noordoostpolder change because of maritime erosion in a period of 300 years (1100–1400)?'

Four main research themes are designed for answering the research question. The first theme treats the palaeography of the Zuyder Zee area, meaning relevant Pleistocene and Holocene events that influenced the dynamic development of the Noordoostpolder sector of the Zuyder Zee from a chronological geomorphological and archaeological perspective. Results have been derived from extensive literature and data research. The second theme consists of the analysis of spatial patterns of medieval archaeological and historical data. It uses primarily results based on analyses of archaeological objects (terrestrial find clusters) and historical sources (geographically ordered toponyms).

The third theme incorporates these within landscape reconstructions, starting with a critical analysis of earlier reconstructions (to decide what info to take over and what info to discard). The final integrated result, the fourth theme, is the new palaeogeographical map series of the northeastern Zuyder Zee area (AD 1100-1400), which is used to present a detailed regional geographic history for the period of AD 900 until AD 1600, with new features and insights highlighted. The usefulness of performing palaeogeographical mapping and the (cultural) consequences of land loss will be discussed in the final section.

Methodology

Materials and data preparation

Several types of primary research materials, *i.e.* datasets derived from different research disciplines, have been used for this research of which a complete overview is presented in Table 2.1. A lot of archaeological research has been conducted since the reclamation of the Noordoostpolder in 1942. A considerable part of the research has focused on the 200 shipwrecks, but the data also include Neolithic and medieval habitation, especially near the former islands Urk and Schokland.[3] Furthermore, amateur archaeologists have surveyed many hectares of land and found substantial amounts of archaeological material. The information obtained from these different kinds of research has been assembled by the first author and is stored in several databases.

The Shipwreck Database Flevoland (SDF) contains information on all known shipwrecks in the Province of Flevoland. Spatial analyses on the wreck locations have shown distinct patterns in the distribution and density of shipwrecks, highlighting past traffic routes, important harbors, hazardous areas and drowned land (Van Popta 2012a: 98; Van Popta 2016: 82; Chapter 5). The same type of spatial analysis is possible with the scattered terrestrial archaeological material that dates back to the Middle Ages. Large amounts of pottery sherds, animal bones, bricks and roof tiles have been documented and added to our Medieval Settlement Database (MSD).[4] Importantly, *in situ* archaeology (terrestrial and maritime) provides a more accurate local age-control on Zuyder Zee deposits, than geological dating methods can provide in the lagoon setting.[5]

Additional information has become available, such as georectified historical aerial photographs (1942-1971), satellite images and high resolution LIDAR elevation data. These datasets are relevant for finding physical and visible traces of the late medieval landscape by means of remote sensing. Regarding the take in of geological data, the starting point materials for this study were the geological maps and palaeogeographical maps (Table 2.1). These were gathered and assessed for differences, before being compared with the archaeological data. The primary data underpinning the maps are thousands of borehole descriptions, of which digital versions are stored in the 'DINO' database of TNO – Geological Survey of the Netherlands that could be accessed online. A further important geological map-dataset for the Noordoostpolder area is the so-called *Bodemkundige Code- en Profielenkaart* (Directie van de Wieringermeer, 1947-1956), that was based on surveying over 1500 km of fresh ditch cut cross-sections from 1940s-1950s (for soil science purposes when the polder was made agriculture-ready).

Further useful evidence is derived from historical source data like maps and charters. There are no historical maps of the research area that depict its state during the Late Middle Ages. However, several maps from the middle of the 16th century do depict the remnants of the erosive phase during the origin of the Zuyder Zee (*e.g.* Christiaan sGrooten, AD 1570). Late medieval historical charters do contain important information on the presence of (later submerged) settlements within the Noordoostpolder region, of which the 13th and 15th century charters (copies and cartulary) of the abbey of St. Odulphus are considered to be the most important.

Palaeogeographical map series have been used as secondary source, mostly for complementing the AD 900 and AD 1600 maps (see Results) of the map series. The national palaeogeographical maps of Vos & De Vries (2013) were considered the starting point. Their information has been compared and related to earlier maps (Wiggers 1995; Zagwijn 1986; Gotjé 1993). The reconstruction for AD 1600 used the digital maps for the Netherlands in 1575 (Kosian *et al.* 2016) as a starting point. For the IJssel river mouth, maps in Cohen *et al.* (2009) were the starting point. For other relevant materials see Table 2.1.

Methods

Although the new palaeogeographical map series of the northeastern Zuyder Zee region is considered to be the main result of the current research, its development is based on several other results. They include a density analysis of late medieval archaeological objects, a geographical analysis of historical charters and maps and a review of other palaeogeographical maps. For the late medieval maps, archaeology is used as the primary source of data to base the reconstruction of areas of former peat land on. It is reckoned that high concentrations of archaeological material represent medieval settlement locations on cultivated peat land. It is important to keep in mind that locations of archaeological object finds do not all equate to past settlements. Only clustering of different object types in relative large quantities would signal former settlements ('lost settlements' even, as some of them are known from historical mention). Individual archaeological objects within find concentrations may have been locally displaced and damaged, but not so much that the concentrations were diluted to background level. In other words: the settlement location signal in the find distributions was not wiped out by younger lagoon rim erosion, and the concentrations recorded in the fallen-dry Zuyder Zee sea floor echo still locations of terrestrial landscape occupation (for more detail, see Chapter 5). Besides would-be settlement sites, individual objects (1) may have belonged to wrecked ships, (2) may have been deposited in the sea as garbage from ships, (3) may have easily shifted on the former seabed or (4) can represent other kinds of noise (*e.g.* (sub)recent contamination).

A density analysis was executed in ArcGIS to find out whether there are distinct locations with a high density of late medieval archaeological objects. Several approaches were undertaken using Kernel Density Estimates and Point Density Analysis with different variables and the results are compared to limit biases (see: Baxter *et al.* 1997; Murrieta-Flores 2014; Ducke 2015). As a result, some spots in the Noordoostpolder were repeatedly highlighted at each of the different approaches. These locations are particularly important for the palaeogeographical reconstructions as they very likely represent medieval settlements, and, therefore, non-eroded land at the time of the settlement.

Table 2.1. Overview of most-used materials and their scientific importance.

Source Group	Data Type	Importance
Archaeological Investigation		
Medieval Settlement Database (MSD) Archaeological Depot Flevoland	Site & object databases	Primary sources
Shipwreck Database Flevoland (SDF) Van Popta & Van Holk 2018	Shipwrecks	Secondary source
Van der Heide 1958, 1965a; Van Popta 2017a	Archaeological studies	Secondary sources
Geological-Geomorphological Mapping		
Stiboka 1947-1956: Bodemkundige Code- en Profielenkaart	Soil cross-sections	Primary source
TNO Netherlands Geol. Survey: DINO-database (dd 2017)	Coring database	Primary source
Wiggers 1955	Map figures NO polder	Primary source
Pons & Wiggers 1959/1960; Pons *et al.* 1963; Ente *et al.* 1971; Ente 1973; Van Loon & Wiggers 1976; Ente *et al.* 1986; Gotjé 1993	Regional studies	Secondary sources
Archaeological Landscape map: Rensink *et al*. 2016; Buried Archaeological Landscapes map series: Cohen 2017	National studies	Secondary sources
Palaeogeographical Mapping		
Zagwijn 1986; Vos & De Vries 2013; Vos 2015; Kosian *et al.* 2016	National-scale maps	Secondary sources
Wiggers 1955; Gotjé 1993; Cohen *et al.* 2009; Ten Anscher 2012; Pierik *et al.* 2016	Regional scale maps	Secondary sources
Historic Cartography		
Northeastern Zuyder Zee (c. AD 1540)	Historical map	Primary source
Zuyder Zee by Christiaan Sgroten (c. AD 1570)	Historical map	Secondary source
Historic Texts		
Charter of Andreas, St. Odulphus Monastery (AD 1132; 13th cy copy)	Historical charter	Primary source
Cartulary, St. Odulphus Monastery (AD 1243, 1245; 15th cy copies)	Historical charter	Primary source
Pomponius Mela, *Chorographia* III, 24; Tacitus, *Annales* I, 60; Plinius Maior, *Naturalis historiae* IV, 101; Eichstätt, *Vita Bonifatii auctore Willibaldi* (AD 793); Otto I, *Monumenta Germaniae Historica* 324 (AD 966)	Classic texts, Vita, Historic charters	Secondary sources
Airborne topographical		
AHN 3	LiDAR elevation	Secondary source
Historische Luchtfoto's Flevoland	20th cy aerial photographs	Secondary source
Satellite Images Esri NL dd. 2017	21th cy satellite imagery	Secondary sources

The flipped strategy of letting archaeological evidence lead the reconstructions over former land surface areas is also functional when reconstructing since when areas were water. It uses scattered terrestrial archaeology around concentration centers (see above: the date of the settlement is a *terminus ante quem* (TAQ) of the time of erosion), as well as the maritime archaeology within lagoon floor deposits. The distribution of medieval shipwrecks (if reasonably intact) represent water courses or sea at the time they last sailed, although one should keep in mind that shipwrecks to a certain extent are movable. In the Noordoostpolder, both the terrestrial and the maritime datasets are considered sufficiently rich for executing the density analysis.

Correspondence of our reconstruction to extra-regional constraints is ensured by comparing the earlier geological and palaeogeographical reconstruction maps and by adopting insights based on (local) geo-

logical data, historical evidence (medieval charters; old maps), LIDAR-data and aerial photography.[6] Both last mentioned datasets contribute to the understanding of the research area, as changes of colour and altitude differences on these pictures often show traces of late medieval landscape elements, like dwelling mounds, dikes, ditches, palaeochannels and shipwrecks. In this step, restricting the study area to the Noordoostpolder's modern borders would be too limiting. The northeastern hinterland of the Zuyder Zee region, the Vecht-and-IJssel mouths, the southwestern part of medieval Urk and possible southeastern parts of Schokland do not fit within the borders of the polder. Hence, the coverage of the palaeogeographical reconstruction includes a fringe zone of relevant area adjacent to the Noordoostpolder.

To manage the various sources of information, and prepare them for use in the reconstructions, the various types of data and maps were imported in a Geographic Information System (GIS), *i.e.* a single digital spatial environment able to access and analyse the combined information. By techniques of overlaying, digitizing, analogue projection and cross-correlation, relevant information was added to the step-wise manually actualized reconstructions. The legend setup chosen for the map adheres to those in use by Vos (2015) and Kosian *et al.* (2016) and is an intuitive one, separating land from water, rivers from open sea, settlements from arable land, and dike-defended from undefended land.

Those parts of the Noordoostpolder area where archaeological find density is too thin to prime the land/sea scape reconstruction were assumed to be empty of former settlement concentrations, *i.e.* they show a negative archaeological evidence. In such locations, the reconstruction needs to fall back on sedimentary geological data to verify the archaeological conclusion and inform the reconstructions with positive evidence for the type of landscape. Was it water? Was it land away from the settlement, not intensely cultivated? Because the Noordoostpolder has an acclaimed and internationally recognized richness of combined terrestrial and maritime archaeology, it is a suitable location to pioneer this palaeogeographical reconstruction strategy. By including an aerial metric on what part is archaeologically (and historically) and what remaining part is geologically reconstructed it can be used to assess transferability of the flipped-strategy palaeo-landscape reconstructions in archaeologically dense dynamic land/sea areas in other parts of the world.

Assembling palaeogeographical maps

A straight forward way to visualize sequential landscape change over a given period in a given area, is by making a time series of reconstruction maps. In such a series, each map visualizes the reconstruction of the landscape at a selected moment in time and stage of development. In the Netherlands, making a so-called palaeogeographical map series to illustrate landscape development over prehistoric and historic time has become established practice (*e.g.* Pons *et al.* 1963; Zagwijn 1983; 1986; Ten Anscher 2012; Vos 2015; Pierik 2017: Ch. 2 and Synthesis; Pierik *et al.* 2017). Even though the views communicated in these maps come across as very realistic, also helped by their graphic styling and intuitive legends, one has to keep in mind that they are interpretative reconstructions of the data as grasped by the author and more certain in some areas than in others. In many cases, authors were forced to decide on drawing lines at arbitrary guessed positions. Land-water boundary lines, featured on such maps in data-control reality, in fact signal non-clarity zones between areas for which the evidence of 'land' or 'water' is more convincing (from the nature of sediments, for example).

The setup of palaeogeographical reconstructions involves choices of time steps and complexity and inclusiveness of legend (see also Pierik 2017). These choices are influenced by factors such as the series usage goal (research focus), the production scale (national, regional, local), the length of time to be covered by the series (Historic, Holocene, Pleistocene) and the quality and density of data (level of detail, uniform dense data cover, spotty cover, hardly data/just concepts, geological and/or botanical and/or archaeological and/or historical data based) of the maps (*e.g.* Berendsen *et al.* 2007; Vos 2015; Pierik *et al.* 2017). A national palaeogeographical map series can exemplify broad scale landscape developments, but cannot contain as much detail as a regional palaeogeographical map, not to mention a local map (see also Vos 2015). Local maps can be highly detailed, but also very much constructed for a particular purpose such as resolving landscape change at and around archaeological sites of specific age. The choice on which time stamps to give to a map series may differ greatly between a national map series and a local one of special purpose. Furthermore, geologists and geographers might prefer constant-size time steps for systematically examining changes to the landscape, while archaeologists and historians might prefer unequal time steps that echo cultural, social, economic and political periodization.

The map series design in this research, is one on a regional scale. It resolves developments in the northeastern Zuyder Zee region over the period 1100–1400 AD, and herein connects to the already existing national and superregional maps for AD 800, 1500 and 1575 (Vos & De Vries 2013; Vos 2015; Vos *et al.* 2015; Kosian *et al.* 2016).[7] The idea is that two new map reconstructions, *i.e.* for AD 1100 and AD 1400, can bridge the gap that exists in the present national series, for the study

area at least. The new reconstructions are flanked by two other regional maps: before (AD 900) and after (AD 1600) the development of the Zuyder Zee. For the Noordoostpolder area, a reconstruction can be made of (1) the region when it was densely inhabited and (2) the region after all remaining islands and rim of the Zuyder Zee were protected with dikes, therefore limiting the marine influence. In earlier palaeogeographical studies of the Netherlands at large and the Noordoostpolder region in particular, the research period of AD 1100–1400 in the map series is skipped (*i.e.* one jumps from well before 1100 AD to after 1400 AD).[8] The focus period is considered a difficult time period to capture in a national map (see also Vos 2015), on the one hand because of the dynamics of storm-surge land loss in many parts of the coastal plain, and on the other hand because of the considerable uncertainty on ages of man-made embankments (dikes) that were being upgraded from locally to regionally managed features. These two factors apply in particular to the medieval cultivated peatland areas (De Bont 2008; Vos 2015; Pierik *et al.* 2017). Much of the original medieval cultivated peat landscapes in late medieval times has disappeared due to punctuated storm surge catastrophes, progressive lagoon rim calving and human interferences such as draining (ditch cutting) and ploughing.

One might argue against the task set in this paper, and consider it inappropriate to create a palaeogeographical reconstruction of a past landscape from which very limited traces remain (or attack the semantics and make a plea for calling the maps *palaeoscenarios* rather than actual reconstructions). One might also argue that it would be better to pick just earlier and later time slices for which data would be more abundant (*e.g.* AD 1000 and AD 1500). However, forcing oneself to visualize maps for precisely the moments with data difficulties is needed as a form of analysis of landscape changes over those periods. The counter argument thus is, that visualizations of time periods that were highly dynamic due to erosion, are the most needed ones. The problems of too little data are made smaller by focusing on a smaller region and by being more interdisciplinary in the sources of data and reasoning considered. Admittedly, reconstruction maps produced for now-gone areas of late medieval landscape, will bear more built-in uncertainty and projection-of-ideas, than reconstructions for preserved buried landscapes of otherwise comparable data quality.

One might also argue about the types and sources of data and reasoning that one should include when drawing the map series. The palaeogeographical maps of *e.g.* Zagwijn (1986) and Vos (2015) for the time frames up to AD 800 are almost solely based on geological data. Zagwijn states (1986: 33) that his map series are reconstructions based on sedimentary geological observations, ^{14}C dates and palynological data and some expert judgment. The expert judgment is especially used in situations where the first three provide insufficient direct evidence. Using just sediments, ^{14}C and palynology stops to work in late medieval drained-away and lost-to-the-sea peat land areas, because too little positive geological evidence remains. At the same time, we enter the time domain with written historical coverage and dense archaeological residue. The latter is the spatially distributed evidence for past human activities in former landscape situations, which can be spatially analysed and expert-judged in similar ways as geological data and complement the reconstructions. If one reconstructs such landscapes independently from sedimentary archives alone, the other types of data would falsify the spatial reconstructions quickly, and it is much better to inform the reconstruction with archaeological and historical insights. This also holds true for the late medieval Noordoostpolder landscape, for which positive sedimentary geological record is scarce and what record exists is related to archaeological finds. To carry out reconstructive mapping for the period AD 1000–1500 (*i.e.* our timestamps AD 1100 and AD 1400), the balance between geological, archaeological and historical information was such, that the order in which the data from the various disciplines were used to inform the reconstruction slightly differed from those of older reconstructions. In other words, compared to maps for earlier time periods, one is forced to flip the order in which data is considered.

Results

Setting

As a starting point for medieval to modern landscape change of the Noordoostpolder, the Pleistocene and Holocene geomorphological elements of landscapes fringing the Zuyder Zee are characterized first (Fig. 2.3). The shores around the Zuyder Zee were of rather diverse Pleistocene and Holocene geology, geomorphology and pedology (see: Pons and Wiggers 1959/1960; Van der Heide 1951; 1974; Berendsen 1997; Westerhoff *et al.* 2003a; Koomen & Maas 2004; Peeters 2007; Cohen *et al.* 2009; Ten Anscher 2012; Vos 2015; Rensink *et al.* 2016; Cohen 2017; Van den Biggelaar 2017; Van Zijverden 2017).

The landforms along the shores range from stretches of cliffs in boulder clay (glacial till-sheet erosive remnants), outwash sands and ice-pushed ridges from the penultimate glaciation (Gaasterland, Steenwijk, Vollenhove, Urk, Muiderberg), to wind-blown coversand ridges of the last glacial (Harderwijk, Nunspeet, Elburg), to indents of small river valleys draining the central, eastern and northeastern Netherlands (Eem,

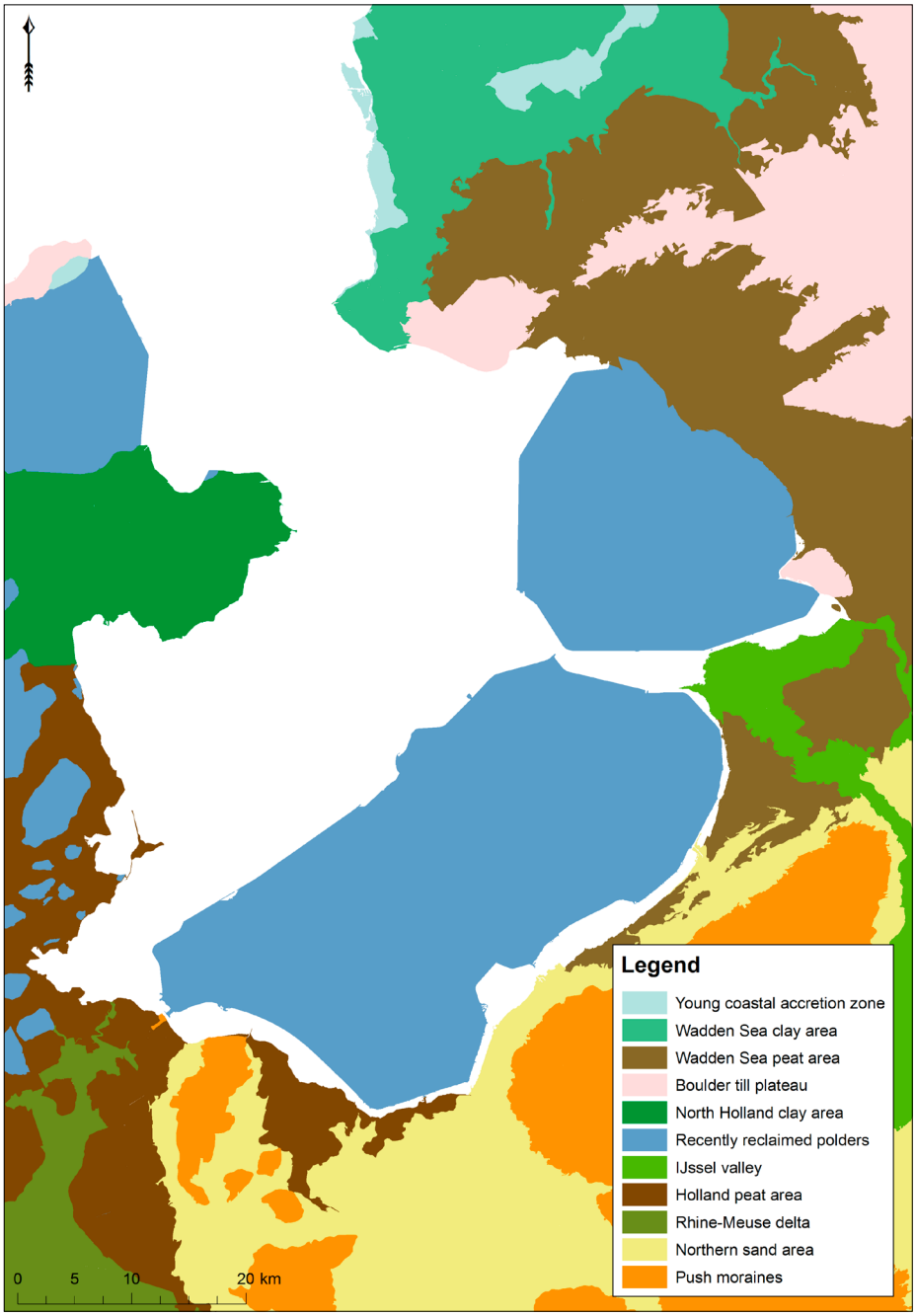


Figure 2.3. Archaeological Landscape Map of the Netherlands, clearly depicting the old land (Wadden Sea peat area) and new land (recently reclaimed polders) in the northeastern Zuyder Zee Region (after Rensink et al. 2016).

Hierdense stream, Overijsselse Vecht, Reest, Linde, Kuinder, Tjonger). Furthermore, the early modern coast included Holocene peatland fringes, cliffs in deposits of former tidal systems (in the northwest of the Zuyder Zee in particular), and mouths of young northward avulsed branches of the river Rhine (Utrechtse Vecht, Gelderse IJssel) building out small deltas (Fig. 2.4).

The latter areas are low-lying and have compaction-prone substrates. Since medieval times they were defended by raising dikes. The variation in lithological and topographical expression between all these features resulted into considerable differences in erodibility, and hence strong spatial influence on the expansive development of the Zuyder Zee.

Pleistocene landforms

During the Pleistocene, Northwestern Europe went through several glacials and interglacials causing major changes in the landscape of the Netherlands. The topography was altered considerably and rivers were able to dissect the landscape with valleys in new positions (see: Zagwijn 1983; Cleveringa *et al.* 2000; Westerhoff *et al.* 2003a; Peeters *et al.* 2016). In the penultimate glacial (c. 150,000 years ago; in the last part of the Saalian), the southwestern front of the Scandinavian Ice Sheet overran the northern half of the Netherlands, including the Noordoostpolder. This transformed the subsoil into push and ground moraines and left glaciogenic aligned ridges and lows dissected by meltwater valleys (Wiggers

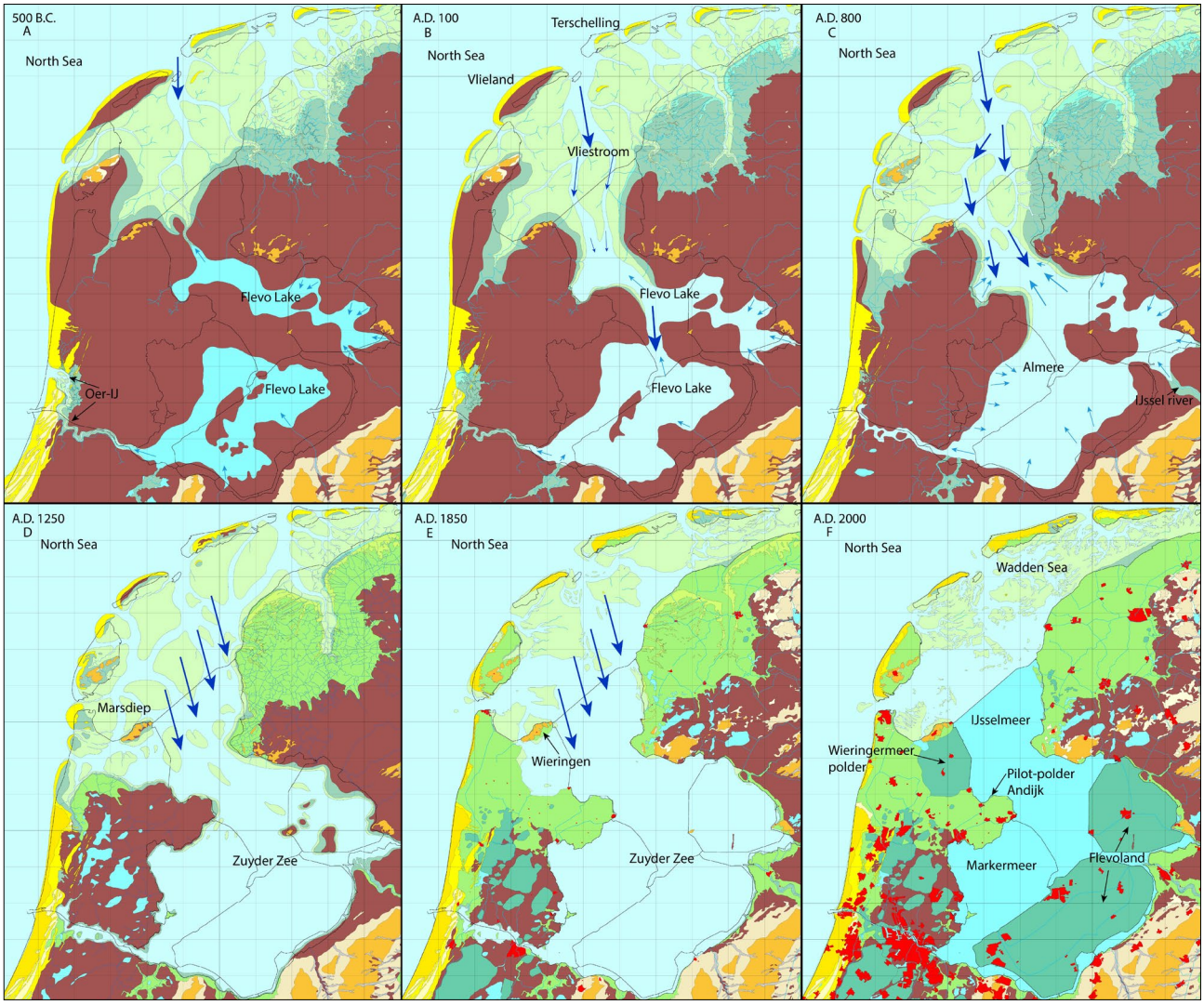


Figure 2.4. Palaeogeographical development of the Zuyder Zee Region between 500 BC and AD 2000 (after Vos & De Vries 2013; Vos et al. 2020).

1955: 19; Ter Wee 1962; Kluiving *et al.* 1991; Gotjé 1993: 15; Busschers *et al.* 2008). After the land ice melted large amounts of erratic boulders and stiff layers of clayey till (boulder clay, *keileem*) were left behind (*e.g.* at Urk and Vollenhove; Bosch *et al.* 2000: 139). Over most of the Noordoostpolder, Saalian deposits occur in buried position (Peeters *et al.* 2016). However, at some key locations outcrops of glacial till have determined the geomorphology of the area until today. An example is the settlement of Urk in the southwestern part of the polder which has been situated on an elevated till relic since early medieval times, and also the settlement of Vollenhove southeast of the polder has been found on such an outcrop. When the Noordoostpolder was pumped dry, the surroundings of such former islands and capes featured Zuyder Zee abrasion platforms into the till, with large boulders on top. The boulder fields on historical maps of the Zuyder Zee are shown as *Steenbank* or *Rif* (stone bank or reef) (Ente *et al.* 1971; Ente *et al.* 1986). Further shallow boulder clay relics in the Noordoostpolder are found near the former island of Schokland and near the settlement Tollebeek (Van Hezel & Pol 2008: 29).

During the Pleistocene's last interglacial, the Eemian (c. 125,000–115,000 years ago), the central Netherlands were inundated by a marine embayment connected to the North Sea (Zagwijn 1983; Peeters *et al.* 2016). The area covered by the inland sea was comparable to that of the Zuyder Zee. At the time, the sea level was a few meters above present but because of long term subsidence Eemian shore line deposits can be found more than 8 m below the present surface. This also means that the till-relic abrasion platforms mentioned above, which occur at depths 1-3 m below present are to be seen as Zuyder Zee erosional features at 1-3 meter water depth, not as old inherited landforms.

During the Pleistocene's final glacial, the Weichselian (c. 115,000 years ago–9700 BC), the Netherlands were

not covered by land ice. Nevertheless, phases of mildly cooler to severely colder climate (relative to present) alternated repeatedly (*e.g.* Zagwijn 1989; Bohncke 1993; Hoek 2000). Due to the growth of land ice at higher latitude locations in the world, global sea level sank to depths up to 130 meters lower than present. This made the North Sea coastline shift several hundreds of kilometers to the northwest. In the coldest phases of the last glacial, the terrestrial landscape of the Zuyder Zee was that of a tundra and/or polar desert, that is an open landscape dominated by a limited and low vegetation cover, with a strongly developed permafrost in the subsoil. In the relative warmer phases the landscape was characterized by open parkland dominated by pine trees and birches (Menke *et al.* 1998: 26). The frozen and barren conditions allowed large amounts of sand to be mobilized by the wind. Admixed with snow these shifted sands were redeposited as so-called coversand deposits, resulting in a series of low sand dunes over a partly deflated, partly buried substrate (Van der Hammen 1951; Kasse 2002; Schokker *et al.* 2007).[9] Meanwhile, smaller melt water rivers like the Linde and Kuinder (fed from the till plateau to the northeast), and the larger rivers Vecht (its catchment reaching east into Münsterland; Van Huissteden *et al.* 1986; Huissink 2000) and in the beginning of the glacial even the Rhine (its course using the IJssel basin was abandoned half way the Weichselian; Busschers *et al.* 2007; Peeters *et al.* 2017), worked their ways through the open low lands of the study area. Snow melt over a frozen subsoil fed these rivers, for which in spring they carried much larger discharges than these systems do nowadays, leaving relatively wide valleys (Van Huissteden *et al.* 1986; Busschers *et al.* 2007). In and along these valleys, mosaic landscapes were created with braid bar topography, residual channels and locally inland eolian dunes (*e.g.* Bosscher *et al.* 1973; Cohen *et al.* 2014; Peeters *et al.* 2015).

The last severe cold phase peaked around 20,000 BC and major cover sand displacement, river bed widening and aggradation characterized the period following it (Late Pleniglacial, until 12,500 BC). Temperature rise characterized the Late Glacial (12,500–9,700 BC), was interrupted by the Younger Dryas cold spell towards the end, then recontinued with the beginning of the Holocene (9,700 BC). The climate warming triggered active-bed contraction and terrace formation in the river and brook valleys, and locally allowed for eolian dunes to form along the terraced river banks.

Early and Middle Holocene landscape development

Continuous global climatic amelioration and melting land ice resulted in rise of the sea level. By 7–6,000 BC, a few millennia into the Holocene, this sea-level rise began to affect the western and central Netherlands directly (Gotjé 1993: 109; Menke *et al.* 1998: 33; Westerhoff *et al.* 2003a: 219a; Koster *et al.* 2017: 8; De Haas *et al.* 2017). Up to that time, peat formation had been a local phenomenon, limited to depressions in the Pleistocene landscape (Westerhoff *et al.* 2003a: 221; Vos *et al.* 2015: 306). Once groundwater levels became affected by the approaching and rising sea level nearby, swampy and marshy conditions expanded considerably and as a result the peat overgrown areas grew in extent. Most of the Noordoostpolder and surrounding parts of Flevoland became peat covered (Wiggers 1955: 49; Ente *et al.* 1986: 46; Gotjé 1993: 18; Menke *et al.* 1998: 36; Westerhoff *et al.* 2003a: 227; Vos & De Vries 2013; Vos 2015; Ten Anscher 2012: 499; Koster *et al.* 2017).

At approximately 4000 BC, the Noordoostpolder landscape consisted mainly of open peat fens and some forestation on isolated outcropping river dune and till plateau remnants (Ten Anscher 2012: 513). To the west, a Wadden Sea like environment existed connected to the North Sea by tidal inlets, the largest one debouching at Bergen. This originally transgressive system silted up slowly, making that tidal flats became supratidal salt marshes, while the tidal channels connecting to the inlets dropped in numbers and became smaller (Lenselink & Koopstra 1994; Vos 2015; Van Zijverden 2017: 36, 38).[10] In this situation, the Noordoostpolder peat fens could expand westwards again. The Vecht river was a conduit of fresh water through these peatlands (Gotjé 1993: 109; Ten Anscher 2012: 500). Originally, the peat and its crossing river drained towards the Bergen tidal system to the west.

Under conditions of modest sea level rise after 2750 BC, the tidal basin serviced by the inlet of Bergen siltened up further while that inlet shrunk in size (Vos 2015: 322). After approximately 2100 BC, tidal basin sedimentation no longer reached into the Noordoostpolder region, but it continued in areas to the west of it (De Mulder & Bosch 1982: 146; Vos 2008: 83; Borger & Kluiving 2017: 42; Van Zijverden 2017: 37). Continued saltmarsh mud deposition in the west, raising that terrain to supratidal levels, changed the hydrological situation of the peat lands of the Noordoostpolder. Drainage was now worse due to the retention of water in the peatlands, and poor vertical infiltration into clayish subsoil and reduced drainage opportunities to tidally silted-up downstream areas. This explains the establishment of peat-lakes in the Noordoostpolder and areas to the south (Roep & Van Regteren Altena 1988: 219; Menke *et al.* 1998: 45; Vos & De Vries 2013: 52; Vos 2015: 323; Van Zijverden 2017: 38).[11] It would take until approximately 1100 BC before the Bergen inlet fully closed and peat started to cover the tidal sediments in the Noordoostpolder

region (Gotjé 1993: 149; Westerhoff *et al.* 2003a: 227; Ten Anscher 2012: 524; Vos *et al.* 2013: 52; Van Zijverden 2017: 40). The accumulation of water in the northern basin was then discharged via an early connection with the Wadden Sea named Vlie or Vliestroom.[12] The size of the basins increased over time due to erosion of the surrounding peat, caused by a combination of high winds and wave action.

The peat, river and lake development in the Noordoostpolder, *i.e.* the northeastern peatland of the later Zuyder Zee, ran parallel to that in areas to the south, with subtle differences in outcome. Initial stages of marine transgression and peat formation up to c. 4000 BC were similar for the southern and northern Zuyder Zee area. Thereafter, when major silting up of the tidal area began, the Holland beach barrier complex matured, the number of tidal inlets reduced and the northern peatland linked up with the Bergen inlet system, the southern peatlands linked up with the Oer-IJ system (*e.g.* Kok 2008; Vos *et al.* 2015; Pierik *et al.* 2017). Around 400 BC, that southerly Oer-IJ inlet began to close, a development thought to be driven by a fall back of discharge routed to it, besides beach ridge sedimentation processes at the coast line itself (Vos *et al.* 2015; De Haas *et al.* 2017). For some time, Rhine river water had fed the Oer-IJ system through the Angstel-Vecht branch (Bos 2010: 56).[13] When the Rhine discharge carried by this branch reduced (as naturally happens in a deltaic distributary system: discharge partitioning over branches is not constant), the Oer-IJ inlet no longer kept itself open (Vos *et al.* 2015: 311; Van Zijverden 2017: 39). Closure of the Oer-IJ inlet meant strongly reduced discharge opportunities for the southern peat area and the lakes that existed in it (ibid.) and consequentially the southern lakes started to leak water towards the north, into the northern area that connected to the Noordoostpolder peat lands and lakes. This new established connection can be regarded as a breach of the peat land barrier that had separated the northern and southern drainage systems of the Zuyder Zee area (compare Fig. 2.4a and 2.4b; Westerhoff 2003a: 232; Vos 2015: 323; Vos *et al.* 2015: 311; Van Zijverden 2017: 39).

Late Holocene landscape development

The lake waters drained using the Vlie tidal channel in the Western Wadden Sea. This situation of south-to-north peat land drainage occurred in the last century BC (Ente *et al.* 1986: 61; Westerhoff 2003a: 232; Kok 2008: 91; Vos *et al.* 2015: 311; Zijverden 2017: 39). From that time onwards, the Vlie tidal inlet could enlarge itself, as it had more peat rivers and a larger inland area it received discharge from, and because during storm surges it could flood their lower reaches and calve off their banks off ('ingression'; Pierik *et al.* 2017), gradually enlarging the inland tidal basin, in turn allowing the inlet to widen some more (Vos 2015).

At this moment, coincident with beginning Roman occupation of the Low Countries, features of the research area are first mentioned in written sources, albeit without any reference to a particular genesis (Gerrets 2010: 31; Borger & Kluiving 2017). It was Pomponius Mela who mentioned in AD 44 *Lacus Flevo* (Lake or lakes Flevo) in his text. Tacitus also mentioned a lake in AD 15, and Plinius Maior used the name *Flevum* in AD 77.[14] This 'Lake Flevo' likely represented not just a single largest lake in the Zuyder Zee basin, but refers to an assemblage of lakes in the area of the later Zuyder Zee: those in the southern and most probably also those in the northern part of it, and including the Noordoostpolder study area. It signals that larger open water areas from that moment in time onwards were and are to be considered a constant factor in the natural landscape (Pierik *et al.* 2017; Borger & Kluiving 2017: 40). Where we use the term Flevo Lake in the rest of this text, it is meant to refer to the interconnected open waters of the region in the first centuries AD.

From the Roman Period onwards, the North Sea gained influence on the back-barrier coastal plain — using the Vlie tidal inlet at storm surges to flood, bury and erode peatland more often and more widespread than before, especially in the northern part of the lagoon (Ente *et al.* 1986: 130; Westerhoff *et al.* 2003a: 232; Vos 2015: 324; Pierik *et al.* 2017). Where the large fresh water basins in Roman texts were referred to as Flevo Lake(s), in early medieval texts the name is Almere which means 'all lake(s)'.[15] Furthermore, from the 7th century onwards the IJssel river became a Rhine branch of importance, routing more fresh water (and clay) into the Noordoostpolder-area than the Vecht river alone had done before (see: Makaske *et al.* 2008; Cohen *et al.* 2009; 2012; 2016; Van Beek 2009; Groothedde 2010). Interference by humans in the natural landscape turns out to have been the most important factor for new marine sedimentation (Vos 2015: 324; Pierik *et al.* 2017: 15). Large peat reclamations in the Frisia, Holland, Utrecht and Overijssel areas from the 10th century onwards caused oxidation and soil compaction, resulting in a considerable time lagged land subsidence and eventually erosion of the peat, resulting in even larger fresh water basins and a more vulnerable coastal defense (Fig. 2.4c). In the 11th and 12th centuries, massive floods[16] widened the Vliestroom and removed the final peat barrier that connected Frisia and North-Holland and separated the Almere from the North Sea, resulting in the genesis of the Marsdiep: a direct connection between the North Sea and the Almere (Fig. 2.4d; Pierik *et al.* 2017: 10). In some places this left an overburden of storm deposits over fringing peat lands, but over large

areas within the Noordoostpolder this caused major erosion of peat land leaving lagoon floor deposits, and both types of deposits contain medieval archaeological objects (Wiggers 1955: 175; Van den Biggelaar 2014: 177), especially from the 12th to 14th century. The more or less simultaneous large scale peat reclamations and damage to the landscape caused by storm floods illustrate a clear reciprocity between large scale human interference with the landscape and increased effects of marine activity (Van Bavel 2010: 45). In the 12th century AD, use of the name *Almaere* was succeeded by that of the Zuyder Zee,[17] referring to an accumulation of water with the characteristics of a sea. The water of the Zuyder Zee became brackish in the northern and western part, but remained fresh in the eastern and southern region for some centuries (Hogestijn 1992: 107-109). To some, calling the Zuyder Zee a sea can create terminological confusion and misunderstanding, as in coastal geological terms, it could be called a tidal lagoon (connected to the open sea via narrow connections between the Wadden Isles, that configuration preventing full mixing of marine and lagoon waters) or an ingression lagoon (significantly widening the inlet, enlarging the lagoon water body so much that it would buff the tidal currents).

The size of the land surface, in the Zuyder Zee basin, consisting of peat island areas and peat lagoon fringe areas, kept on decreasing with the passage of time due to floods, storms and dehydration. As a reaction and way of protection, dikes were built all along the shores of the Zuyder Zee from the 12th centuries onwards. The oldest ones are estimated to have been constructed in the 12th, 13th (both local) and 14th (regional) century (De Langen 1992: 30-37; Hogestijn 1992: 110; Hogestijn *et al.* 1994: 93; Gerrets 2010: 37; Van den Biggelaar 2014: 178; Bartels 2016b: 212). Habitation became limited to the relative safety of the boulder clay at Urk, along the east coast of the Schokland-area and along the north-eastern Zuyder Zee coast in the vicinity of Kuinre. The inhabitants of the Schokland-area were forced to leave their small terps in the 14th century, and to live on four major new terps (Emmeloord, Middelbuurt, Zuiderbuurt and Zuidpunt) until the abandonment of Schokland in 1859.[18]

The Zuyder Zee reached a more or less stable size at approximately AD 1600 as is proven by comparing historical maps from that moment onwards. However, this stability of the landscape is very relative as can be proven with the land decrease of the island of Schokland in the second half of the 18th century: its size was reduced to half of that at approximately 1600 AD (also compare Fig. 2.4d and 2.4e; Geurts 1991: 29; Van Hezel & Pol 2008: 88; Van den Biggelaar 2014: 177; Van Popta & Aalbersberg 2016: 129).

Density patterns in the archaeological data

The density maps depict seven areas with a high density of archaeological material (Fig. 2.5; A-G). The areas A and B are well known: they represent the still existing settlement Kuinre and the former island of Urk. Kuinre is nowadays a small and quiet town, but it played a remarkably important but hardly known role in Dutch history. The remnants of three castles, a sconce (fortification), the highest concentration of shipwrecks in the Zuyder Zee and several written sources testify to this past importance.[19] The concentration of late medieval archaeological material on the island of Urk is not very high when compared to the other concentrations. The standing hypothesis for this difference is the assumption that the late medieval (say 11th and 12th century) predecessor of the settlement Urk was positioned over 1 kilometer to the west of the current location of the town, an area that in the meantime has been washed away by the Zuyder Zee and whose remnants are submerged nowadays (Vreugdenhil 1999; Geurts 2005).

Concentration C corresponds closely to the contours of the later island Schokland. It is important to keep in mind that the toponym of 'Schokland' is post-medieval: it started circulating in the first half of the 17th century after the area had become isolated within the expanding Zuyder Zee (Van Vliet 1992: 6; Van Hezel & Pol 2008: 71). In our text we will use the term 'Schokland area' for 2200-3000 ha of middle and high density Medieval archaeological finds, whereas we use 'Schokland island' to indicate the much smaller c. 115 ha that were left in Early Modern times after the Zuyder Zee erosion processes.

Many finds indicate the Schokland area to have been inhabited since before AD 1100 (Hogestijn 1992: 106; Hogestijn *et al.* 1994: 93; Van Hezel & Pol 2008: 41). The inhabitants started living on small artificial mounds (*terps*) on a clay layer that was deposited in the area before AD 1100, and protected themselves against the water by small dikes in between and around the terps (Van Popta & Aalbersberg 2016: 130, 134). The terps and dikes, both dating to the 12th and 13th century based on the analysis of pottery, left clear traces in the peaty soil (*e.g.* depressions filled with clay and archaeological objects) and although they submerged and eroded after AD 1300, the lowest parts and depressions were preserved far beyond the existence of the Schokland area (see: Hogestijn 1992: 109; Hogestijn *et al.* 1994: 93). After the reclamation of the Noordoostpolder and the cultivation of the new land, the traces of late medieval habitation were uncovered: the locations (shown by colour differences) of approximately 130 terps, ditches and dikes were spotted on aerial photographs of the Royal Air Force that were made during the Second World War.[20] Many of the terp sites close to the east coast of

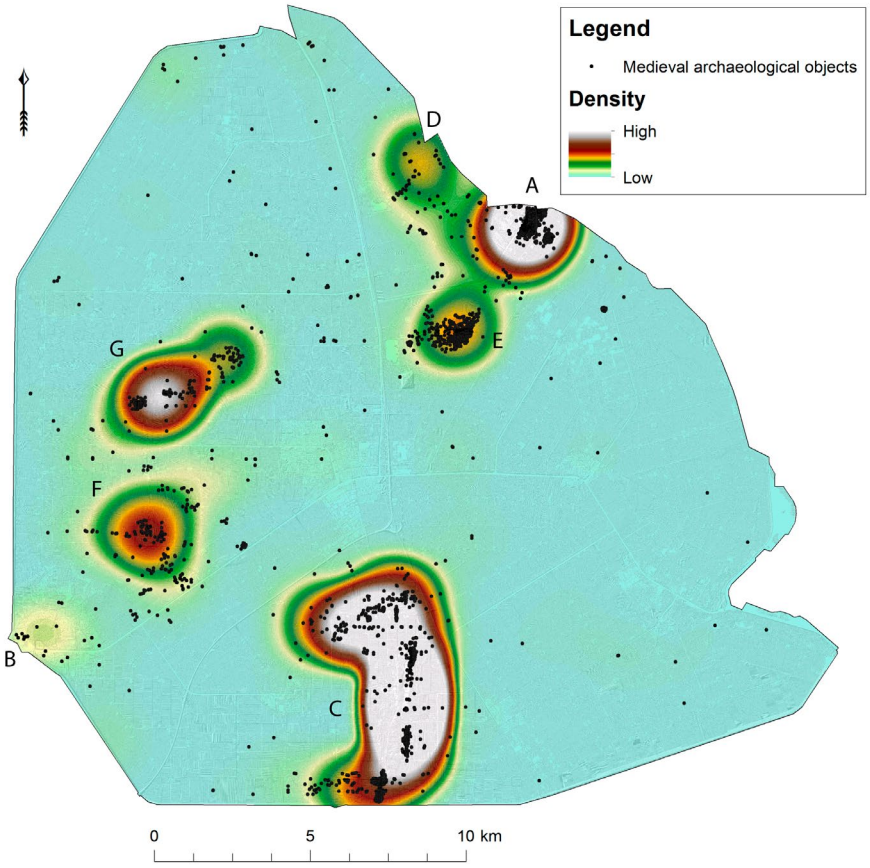


Figure 2.5. Density map of medieval archaeological objects that were found in the Noordoostpolder. A = Kuinre, B = Urk, C = Schokland, D – G = drowned settlements.

the later island Schokland were examined in the years after, but in most cases only a scatter of archaeological material was found; no recognizable remains of houses or their foundations were identified (Van der Heide 1958: 168). It was possible, however, to assess the habitation history of the Schokland terp swarm. The terps in onset appear to date from the 12th century, with no prior occupation. The small terps were constructed of clay sods[21]. The first dikes were constructed in the same period as a way of protection against heavy storms and floods of the Zuyder Zee (Geurts 1991: 15; Hogestijn 1992: 110; Van Hezel & Pol 2008: 44; Van Popta & Aalbersberg 2016: 130). Many of the dikes are positioned behind other ones, in general dating to the same period and with the same orientation, indicating rapid land erosion and minimal protective output (Fig. 2.6; Van Popta & Aalbersberg 2016: 130). At the end of the 14th century, four large terps (now known as Emmeloord, Middelbuurt, Zuiderbuurt and Zuidpunt) were built on the relative sheltered eastern part of the Schokland-area. This seems to have been a response to declined habitability of the small terps, under increased threat and occurrence of floodings during storms. The northern part of the island became known as *Emelwerth.* The large terps have withstood weather and time and can currently still be visited.[22]

The other concentrations on the map (D-G) represent high density scatters of late medieval archaeological material only. There are no traces of terps, houses or dikes preserved here. Concentration D appears to overlap with that of the lost settlement *Fenehuysen* as depicted on several 16th century maps and mentioned in historical sources. Concentration E lies in close vicinity of Kuinre and contains many late medieval pottery shards and animal bones. In a number of recent studies, such finds have been interpreted as 'noise' or 'waste from ships' without much argumentation (*e.g.* Teekens & Spoelstra 2009: 29). Given the predominantly late medieval age (c. 1100–1400 AD) of the pottery and bones, their composition and concentration, and considering the contemporary extent of the Zuyder Zee, this being ship-waste would be a-typical and unlikely. The amount of material found also exceeds that of 'noise'. This means that the area of concentration E should receive future research attention in relation to the Kuinre town and harbor locality[23]. The concentrations F and G represent two more isolated locations in between the mainland in the northeast and the island Urk, where great amounts of pottery shards (dating from the 12th century until the 14th century), animal bones, bricks and tuff stone have been found. The composition of the find assemblages and the sheer amount of archaeological finds in each

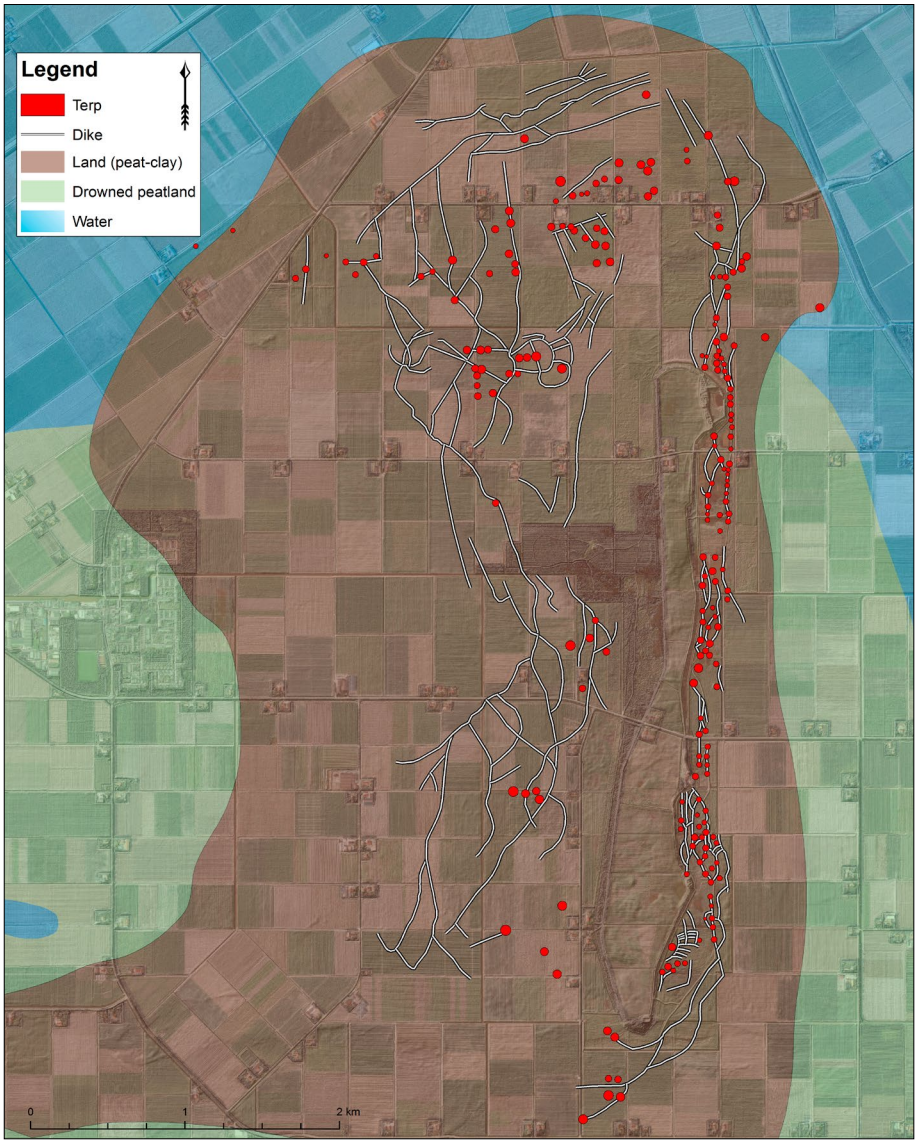


Figure 2.6. Detailed archaeological landscape map of late medieval Schokland, framing the dozens of small dwelling mounds (terps) and dikes.

of the clusters alone already is strong indication that locations A-G represent medieval settlements that were calved and drowned by the Zuyder Zee. It is important to find out whether there is historical evidence that might strengthen the archaeological assumptions.

Historical settlement information

Several historical sources deliver evidence that the peatlands in the northeastern part of the Zuyder Zee region were cultivated during the Middle Ages (see: Table 2.1). The process of peat reclamation, exploitation and inhabitation of the region started approximately in the 10th and 11th century (Van Bavel 2010: 38; Buhlman 2012: 5). This is proven by a historical document from AD 966 in which emperor Otto I donates land to the new established St.-Pantaleon monastery of Cologne (Vreugdenhil 1999: 15-17; Geurts 2005: 32; Henstra 2010b: 136). The land is described as half of the island Urk and all in between the far side of the river *Nakala* up to *Vunninga*, including meadows, fishing grounds, all waters, roads, movable and immovable properties.[24] Although the record does not contain names of settlements ('Urk' refers in this document to the island, not the settlement), the tenor of the text proves the presence of humans in the northeastern Zuyder Zee region.

Several historical documents from the abbey of St. Odulphus near Stavoren (Province of Friesland) provide valuable information on the presence of medieval settlements in the research area. The oldest surviving document (A) from the abbey's archive dates back to the middle of the 13th century and is a copy of its foundation charter (Charter of Andreas from AD 1132) on parchment (Mol & Van Vliet 1998: 93). Two other copies of the Charter of Andreas (B and C) date from a 15th century cartulary that also belonged to the abbey. The charter contains a list of chapels and goods that belonged to the abbey, and it is this list that provides insights on the habitation of the northeastern Zuyder Zee region. A total of 25 chapels are mentioned on the oldest document (A), of which the last three chap-

els are probably not from the original charter (Mol & Van Vliet 1998: 102; Mol 2011: 65). The list contains not only locatable settlements like *Kunre* (Kuinre), Urk (settlement) and *Emelwerth* (Emmeloord), but also the names of several settlements of which the locations are unknown like *Ruthne* and *Marcnesse*. The 15th century cartulary copies of the foundation charter contain an extra name of a settlement that might be related to the research area: *Nagele* (location unknown). Two copies of other charters from the cartulary, dating back to AD 1243 and 1245, contain even more names of chapels and properties of the abbey, of which the settlement names *Fenehuysen* and *Kunresijl* are the most interesting for this research.

When studying the lists of chapels in the different charters it becomes clear that the list order in general matches a (clockwise) geographical order, although there are some differences between the various lists (Fig. 2.7). The route starts with the chapels that lie close to the east of the St. Odulphus-abbey: *Laxnum* (Laaksum), *Wardelse* (Warns) and *Karnewald*. The route then heads north and northeast, via *Hindelepum* (Hindelopen), *Gersmere* (Gaastmeer), *Heslum* (Hieslum), *Santforde* (Sandfirden), *Eddeghe* (Idzega), *Aldekerke* (Oudega), *Hagekerke* (Heeg), *Ipekeldekerke* (Ypecolsga) and *Wicle* (Wijckel). It continues to the most southern tip of Frisia and across the border to the Province of Overijssel: *Osterse* (Oosterzee), *Acthne* (Echten), *Scherpensele* (Scherpenzeel), *Kunre* (Kuinre), *Ruthne* and *Sillehem* (IJsselham). Before the route continuous to the island Urk and *Emelwerth* (Emmeloord), the names of *Marcnesse* and *Nagele* are mentioned, implying that they are positioned somewhere between *Sillehem*, *Emelwerth* and Urk. The route ends across the Zuyder Zee on the Frisian coast via *Midlinge* (Mirns) and *Harch* (Harich). The chapels of *Fenehuysen* (*Fenehuysen*) and *Kunresijl* are added to the list of AD 1243 and their names are positioned in between *Sillehem* and *Marcnesse*.

Based on the geographic order of the charter lists, a selection can be made of chapel names that were (probably) positioned within the research area. Therefore, focus should be on the sequence from Kuinre to Emmeloord, including the names *Ruthne*, *Fenehuysen*, *Kunresijl*, *Marcnesse*, *Nagele* and Urk.

There is no discussion about the location of the settlements Kuinre and Urk, as they still exist. The same is true for *Emelwerth*, although the settlement was abandoned in 1859 and only the remains are preserved (Van Hezel & Pol 2008: 199). The name of *Ruthne* is often associated with one of the drowned medieval settlements in the northeastern Zuyder Zee region, even relative precise described as 'laying on an island,

Figure 2.7. Geographical representation of the list of chapels from the st. Odulphus monastery of Stavoren.

north of Urk'.[25] However, when looking at the order of chapels on the charter lists it would seem very unlikely that the chapel of *Ruthne* was positioned somewhere in the northeastern Zuyder Zee region: the name of the chapel is mentioned in between Kuinre and *Sillehem*, pointing more likely in a northeastern direction, rather than towards the southwest. This is proven by a study of Mol (2011), in which he states that the name *Ruthne* is a medieval variation of the name Rottum (Moerman 1956: 91; Gildemacher 2001: 162; Mol 2011: 66). Rottum is a settlement that lies approximately 20 kilometers to the northeast of Kuinre and could only be reached by traveling from Kuinre upstream on the Tjonger river (*ibidem*). It means that the interpretation of the settlement *Ruthne* as drowned somewhere in the northeastern Zuyder Zee region is incorrect; the settlement still exists under the currently used name Rottum.[26]

Following the imaginary route of chapels on the charter lists, one would reach *Marcnesse* and *Nagele* in between visiting *Sillehem* and Urk. It does not mean that both settlements were obviously located in the northeastern Zuyder Zee region, but there are several arguments that help explain why both names are to be associated to this area. First of all, when examining the chapel list from the confirmation charter of Otto III (AD 1243), two new settlement names are added in between *Sillehem* and *Marcnesse*, namely *Fenehuysen* and *Kunresijl*. The exact location of late medieval *Fenehuysen* is unknown, but the location of the settlement is visible on a 16th century map (written as *Veenhuijsen*), slightly to the northwest of Kuinre. It is plausible that the settlement shifted through the landscape due to land subsidence, rewetting, collapse or erosion of the peatlands: a common late medieval phenomenon in the Dutch peatlands (Edelman 1974; De Bont 2008; Vos *et al.* 2015). Settlements like Staphorst, Rouveen and Elburg and the Kuinder castle sites shifted through the landscape, threatened by the water or looking for more space and new unexploited lands (De Boer & Geurts 2002; Gottschalk 1971; Spek *et al.* 1996; Rutte 2003). It means that the location of 16th century *Veenhuijsen* is not necessarily the same as the 13th century *Fenehuysen*. Even in that case, it is still very likely that the younger settlement was in the vicinity of the older.[27] The other new added settlement, *Kunresijl*, should be sought in the vicinity of Kuinre, close to the Tjonger or Linde river, as the name of the settlement means: "sluice or lock of Kuinre".

Following the geographic route of the chapel lists, it means that *Marcnesse* and *Nagele* are positioned beyond *Fenehuysen* and *Kunresijl* and towards Urk, leading right into the northeastern Zuyder Zee region. Secondly, the toponym *Nagel*(*e*) has been used beyond the existence of the settlement, directing to an area to the east of the island Urk (Wiggers 1955: 180; Geurts 2005: 29, 33; Van Hezel & Pol 2008: 46; Pol 2015: 42). Finally, there are also post medieval records of fishermen complaining about their nets getting torn apart while fishing in the vicinity of Urk, even finding grave stones, bricks and other remains of a drowned settlement in their nets (Franke 1932: 6-8). One final striking thing about the charter lists is the fact that Urk is mentioned before *Emelwerth* (except for the copies from AD 1245), while it would seem more logic to mention them the other way around (to close the geographic circle). However, it also implies that it was more logic to travel from *Kunresijl* towards *Marcnesse*, *Nagele* and then Urk which could indicate that there was more land mass between *Kunre* and Urk than between *Kunre* and *Emelwerth* (see the palaeogeographical reconstructions).

Further evidence of medieval habitation and cultivated lands comes from several historical maps. The historical map of Christiaan Sgroten (circa AD 1570) and the map *Provinces Unies des Pays Bas* (AD 1648) both may contain information on the remains of the medieval landscape in a retrospective way. The first map depicts a flat to the north of Urk on which the toponym '*Hofste*' (house) is written, which implies that the area was once inhabited. The second map depicts an actual island to the north of Urk. This is definitely incorrect as other maps from the same period prove that Urk and Schokland were the only islands in the area. However, there is a good chance that the 'third' island refers to an area that was inhabited in the past and was put on the map by mistake (Van Popta 2016: 82; Van Popta 2017a: 148). For the southeastern fringe of the study area, the historical record produced by late medieval boom town Kampen is particularly rich (e.g. Spek *et al.* 1996). It includes dates of embankment and reclamation in the 13th and 14th century, including that of the archetypal polder of Mastenbroek (1364). It also includes 16th/17th century maps of the IJssel-delta river mouths and islands, the positions of which had become man-managed in the 15th century (Waldus 2018).

Depictions on earlier reconstruction maps

Earlier reconstruction maps of the research area are not considered as fully reliable and/or sufficient for a detailed reconstruction of the maritime landscape between AD 1100 and 1400. Nevertheless, they provide a 'starting point' and offer insights into the choices and interpretations made to depict the landscape of the region of study throughout time. Wiggers depicts the remains of the clay covered peatlands that were inhabited from the 11th to 14th century (Wiggers 1955: 98; Fig. 2.8a). His map contains four areas that have a clay-on-peat topsoil: the direct surroundings of Urk and Schokland (A, B), the peninsula to the southwest

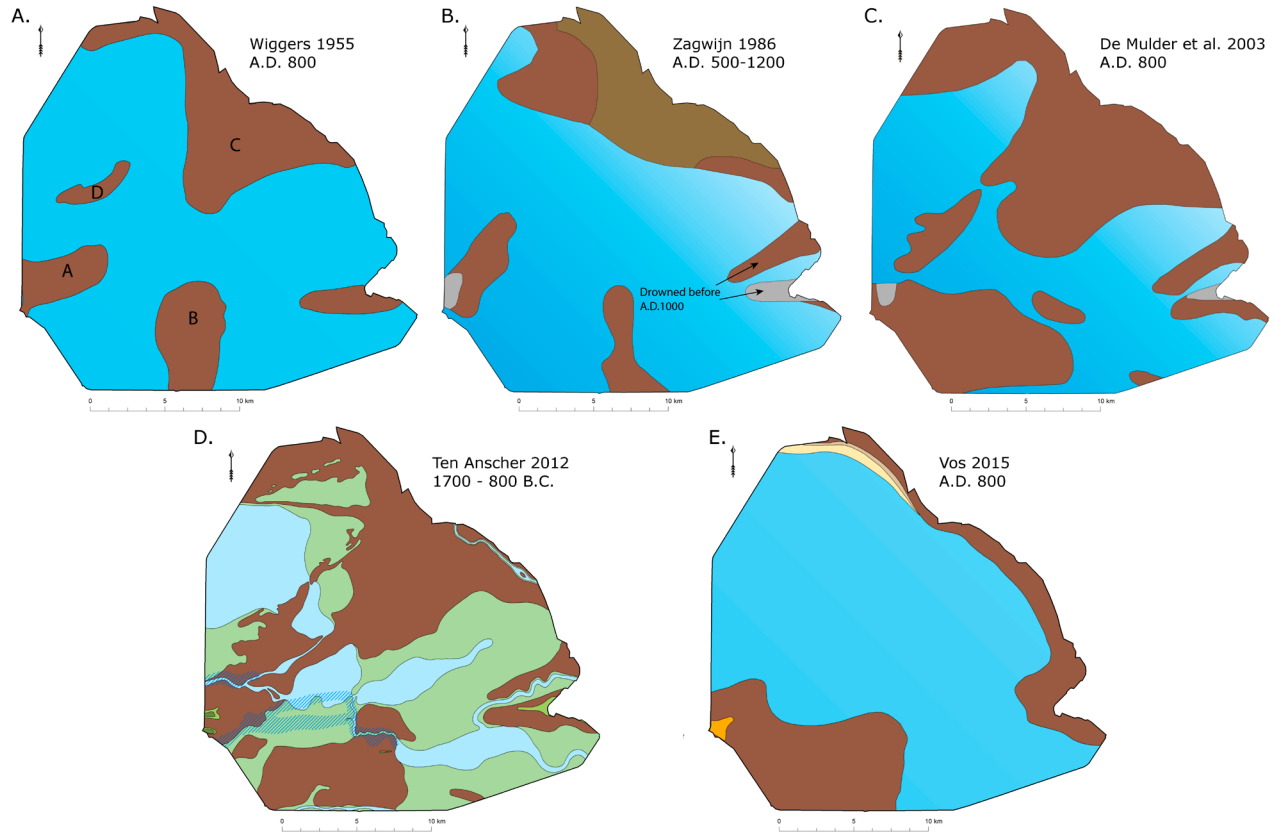


Figure 2.8. Multiple national and regional palaeogeographical reconstructions of the Noordoostpolder area.

of Kuinre (C) and a small island area to the northeast of Urk (D). As archaeological research was still in its initial phase, Wiggers only briefly mentioned some late medieval (not further specified) find spots that corresponded with the distribution of the clay deck (Wiggers 1955: 193). Recent research has proven that the research and interpretations of Wiggers is actually very accurate (see: Van Popta & Aalbersberg 2016; Van Popta 2017a).

From the national map series of Zagwijn (1986: 7; Fig. 2.8b), those for the Roman Period, the Early Middle Ages and the Late Middle Ages are most relevant here. The presence of land in the Noordoostpolder region for the Roman Period was clearly based on the mapping by Wiggers, considering the fact that the locations of land correspond to the distribution of the clay deposit as depicted by Wiggers (1955: 194; Zagwijn 1986: 38). The palaeogeography of the research area in the Early Middle Ages and the Late Middle Ages maps are practically the same, the only difference is some limited land loss depicted near Vollenhove in the southeast, possibly based on the work of Ente (1973). There might have been some struggle with the timing of peat erosion in the Noordoostpolder region, as the time stamps on the maps suggest that peatland fringes did not recede at all for hundreds of years. Nevertheless, Gotjé (1993) and Ten Anscher (2012) provide important information on the composition of the peat substrate, cultivated and inhabited in the Middle Ages, in large parts of the Noordoostpolder. Starting point for the reconstructions of Gotjé (1993) was the mapping of Wiggers (1955) and the Noordoostpolder reclamation soil maps and profiles. Gotjé (1993) added lithological and palaeobotanical information from new corings and ^{14}C dates. A distinction was made between adjacent brackish lagoonal and peaty terrestrial depositional environments and relative sea-level rise was quantified (age-depth curve based on dating peats overlying inland dunes around Schokland). The resulting peat land reconstructions for the last five millennia BC are very detailed in the case study areas Schokland and Urk, but they are more tentative extrapolations beyond that (Gotjé 1993: 107). Ten Anscher (2012) improved and expanded the Gotjé map products as part of Neolithic and Bronze Age archaeological research, covering the full Noordoostpolder (Fig. 2.8d). For this purpose earlier palaeogeographical maps (Wiggers 1955; Zagwijn 1986; Gotjé 1993) were combined with new geological, palynological and archaeobotanical information. It made the palaeogeographical maps for the period 6000–2600 BP (c 4900–800 cal BC) of better quality, although the author stresses not to overestimate the (archaeological) predictive quality (Ten Anscher 2012: 495-496).

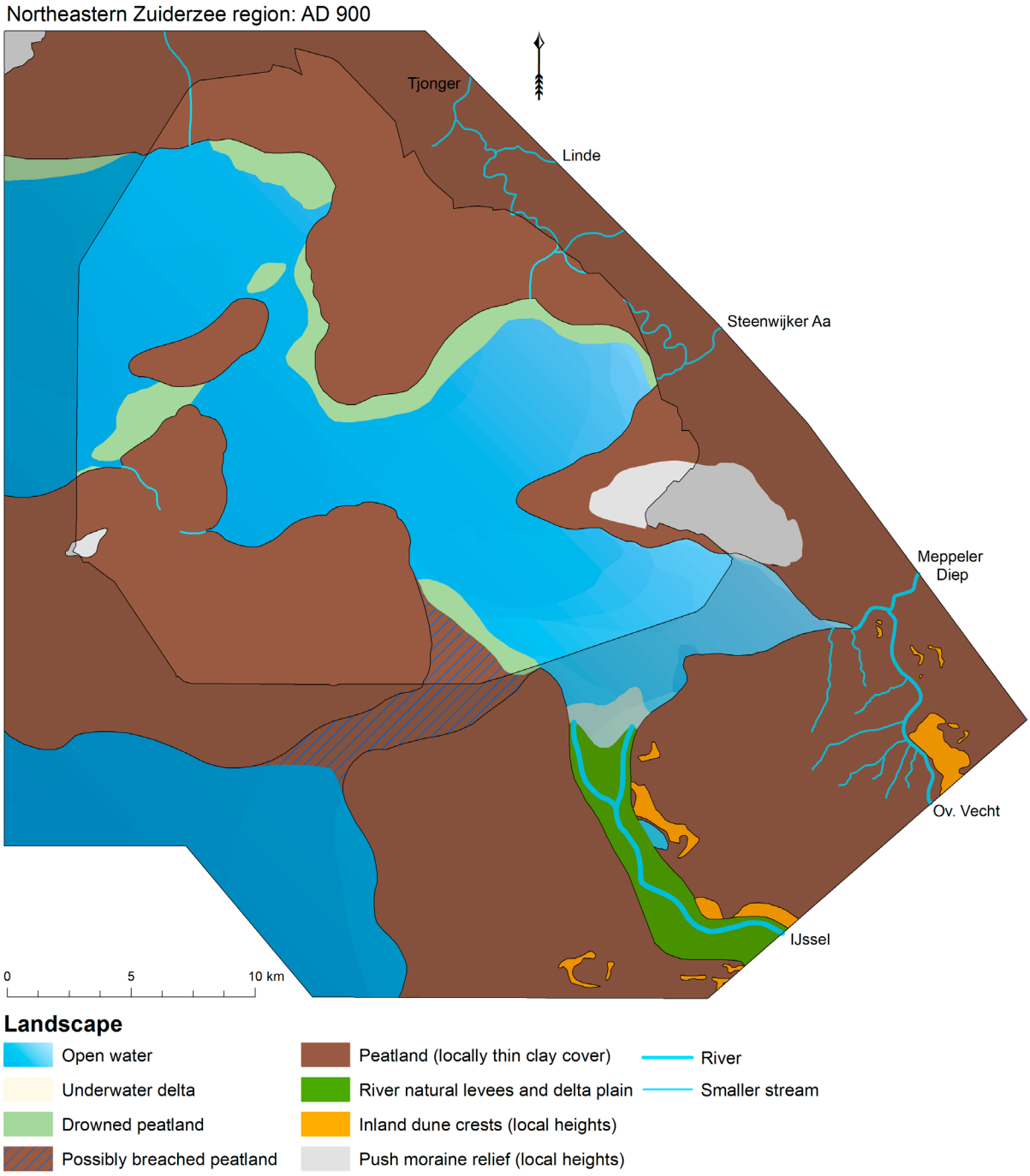


Figure 2.9. Reconstruction of the northeastern Zuyder Zee region for AD 900: peat land dominates, limited marine influence and land cultivation.

The maps featured in De Mulder *et al.* (2003; Fig. 2.8c) for the Noordoostpolder copied Zagwijn's interpretations, with one big unexplained difference: De Mulder *et al.* have copied Zagwijn's map for 1250 BC to resemble the situation in the Roman Period too, while Zagwijn's map for the Roman Period became that for the Early Middle Ages (AD 800) (Westerhoff *et al.* 2003a: 235). In the map series of Vos & De Vries (2013) the interpretative reconstructions of Wiggers (1955), Zagwijn (1986) and De Mulder *et al.* (2003) were adapted once more (Vos 2015). The AD 100 and AD 800 maps of this series depict an extensive peat-land peninsula in the southwest of the research area, encompassing both Urk and Schokland, and connecting to mainland peat areas to the south (Dronten, Kamperveen, Oosterwolde, Oldebroek, Hattemerbroek). This corresponds with the series in De Mulder *et al.* (2003), but for AD 800 contradicts the depictions of Zagwijn (1986) who has early-medieval Urk as a separated island (Fig. 2.8e). When focusing on northeastern shores of the Zuyder Zee, it

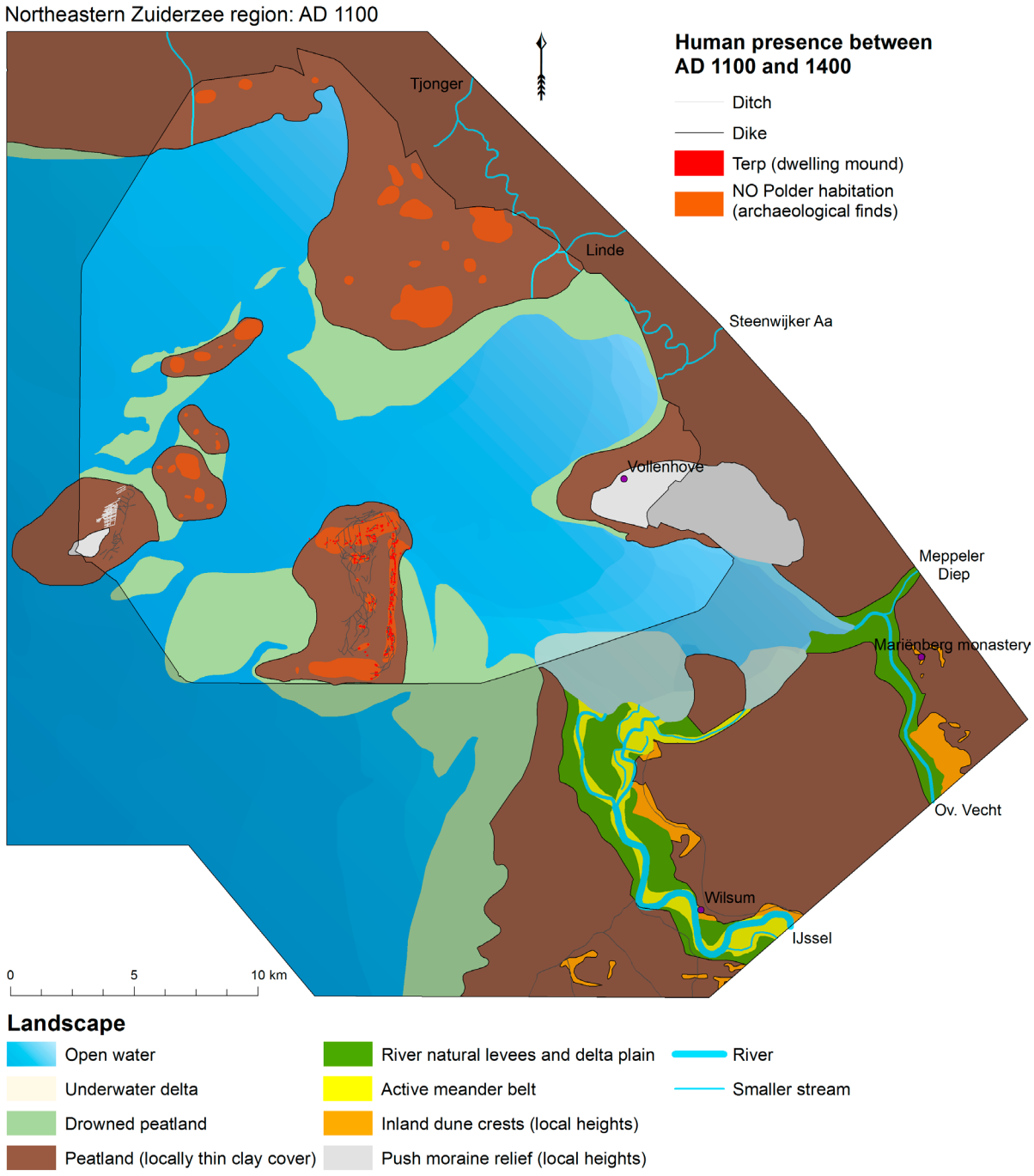


Figure 2.10. Reconstruction of the northeastern Zuyder Zee region for AD 1100: Zuyder Zee enlarged majorly, new routes, land cultivation and habitation.

is clear that these are considered to result from extensive peat land erosion, that was ongoing at AD 100 and by AD 800 had progressed (see also Setting: Holocene landforms). That depiction is at odds with geological, archaeological and historical data as presented and interpreted by earlier mentioned authors. Vos & De Vries (2013) seem to have dated the large scale erosion of the Zuyder Zee area far too early, as their older maps (*e.g.* AD 100) depict a more intact peat landscape that fits better in the overall interpretation of the landscape history of the region. For 1000 AD, Zagwijn depicted some remaining peatland along the east coast, east of Urk and directly to the south of Schokland. De Mulder *et al.* reckon any remaining peat islands and shoreline fringes to have eroded prior to AD 1250 (Westerhoff *et al.* 2003a: 238).

Late medieval palaeogeography of the Noordoostpolder with all the assembled archaeological, geological and historical information, a new palaeogeographical map series was made for the time span of AD 900–1600

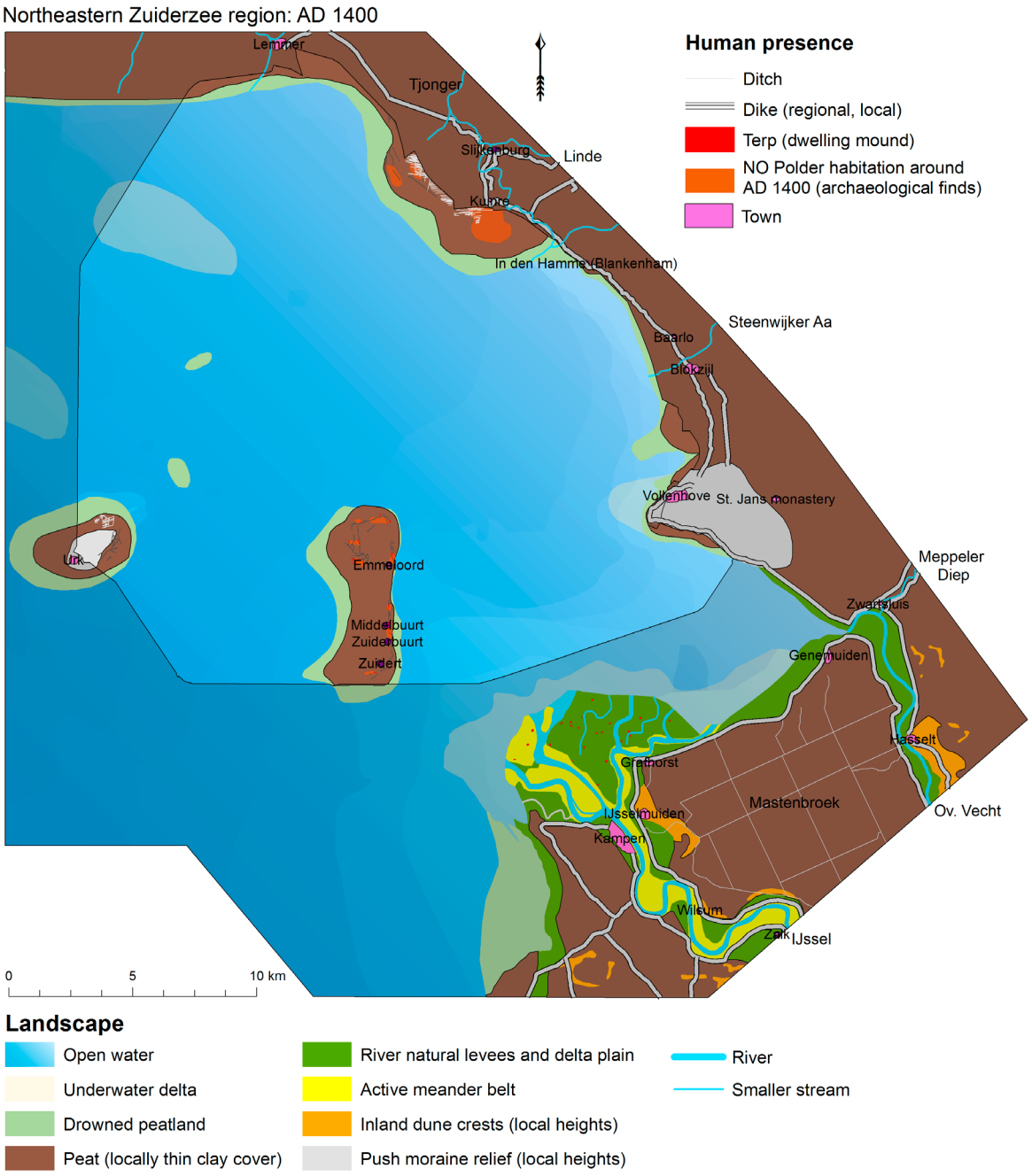


Figure 2.11. Reconstruction of the northeastern Zuyder Zee region for AD 1400: land loss, drowned settlements, harbour towns form.

(Fig. 2.9-2.12). The Noordoostpolder is highlighted in the maps, but they depict a larger area than the Noordoostpolder itself. The working rules when dealing with calved and remaining land are presented here first, after which key points in each map are highlighted. The maps for AD 900 and AD 1600 are strongly based on earlier geological-palaeogeographical respectively historical-geographical studies. The map for AD 1100 must be considered as a complete new mapping, with an important role for the density analysis of terrestrial archaeology. The map for AD 1400 builds on the AD 1100 reconstruction, and frames land erosion and loss of settlements, making good use of the historical and maritime archaeological results.

A first working rule that steered the reconstruction, is the premise that the medieval peatlands were subject to a *continuous* process of small steps of erosion and incremental decrease. This affected our (modified) reconstructions for AD 900, 1100 and 1400. The reconstructions presume that the land loss was the product of series of large and very large storms over several centuries. We have not singled out a particular storm event to have caused the great majority of land loss (although some storms were more extreme than

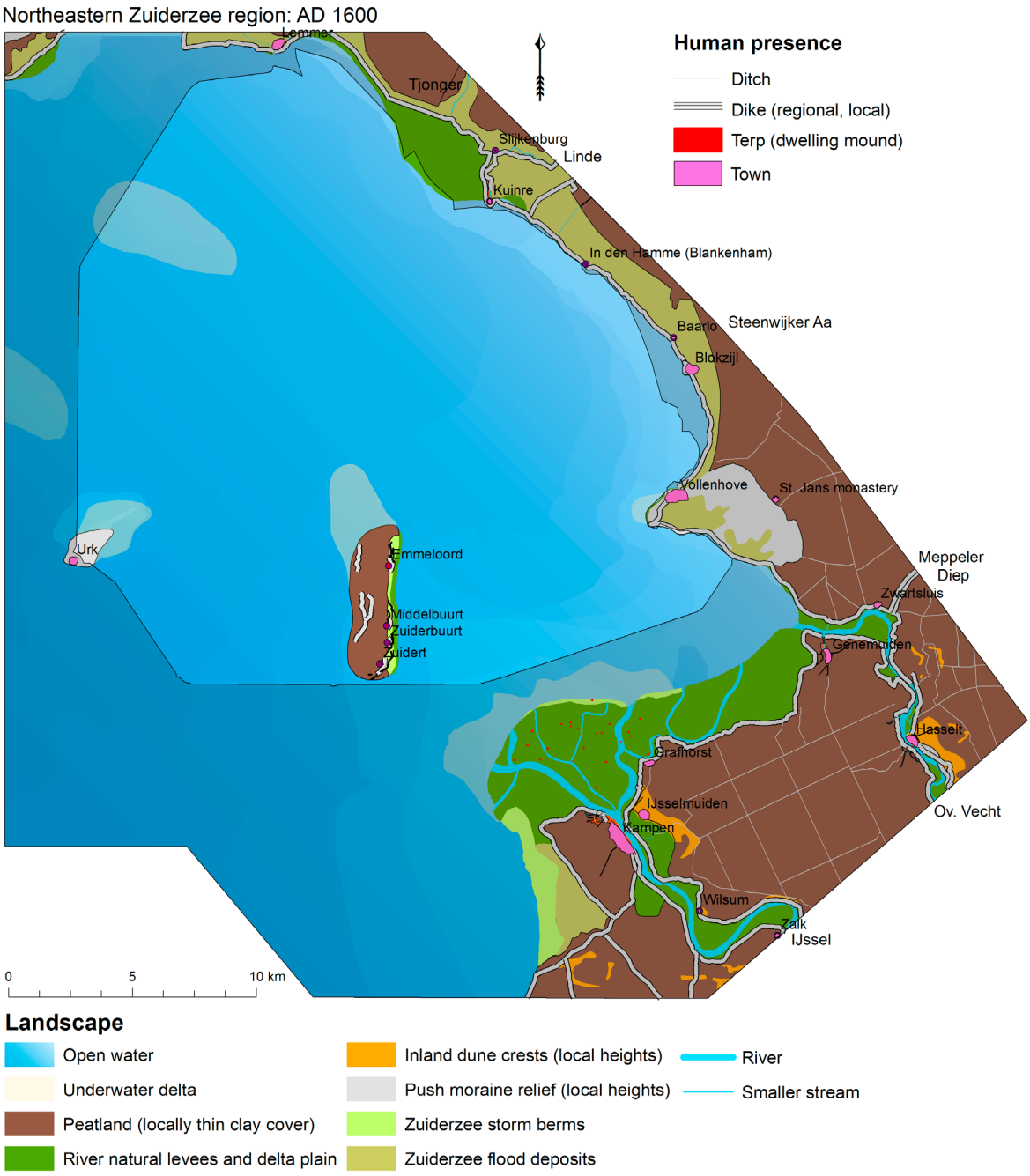


Figure 2.12. Reconstruction of the northeastern Zuyder Zee region for AD 1600: near-final size of Zuyder Zee reached, consolidation with dikes.

others; see Gottschalk 1971; Oost 1995; Buisman 1995; Buisman 1996; Vos 2015). Repeated storm attacks lead to the eventual extent of the Zuyder Zee with peatland surviving at the island Schokland and along the eastern and southern fringes (Fig. 2.13).[28]

A second working rule that steered the interpretative mapping considers the use of geological mapping of the extent of young detritus gyttja (Flevomeer- and Almere Beds, Formation of Nieuwkoop). The reconstruction holds this mapping as a constraint for the minimum extent of the Zuyder Zee water body by the end of the Early Middle Ages. Eroded peat is deposited as detritus gyttja underwater and therefore represents bodies of water (lakes, channel systems) that date back to at least the Roman Period (Wiggers 1955: 64; Gotjé 1993: 9, 110; Ten Anscher 2012: 496, 502-503). These lakes increased in size over time due to the peat erosion, caused by strong winds and large waves (Ente 1986 *et al.*: 130; Gerrets 2010: 31). Where young detritus gyttja was mapped, the palaeogeographical maps for 1100 and 1400 show open water (see Fig.2 9a). Where young detritus gyttja is absent (*i.e.* Zuyder Zee

Figure 2.13. Historical map of the Zuyder Zee region by Christian Sgroten (c. AD 1573), depicting the final stage of land erosion and the rise of the Zuyder Zee.

deposits directly overly peat and older substrate), the AD 1100 map depicts medieval land surface (peat land and clay-on-peat land). Approximately 45% of the AD 1100 landscape was reconstructed based on maritime and terrestrial archaeological findings, the other 55% is based on geological data and historical sources. The AD 1400 map shows partial loss of land, making use of the age-indications that archaeological data provided (site-distribution based: high density areas in Fig. 2.5). Our AD 1600 map (Fig. 2.12), historical maps from the 16th and 17th century and the maps of Vos (2015) and Kosian *et al.* (2016) show that by 1600 the size of the Zuyder Zee was close to that of the 19th and early 20th century.

In the Noordoostpolder study area, peatland extent as depicted on the new AD 900, 11100 and 1400 maps is greater than that in earlier national palaeogeographical map series (AD 800 maps of Zagwijn 1986; Vos 2015). This difference results from the archaeological find density analysis, that is depicted on the map for AD 1100, and that in places stretches to AD 1400. This evidence comes from relatively large areas that earlier reconstructions mapped as already eroded by that time. The map for AD 900 features several local-detail changes (compared to Vos & De Vries 2013/Vos 2015). The map depicts Urk and Schokland to form a peat land peninsula that is about to be breached by the expanding lagoon and to become cut-off from the mainland (Vos & De Vries 2013 depict a breached situation). This is also notable in the lithological characteristics of the contemporary lagoon floor deposits in the study area (Almere Bed) surrounding the peat peninsula: these show increased intercalations of sandy layering, indicating increased water movement (Wiggers 1955: 92; Ente *et al.* 1986: 130; Westerhoff *et al.* 2003b: 316; Gerrets 2010: 33). Surrounding peat land began to collect a cover layer of lagoon-derived clay owing to wind setup and flooding during storms (often referred to as 'clay deck') from the 9th century onwards.[29]

Urk would have been separated from Schokland in the 9th or 10th century. On the map for 1100 AD, Urk is depicted as an island. This reproduces the scenarios in Wiggers (1955: 68) and Ten Anscher (2012: 527), both leading back to the interpretation of the *Code- en Profielenkaart* (1947-1956) of the Noordoostpolder on which layers of young detritus gyttja are depicted in between Urk and Schokland. This is in accordance with the interpretations of Ente (1973: 141) and Hogestijn (1992: 110) who date the detachment of Urk-Schokland in respectively the 9th and 10th century AD on the basis of a massive storm flood in AD 838 and the 10th century donation of emperor Otto I. In this donation (AD 966), Urk is mentioned as an island whereas the lands of Schokland are not described (Geurts 2005: 22; Henstra 2010b: 143). Schokland presumably separated from the mainland a little later than Urk, likely during repeated heavy floods in the 11th or 12th century (Ente *et al.* 1986: 132 and Cohen *et al.* 2009: 92 earlier entertained such reconstructions). The map for AD 1100 shows the peatland between Schokland and Kampen just breached.

Traces of late medieval habitation in the Noordoostpolder area are also depicted in the west of the Noordoostpolder (AD 1100 and 1400 around Urk; AD 1100: further islands north of Urk) and in the northeastern fringe (AD 1100 and 1400 maps; peninsula in front of Kuinre). Adjacent to Urk the habitation is clearly late medieval (concentration F). Depicting peat land islands to the north of Urk on the map for AD 1100 (concentration G) corresponds to the mapping of Wiggers (1955: 193; fig. 108) who presumed the area to be part of the larger island Urk, and that by Ten Anscher (2012: 527) that has them separated by water. The find concentrations are from areas that by AD 1100 had a developed clay deck topping the peat land. While storms made the Zuyder Zee enlarge and eroded away peat land, the same storms also caused flooding of peat land, depositing the clay deck (Wiggers 1955: 96; Hogestijn 1992: 98; Jongmans *et al.* 2013: 792). It is plausible that the clayey topsoil proximal to the Zuyder Zee provided a better surface than peaty grounds some distance inland. Archaeological concentration G must have been an island in the period of approximately AD 1100-1300. The piece of land is considered lost to lagoon erosion on the maps of Zagwijn (1986, AD 500-1200) and Vos & De Vries (2013, AD 800), but when their maps of the Iron Age (Vos & De Vries) and the Roman Period (Zagwijn) are taken into account, the land becomes visible as a peninsula (Vos & De Vries) and an island (Zagwijn). It means that their maps depict the transformation of the Noordoostpolder landscape as happening somewhat too early (as mentioned above).

Clayey topsoil in the northeastern part of Schokland (sourced from the rivers IJssel and Vecht, stirred up and deposited by the Zuyder Zee) must have been the ideal surface for the medieval habitation in the northern part of Schokland, considering the high amount of medieval archaeological finds in this area. Population growth and a growth of trade in the Low Countries during the Late Middle Ages resulted in rapid extend of agriculture and land cultivation (Van Bavel 2010: 325). It is therefore likely that other parts of the Noordoostpolder region were cultivated as well, causing rapid compaction and erosion of the peat. Recent archaeological research in the remaining parts of the Kuinre peatland peninsula revealed remains of a late medieval (AD 1300-1600) network of ditches, dug into peat as part of a reclamation (see Fig. 2.11).[30] Remains of the drowned late medieval settlement *Fenehuysen* (which translates as *peat houses*) were found inside the ditches, making it plausible that people placed their houses directly on the peat, while reclaiming the peatlands.

The reconstruction of the IJssel and Vecht river mouths in the south of the map build on Ente *et al.* (1973; 1986), Dirkx *et al.* (1996), Cohen *et al.* (2009; 2012; 2016). Delivery of large volumes of sand and the build-out of the IJssel delta to the north of Kampen (underwater as well as above the water), commenced centuries later (peaking after 1200 AD; *e.g.* Ente 1973; Van der Schrier 2004; Cohen *et al.* 2009) than the first delivery of fresh water and fines (abundant well before 1200 AD; *e.g.* Kooistra *et al.* 2006; Sass-Klaassen & Hanraets 2006; Makaske *et al.* 2008; Cohen *et al.* 2012; Jansma *et al.* 2017). Therefore, in the maps for AD 900 and 1100 a still modest IJssel delta is depicted, aligned along easterly branches. The delta took its semi-circular shape with branches directed northwest in the centuries following that (Ente 1973: 153; Dirkx 1996: 21; Cohen *et al.* 2009: 90-92; Waldus 2018: Ch. 11) — as seen in the maps for AD 1400 and 1600 (*Kampereilanden*: Isles of Kampen). Besides ample sand delivery by the fully established river to its delta, delta growth had become possible because of the enlargement of water body in which the river ended. The IJssel delta can be considered land that replaced parts of the peat peninsula that existed in the AD 900 map.

Discussion

Landscape changes after 300 years of maritime development

The map of AD 1100 (Fig. 2.10) depicts a landscape in which mankind had cultivated parts of the peatlands but was driven back by the water, most clearly illustrated by comparing it to the map of AD 900 (Fig. 2.9). It shows the region before the major and final erosion of the peatlands that started in the 12th century and of which the results can be seen on the new map of AD 1400 (Fig. 2.11). The region was populated, with habi-

tation on individual house terps (Schokland-area), on the southwestern part of the island Urk, on several islands north of Urk, on the natural heights of Urk and Vollenhove (boulder clay), on the peat peninsula to the north and west of Kuinre and on the end of the peat peninsula (the future northeastern shore). Historical documents further contribute to the understanding of the landscape by naming several chapels in the area: *Kuinre*, *Kunresijl*, *Fenehuysen*, *Marcnesse*, *Nagele*, *Emelwerth* and *Urk*. It is yet not possible to connect all the names of the unknown chapels/settlements to the settlement locations as clear descriptions of their locations are lacking. The order of names in the Andreas charter does imply that *Marcnesse* and *Nagele* should be located somewhere in between the peat peninsula and the island Urk, for example on one of the islands close to Urk. The settlements *Fenehuysen* and *Kunresijl* should be sought in the direct vicinity of Kuinre. At approximately AD 1400 in time, the number of archaeological sites with a high density is limited to the coastal zone in the northeast, the Schokland-area and Urk. The other islands, a large part of the peninsula and the western shore of the Schokland-area were either drowned or completely washed away. Dikes were built along the coast, the Schokland-area and on Urk in order to withstand the floods (Van Hezel & Pol 2008).

After 300 years of marine influence, nothing remained on the surface of the former islands, the peninsula and the Schokland-area except for some flats to the north of Urk (Fig. 2.11). Historical documents testify of heavy stormsurges in AD 1163, 1164, 1170, 1173, 1196, 1214, 1219, 1220, 1221, 1246, and 1248 that terrorized the inhabitants of the Zuyder Zee region and demolished a large part of the peatlands (Buisman 1995: 361). Several settlements (*e.g. Marcnesse* and *Nagele*) must have drowned due to these floods and their names are not found in historical records from the 14th century onwards. The people that once inhabited the region were forced to leave their settlements due to the many floods and resettled on the islands Urk, Schokland or further inland. This trans-placement towards the less threatened parts of the region is clearly visible in the case of the medieval settlement *Fenehuysen*, as depicted on a historical map from circa AD 1540 (Fig. 1.4). The first location of the settlement had already been overtaken by the Zuyder Zee and is depicted as a half-submerged building in the sea (blue circle), while the new location (same name) is shown to the north and close to the shore (red circle).

From the 13th century onwards, dikes were constructed along the main coastal areas of the Zuyder Zee for protection against the raging floods of the sea (Van der Heide & Wiggers 1954; Hogestijn *et al.* 1994; Van den Biggelaar *et al.* 2014). In the 14th to 15th century, in the wake of IJsseldelta expansion and shortening of the distance to the open Zuyder Zee, Kampen established itself as a harbor town. The AD 1400 map depicts two main branches (Noorderdiep and Zuyderdiep/Brunneperdiep; cf. Waldus 2018) and dashes a central third new branch (Rechte Diep) that was heavily engineered to become the main entry to the town during the 15th century (historically evident, *e.g.* Tamse 1963; dendro-archaeologically evident: Waldus 2018), if this branch was a natural channel originally at all.[31]

Usefulness of palaeogeographic mapping

The development of the new palaeogeographical map series for the research area aimed at exploring and explaining the late medieval natural and cultural developments of the research area. It has changed the thoughts and interpretations of the late medieval Zuyder Zee region, from 'extensively eroded' and 'largely uninhabited' to 'densely inhabited at the borders of a dynamic maritime landscape'. It opens up questions on how this 'archaeology-first' map series can or should be used. The maps are in fact sceneries ('theater stages', 'game boards') that serve for the development of different scenarios of human behavior: more facts reduce the degrees of freedom of the scenarios.

Our detailed regional palaeogeographical reconstructions, can be compared with superregional reconstructions (*e.g.* national map series Vos & De Vries 2013). The latter tend to be based on geological-geomorphological insights primarily, and where regional reconstructions are available tend to subsume these. In the Zuyder Zee region, the quality of superregional reconstructions for medieval time frames, can benefit from the more interdisciplinary takes of regional palaeogeographical reconstructions as developed in this paper. At the start of this study we argued that this would be the case for the late medieval time periods (maps for AD 1100 and 1400, with abundant archaeological observations), and with completing it one could even say that it holds for Early Medieval time frames (AD 800 / AD 900) too (clayey overburden inhabited by AD 1100, was laid down in centuries before). The new insights for the study area (more Early Medieval peatland) have already been taken on board in the upcoming revision of the national map series (Vos *et al.* 2020; in exchange with the current study). Furthermore, the revised national series includes a new map for AD 1250, in which the Noordoostpolder region is depicted during the marine erosion as an average of the new maps of AD 1100 and 1400 (Vos *et al.* 2020).

The Noordoostpolder map series helps to sharpen research questions regarding changes in medieval habitation of the area. Hypotheses can now be diversified for the coastal zones versus the peaty inlands, and related

to variations in rapidity of the changes across the landscape. The late medieval changes to the landscape like ditch cutting in the peat, deposition of decks of clay, land erosion, increasingly brackish environment had long-term cultural effects in the region. The landscape maps facilitate research to the cultural component, so that the maritime cultural landscape can be studied in its entirety. As an example: literature on Schokland often portrays it as a local peat island that survived against the odds, *i.e.* to illustrate how so many other peat islands eroded away. With the insight that comes from palaeogeographical analysis at the more regional scale, and by incorporating archaeological insights from smaller and larger terp sites, we may also try to identify positive causal explanation on how peat islands could survive. One of these may be the clay cover that exists over the peat on Schokland and that is of fluvial origin primarily.[32] Owing to relative proximity to the IJssel and Vecht river mouth waters of the 9th to 12th century AD, the eastern fringe of the Schokland island may have had a thicker clay overburden (Biggelaar *et al.* 2014: 189) than the lost western sides. This would have led to stronger compaction of the underlying peats, making these more resistant to the Zuyder Zee calving erosion than areas to the west.

Attention of the role of clay deposition in the geographical history example for Schokland, connects this area to the clay-on-peatlands along IJssel and Vecht to the southeast and east of the Noordoostpolder that survived Zuyder Zee expansion (*e.g.* Oldebroek 12th-13th century and Mastenbroek 14th century reclamation on either side of the river IJssel just south of the IJsseldelta). Initially, the habitation development may be considered to have run parallel. Eventually the developments diversified and one can use the map series to identify the key changing moment. The position of Schokland in front of the mouth of the new river IJssel between AD 900 AD – AD 1100, thus can be a palaeogeographical factor in explaining the preservation of this peat island (the only peat island to survive). The presence of clayey top-soil can also have been a co-factor to decide where to raise terps (besides increased flooding as the push factor).

From the 17th century onwards, inhabitants on the islands of Schokland and Urk were left with no choice and started to make a living out of fishing instead of farming (Geurts 2005: 75; Van Hezel & Pol 2008: 52). These originally maritime farmers buckled up and stayed, accepted landscape changes and decided to culturally adapt. That decision on Schokland contrasts with that made in areas to the east and northeast. In those regions people appear to have decided to retreat, moving away from the Zuyder Zee fringe, for example the people that lived in *Fenehuysen*. Their actions may be more comparable to settlements that shifted through the peat lands, of which the Staphorst-Rouveen region across the river Vecht in the very southeast of the research area is a well-known example (see *e.g.* Spek *et al.* 1996). The new map series makes it possible to explore medieval spatial development in detail, also where final stages of Zuyder Zee expansion tampered with the evidence. Traces of late medieval ditches that were found at the site of *Fenehuysen* (Fig. 2.5, concentration D) link up with former inland ditches that can be seen on historical maps and LiDAR-data (see Chapter 5 for more detail). It illustrates that the dikes have created a border that divides the former coastal landscape of the Zuyder Zee in two parts: one has been washed away, the other is (partially) preserved.

Regional palaeogeographical studies for the Medieval time period may also be developed for other sectors of the Zuyder Zee, adopting the methodological ideas of this study and adapting it to particularities of these sectors (having an intensively surveyed 20th-century reclaimed lagoon floor at disposal differs from having to deal with a vast open water area), to upgrade maritime cultural landscape and general historical research in these areas. One could think of areas like the Amsterdam-Pampus-side (southwest), the drowned landscape of Arkemheen (southeast; Hagoort 2006) and the maritime landscape of West-Frisia (northwest; *e.g.* Bartels 2016a). However, such comparisons can only succeed if a similar approach is undertaken, reprocessing primary (archaeological) datasets for a reconstruction of landscape development. Only then it is possible to find out whether landscape changes resulted in similar adaptations and practices.

Conclusion

We aimed to reconstruct the dynamic development of the landscape of the northeastern Zuyder Zee region over late medieval time. The highly dynamic late medieval past of the area made it difficult to comprehend, especially because of the coastal erosion that destroyed most of the time-relevant geological record, and the period lies beyond that from which historical maps are available. As marine erosion has caused the loss of most of the time-relevant geological record, this paper used an 'archaeological data first'-approach — very much needed for the period AD 1100-1400 — whereto archaeological site distributions and spatial density analyses were combined. The order and priority that this information gets and when complemented with information from geological observations, differs from the classical 'geology-first' palaeogeographical approach (working for mapping up to c. AD 900). This reconstruction approach allowed to bridge a gap that that otherwise existed for the late medieval period, allowing to connect

the series to the period coverage with historic maps, where palaeogeographical reconstruction data combination methods again switch order and priority (working onwards from c. AD 1600).

The 'flipped' approach proved to be successful in reconstructing the late medieval landscape of the study region as a four step map series. The archaeological data-incorporation methodology is however limited to the reconstruction for time periods when past habitation and recent surveying were both sufficiently dense. In the case of the Noordoostpolder, archaeological residue from before AD 1100 is insufficient. The priority of archaeological finds for the reconstructions does not mean that an exclusive archaeological (or geological) path should be chosen for the development of new map series: multidisciplinary data use is recommended.

The map of AD 900 still depicts large areas of peat land, that for AD 1100 depicts large islands and capes of peat land around an enlarged lagoon (origin of the Zuyder Zee) and that for AD 1400 considerable further land loss. The AD 1600 map depicts a fully maritime-cultivated landscape, with the Zuyder Zee greatly enlarged and its surviving peat land fringes embanked. Based on these new maps, several important conclusions can be made. First of all, the peatland areas between AD 900 and 1100 were far greater than depicted on earlier national palaeogeographical map series. Second, the Noordoostpolder region was relative densely populated in the Late Middle Ages. This is testified by archaeological remains of drowned settlement and the historical records that contain descriptions of the area and lists with (drowned) settlement names. Furthermore, nature can only partially be blamed for the land loss catastrophes that it caused: much of the original medieval cultivated peat landscapes in late medieval times disappeared due to a combination of punctuated storm surge catastrophes, progressive lagoon rim calving and especially human interferences such as draining (ditch cutting) and ploughing. The latter made the lands more vulnerable to storms and floods. As a first reaction, people fled to the higher grounds of the islands and northeastern shore and started to build small terps and dikes. Although the Zuyder Zee drastically limited habitation grounds and agricultural exploitation of the region, its development also opened up new maritime possibilities as can be seen on the new map series, such as the development of harbours along the eastern shore and the IJssel river, and by that a better connection to other parts of the world.

We would recommend to further explore methodological issues concerning physical-geographical and human-landscape impact, for example by comparing old and new reconstructions maps, asking the question whether the new reconstruction is solely based on more (archaeological) data or also on new visions of lagoon development and the human-induced development of peatlands. To conclude, our methods of palaeogeographical reconstruction provide a practicable concept that may be used outside the northeastern quadrant of the Zuyder Zee too, and the map-series result provides a higher resolution backdrop for understanding late medieval developments in the quadrant: the land loss history of the Zuyder Zee is no longer unknown.

Endnotes

1 "*…Hoe nu de Zeeusche en Maesstromen tot sulc eynde te tasten zijn, dat sullen wy, (om niet het hemt over de roc of anders geseyt, om niet al te veel werc tevens overhoop te halen) seggen, als de zuyder zee vande Noort zee af gescheyden en ten grote dele lant zijn, so gy het dan noch niet cont versinnen*"(Stevin 1667: 51; Van der Heide 1965a: 7).

2 Boulders and boulder clay proved to be the most resistant natural materials against the water of the Zuyder Zee, and were therefore used for the construction of the Afsluitdijk.

3 *E.g.* Gotjé 1993; Geurts 2005; Van Hezel and Pol 2008; Ten Anscher 2012.

4 The content of the MSD will be made available on the Dutch Data Network DANS and is published in a separate forthcoming paper.

5 Geological dating methods applied abundantly to underpin the reconstructions of the maps up to AD 800, do not work well for dating the Zuyder Zee deposits for several reasons: organics are abundant in the Zuyder zee deposits, but they are predominantly detritus calved from the peat rims surrounding the lagoon. ^{14}C dating detritus is to be avoided because it would date the age of the calved peats rather than that of the redeposition as detritus. Mollusk shells of brackish and fresh water species also occur in the deposits, and can be ^{14}C dated, but dating such carbonates suffers from reservoir effects that are hard to quantify. Wooden parts of ships can be ^{14}C numerically dated, and/or dendrochronologically correlation-dated but that we regard archaeological dating, as do we regard dating of archaeology based on typology or association with other finds.

6 It would prove helpful to examine the outcomes of the same approach (archaeological data first) for the older palaeogeographical maps of the study region, in order to create more accurate and detailed maps.

7 A long-term reconstruction frames a period of thousands of years, while a short-term reconstruction focuses on hundreds of years.

8 A local map series exception is for SE of the study area, in the immediate vicinity of the Noordoostpolder: Cohen *et al.* 2009 provide a reconstruction on the late medieval Gelderse IJssel river mouth, an actively depositing system into the study area during the period of interest. The reconstructions incorporated Spek *et al.* 1996, who reviewed the preserved medieval peat land reclamations of the Kampen, Mastenbroek and Munninkenslag-Rouveen areas.

9 This top of these deposits, often called 'the Pleistocene sand', is in most archaeological studies of the Noordoostpolder the deepest exposed layer. Pleistocene surfaces in the Noordoostpolder are generally covered by a few meters of Holocene deposits (with local exceptions). This in contrast to areas surrounding the study areas to the north and east, where Holocene cover is mostly superficial.

10 This deepest bed of Holocene peat, where it is covered by substantial thickness of coastal plain deposits, is referred to as the Basal Peat (*Basisveen-Laag*; Westerhoff *et al.* 2003b: 351).

11 It is evident from the distribution of Flevo Laag detrital deposits, that smaller lakes merged into larger lakes in several places (Gerrets 2010: 31).

12 Van Zijverden (2017: p. 38) briefly entertains the idea that after the closure of the Bergen inlet, the Vecht river coming from the Noordoostpolder-area connected to the Flevo-area basin, *i.e.* draining southward using the Oer-IJ instead of northward using the Vlie — although the map figure in the same publication shows the northward routing. Vos *et al.* (2015: 311) estimate the beginning of a connection between Oer-IJ and Vecht/Vlie to have established later in time (c.400 BC), not as the direct effect of the closure of the Bergen inlet.

13 Note that the name Vecht is used for two rivers entering the Zuyder Zee area. In this paper, of main importance is the Overijsselsche Vecht river which ran through the Noordoostpolder study area in Pleistocene and Holocene times (present mouth into Lake IJssel at Genemuiden; the last part of the river is named Zwarte Water). The hinterland of this modest-sized river is the Eastern Netherlands and adjacent parts of NW Germany. The other river Vecht is the Utrechtse Vecht in the southwest of the Zuyder Zee (present mouth into Lake IJssel at Muiden. Muiden means river mouth). This is a Rhine deltaic branch, and it runs parallel to the river Angstel which is also a Rhine deltaic branch and are often regarded one and the same distributary system (Angstel-Vecht system, Bos 2010). The Angstel-Vecht system is of secondary importance to our study area, but plays a role in the genesis of Oer-IJ, Lake Flevo and the connection of southern parts of the later Zuyder Zee area to the north. See also Buitelaar & Borger 2015; Vos *et al.* 2015.

14 Pomponius Mela, *Chorographia* III, 24. *"...ad dextram primo angustus et sui similis, post ripis longe ac late recedentibus iam non amnis sed ingens lacus ubi campos implevit Flevo dicitur, eiusdemque nominis insulam amplexus fit iterum artior iterumque fluvius emittitur".* Tacitus, *Annales* I, 60*: "...ipse inpositas navibus quattuor legiones per lacus vexit; simulque pedes eques classis apud praedictum amnem convenere".* Plinius Maior, *Naturalis historiae* IV, 101: *"...quae sternuntur inter Helinium ac Flevum. ita appellantur ostia, in quae effusus Rhenus a septentrione in lacus, ab occidente in amnem Mosam se spargit, medio inter haec ore modicum nomini suo custodiens alveum".*

15 The name *Almaere* became in use in the second half of the 8th century AD Bishop Willibald van Eichstätt writes in his *Vita Bonifatii auctore Willibaldi* (AD 753) on the death of the missionary Boniface (Saint Boniface) and the transportation of his remains on the *Almaere* (Mostert 1999: 9).

16 According to the work of Buisman (1995: 361), the storm floods of 1163/64, 1170, 1173, 1196, 1214, 1219, 1220, 1221, 1246 and 1248 were responsible for the genesis of the Zuyder Zee. In most of the papers and articles on the former Zuyder Zee, the year of 1170 is used as the specific moment on which the Almere transformed into Zuyder Zee. See also: Gottschalk 1971: 30; Walsmit *et al.* 2009: 15.

17 The name *Zuyder Zee* is mentioned for the first time in 1340 when count Johan III of Holstein offers privileges to the cities that surround the *Südersee* (Hansisches Urkundenbuch, 1879: part II p. 291, act 664).

18 According to Van Hezel and Pol (2008: 44), the abandonment of the small terps, is in particular a consequence of the St. Victor flood of the 10th of October 1375.

19 See: De Boer & Geurts 2001; De Boer & Van Doesburg 2002; Van Popta 2012a.

20 New research by Van Popta (2017) has proven that there are many more terps and dikes in the surroundings of Schokland than the 130 known ones.

21 The notion that local clay sods were used to build terps in the 12th century, means that by that time a clay-on-peat cover had developed. This is in agreement with dating of the clay-on-peat sequence at Schokland (Biggelaar *et al.* 2014) and the ideas on maturing of the river IJssel as the Rhine branch delivering clay to the study area since around 950-1000 AD (Makaske *et al.* 2008; Cohen *et al.* 2009). Note that areas to the west of Kampen also saw terps and early dikes being constructed in young clay-on-peat areas next to the river IJssel, in the same 12th century (Cohen *et al.* 2009 and sources therein). The practice of raising terps was also deployed in the IJsseldelta proper (immediately north of Kampen), but this appears to be a few centuries younger (14th-15th century).

22 Preservation was helped by defense mechanisms such as eradicating wooden pole screens along the calving shores. Defense was actively maintained until in the 19th century. In 1859, after a series of stormsurges, the population was forced to evacuate and the island was left inhabited, as sustaining the occupation had become too dangerous and expensive. Despite the island abandonment, the terps survived to today,

23 The research attention advice also applies to routine archaeological investigations, as executed by commercial companies and ordered/waived by municipalities (Netherlands implementation of Valetta agreement).

24 *"...suppliciter attacti cuiusdam insulae medictatem in Almere, que Urch vocatur, et ultra amnem Nakala quicquid interjacet usque Vunningam..."* In: Monumenta Germaniae Historica. Diplomata Regum et imperatorum Germaniae I. Conradi I, Heinrici I et Ottonis I diplomata, no. 324.

25 See for example the website of the town Rutten (named after *Ruthne*): www.ruttennop.nl.

26 It also means that the reinstatement of the name in the late 1940s (Rutten, Ruttengemaal), based on then available historical interpretations, is considered incorrect by the present day information.

27 For example: the settlement of Urk shifted due to land loss and coastal erosion almost 1,5 kilometers to the northeast within 800 years (based on 16th century maps compared to 19th century cadastral maps).

28 Peat growth could have occurred on a locale scale, the assumption is based on the whole region (see: Wiggers 1955: 95; Hogestijn 1992: 99).

29 The start of the deposition of clay is based on ^{14}C dates of top peat samples in the Schokland area (cal AD 770-940) and near the former northeastern shore (see: Hogestijn 1992: 98; Van den Biggelaar 2014: 186).

30 Van Popta — personal observation. Site excavated in 2017 (staff & students University of Groningen), documentation: Van Popta 2019b.

31 Traditional interpretation of the historic sources has been that the Rechte Diep existed before the first engineering works into and along it are mentioned. The position and morphology of this branch seem engineered, and the toponym suggests this too (*recht* means straight). Just upstream of the Kampen an IJssel river meander was cutoff in the same time period.

32 Such argumentation can also be upheld for survival of peat land polders fringing the Zuyder Zee to the south of the Noordoostpolder (*e.g.* west of Kampen), and it echoes considerations of peat land polder stability against eroding calving lake water bodies (Haarlemmermeer, Zoetermeer) elsewhere in the Rhine-Meuse delta (*e.g.* N and S of the Oude Rijn channel belt between Woerden and Leiden; De Bont 2008), and generic insight in the geomechanical properties of clay-on-peat substrates (Van Asselen *et al.* 2009; Koster *et al.* 2017).

3 Maritime Culture in the Netherlands

Accessing the late medieval maritime cultural landscapes of the northeastern Zuyder Zee

*Yftinus T. van Popta & Christer L. Westerdahl**

Abstract
This paper examines the theory and practice of the maritime cultural landscape (MCL) in general, and projects the theoretical concepts and aspects involved on the highly dynamic late medieval northeastern Zuyder Zee region in the Netherlands. The cultivation of land and marine erosion (floods and rising sea level) are considered as the main factors that caused the transformation of the physical landscape of this region from peatlands with freshwater basins into a tidal lagoon. As a consequence, several settlements drowned, large areas of land submerged and culture and the landscape gradually became more maritime, giving the research area a cultural identity.

Keywords
Maritime cultural landscape, interdisciplinary approach, drowned settlements, maritime erosion, Noordoostpolder, Late Middle Ages, sea-level change.

Published
2019, International Journal of Nautical Archaeology 48.1: 172-188**

* We would like to thank editor Miranda Richardson, dr. Brad Duncan, prof. Thijs Maarleveld and an anonymous reviewer for their useful comments and remarks.

** This chapter is a minor revision of the IJNA-article and reproduced with permission of the IJNA and John Wiley & Sons publications.

Introduction

For a long time, archaeological studies were too narrowly focused on terrestrial archaeology, often ignoring the potential importance of maritime archaeology (Maarleveld 1998: 48; Flatman 2003: 144). There were few active maritime scholars and the discipline was still perceived to be engaged in antiquarianism (Muckelroy 1978: 4; Gibbins & Adams 2001: 279; Flatman 2003: 143). There has been recent motivation, over the past decade or so, to move forwards, expanding the focus of maritime archaeological studies to examine the wider significance of shipwrecks within their social and cultural contexts (for example Westerdahl 2017: 3). New interdisciplinary approaches are recommended and much more could be done with the large amounts of data generated by Dutch maritime research, wreck contexts should be assessed and synthesized and integrated with data from terrestrial archaeology and maritime history. This would improve maritime archaeological explanation and theory and open up ways to reconnect and restore balance between Dutch and international development on the one hand, and the terrestrial and maritime archaeology on the other. The maritime cultural landscape is a theoretical concept with a profound impact on maritime archaeology that promotes an interdisciplinary approach (Westerdahl 1992: 6; Firth 1995: 5). The concept has great utility when applied to one of the most important Dutch maritime landscape regions: that of the *Zuyder Zee* (Southern Sea).

The aim of this article is to investigate the theory and practice of the maritime cultural landscape using the theoretical approach proposed by Westerdahl (1992; 2011; 2013), thereby exploring ways to examine the maritime cultural landscapes of the northeastern Zuyder Zee, primarily in the period of AD 1100–1400. It demonstrates how maritime cultural landscape elements, previously proposed by others, can directly be applied to investigate the region of study. Hereto, a multidisciplinary approach is proposed that integrates and compares pertinent yet seldom-used historical, geological, geographical, and (maritime) archaeological data sources of the Zuyder Zee. Changing the focus from object- and shipwreck-orientated maritime archaeological studies to more integrated studies of the maritime cultural landscape forms the core of the present study. The current study aims to: 1) reconstruct the physical maritime landscape of the region; and 2) characterize the unrecognized maritime remains (such as submerged settlements) in the region. Only then, the late medieval maritime cultural landscapes of the northeastern Zuyder Zee region will be perceived in the most accurate way (see for example Van Popta 2016; 2018).

Love, hate and the Zuyder Zee

When focusing on the history of the Netherlands, one cannot deny that the Dutch had (and have) a true love-hate relationship with water. The Dutch love for water is mainly based on using water for a transportation network, as a source of wealth and power. For a century and a half, the Dutch dominated world trade and were considered the leading sea power of Europe. This period started in the late 16th century and lasted until the early 18th century and is known as the 'Dutch Golden Age' (Israel 1989: 15; Gaastra 2009: 17). One might imagine that Dutch wealth was primarily provided by their most famous commercial institution: the Verenigde Oost-Indische Compagnie (VOC or Dutch East India Company). While it is true that the Company brought great wealth and power to the Low Countries, the main sources for economic hegemony was the Dutch influence in the Baltic trade, the unique methods of shipbuilding, the systems of ship ownership, and a highly developed system of inland shipping (De Vries 1976: 117; Israel 1989: 48, 408–410; Van Holk 2017b: 75). The geographical location of the Dutch Republic in the northwestern tip of the European mainland was also considered to be a considerable advantage, connecting the Atlantic, Baltic, and the West-European hinterland via the Rhine and Meuse rivers. The national waters of the Netherlands (including many lakes, rivers, and their tributaries), functioned as the most important transportation network of people and merchandise for many centuries. Many of the transport routes led to a large inlet of the North Sea in the central part of the Netherlands that separated (and integrated) the Dutch lands in the north, east, south, and west (Fig. 3.1). The waters of this region were referred to as the Zuyder Zee and were considered the most important Dutch traffic junction in Medieval and Early Modern periods (see for example Van Popta 2012a; 2017b; Chapter 5).

The literal translation of the Dutch word *Nederland* is 'Lowland' and underlines the vulnerable location of the country on the borders of the North Sea, and how Dutch hatred of the sea also comes into play. Large parts of The Netherlands lie below sea level and were regularly flooded in the past. From the Iron Age onwards, as a first form of protection against the water, people started to live on artificial mounds called *terpen* (see for example Nicolay 2010; Nieuwhof 2016b). Then, in the Late Middle Ages, dykes were built along large parts of the Dutch coastline, providing supplementary and better protection against regular floods for the increased population of the Netherlands. However, the first dykes did not constitute an efficient barrier against the many heavy storm floods that scourged the land from the 12th century onwards (for example Gottschalk 1971; Buisman 1995; Jongmans *et al.* 2013: 682; Van den

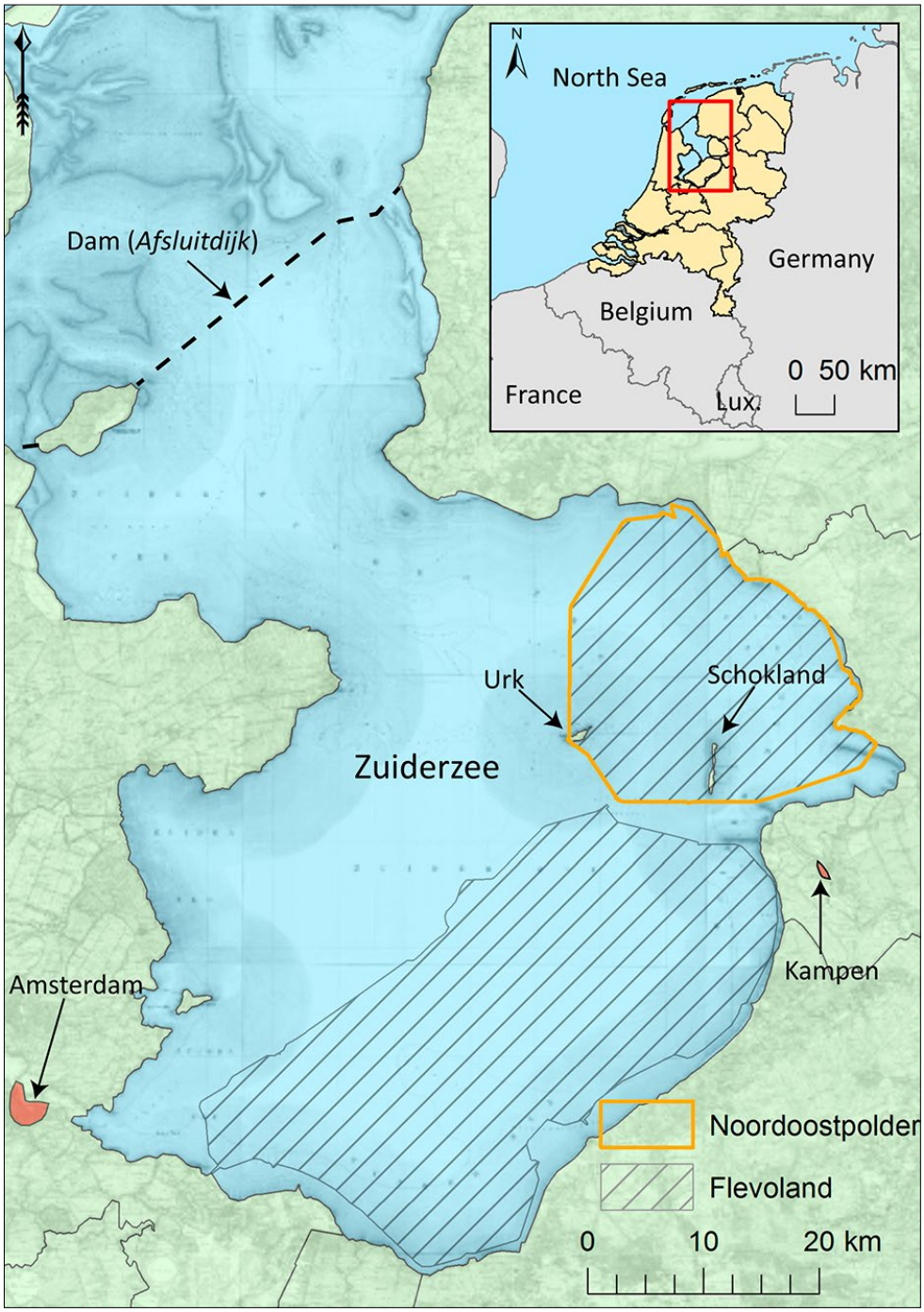


Figure 3.1. Geographical map of the Zuyder Zee region at approximately AD 1832. The shaded part of the sea is nowadays known as the province of Flevoland. The part of Flevoland with an orange outline is known as the Noordoostpolder region, corresponding to the north-eastern Zuyder Zee research area.

Biggelaar *et al.* 2014; Pierik *et al.* 2017: 10). Residents of the coastal zones were struck hard by the many floods, as cultivated land was washed away, complete settlements were inundated and thousands of people died. In order to win the battle against the water, drastic measures were undertaken, leading to the construction of the Zuyder Zee Works in the first half of the 20th century and the Delta Works in the second half of the 20th century (dams, storm surge barriers, sluices, and dykes). In AD 1932, the Zuyder Zee was artificially separated from the North Sea by the construction of a 32km-long closure dam (*Afsluitdijk*; Fig. 3.2).

A considerable part of the former sea was then reclaimed and put to use as arable fields. This new land is now known as the province of Flevoland. This unique piece of land, also known as both one of the largest artificial islands in the world by land reclamation (Eastern and Southern Flevoland) and as the largest ship's graveyard on land in the world, is the main subject of this study. The northern part of Flevoland, known as the *Noordoostpolder*, is especially of interest as it contains clear evidence of the dynamic battle the Dutch have fought against the water (see for example Wiggers 1955; Van der Heide 1965a; Van Popta 2017a).

Figure 3.2. The 32 km long closure dam Afsluitdijk (photo C. Messier, https://commons.wikimedia.org/wiki/File:Afsluitdijk_1031.jpg; CC BY-SA 4.0) separating the North Sea and Wadden Sea (left) from the IJssel Lake (former Zuyder Zee). Top left: the closure of the final gap of the dam in AD 1932 (Batavialand). Top right: Kadaster aerial photo of the Afsluitdijk (https://kaart.flevoland.nl/luchtfoto/).

Maritime archaeology and the MCL

Interest in maritime archaeology originated in the 15th century and was initially driven by the curiosity of antiquarians. The first scientific considerations date back to the beginning of the 19th century but were not yet related to archaeology. Charles Lyell's *Principles of Geology*, (1832) demonstrates for example the use of shipwrecks to date the youngest geological deposits (Muckelroy 1978: 11). In addition, shipwrecks were mainly examined from an economic/salvage perspective. The first systematic academic studies appeared in the late 19th century in Scandinavia, Switzerland, and Great Britain (Muckelroy 1978: 11–12; Bass 2013: 5). The methodological standard of underwater archaeological fieldwork was, however, by no means comparable with terrestrial investigations. Technological innovations in the first half of the 20th century, such as airlifts and the aqualung, improved the ability to excavate under water (Tuddenham 2010: 6). As a result, many wrecks were explored in a more systematic way, but a theoretical foundation was missing and the particularist focus remained (Muckelroy 1978: 10). Many scholars (for example Bass 1966; Kuhn 1970; Muckelroy 1978; McGrail 1984; Gibbins 1990; Van Holk 1991; Gibbins & Adams 2001; Flatman 2003; Delgado & Staniforth 2009; Tuddenham 2010; Bass 2013) have recognized the need for the theorization of maritime archaeology and the need to move away from a particularist/material culture driven approach to one that examines the wider contextualized significance of maritime cultural heritage sites. The work of Keith Muckelroy, *Maritime Archaeology* (1978), which is considered as the most important single statement of method and theory in the discipline 'maritime archaeology' (Gibbins & Adams 2001: 284), should be mentioned: Muckelroy focused on site-formation processes of wreck-sites, interpretative methodologies carried out in a scientific and analytic manner, and provided the academic world with a holistic definition of maritime archaeology: 'the scientific study of the material remains of man and his activity on the sea' (Muckelroy 1978: 4, 160–165; Tuddenham 2010: 7).

However, discussion ensued because the focus on ships and shipboard communities was too narrow; and it did not take into account shores, lakes, and rivers,

that is the terrestrial and inland part (see: McGrail 1984; Westerdahl 1986; Adams 2002). Therefore, a new concept was formulated that bridges land and sea, because maritime cultures are related to both: the maritime cultural landscape (Crumlin-Pedersen 1978; Westerdahl 1986; Westerdahl 1992; Westerdahl 2007; Westerdahl 2014). Although the first applications of the concept date back to the 1970s, it was internationally introduced by Westerdahl in 1992 in English (Westerdahl 1992: 6 and Westerdahl 2013: 733):

> *…the whole network of sailing routes, with ports, havens and harbours along the coast, and its related constructions and other remains of human activity, underwater as well as terrestrial.*

Mainly based on Scandinavian archaeology, it had a profound impact on maritime archaeology worldwide, as noted by Jasinski (1999: 9):

> *This concept proved very important for the development of, at any rate, a significant part of maritime archaeology because it shows how large a range of data archaeologists can exploit in their studies of human relation to the sea.*

The discipline moved to a more holistic understanding of the relation between maritime and terrestrial counterparts, not solely concentrating on shipwrecks and the seabed, and requiring an interdisciplinary approach (Tuddenham 2010: 8). Furthermore, the maritime cultural landscape approach turned out to be suitable for spatial research instead of only studying individual sites or major excavations (for example Bannerman & Jones 1999; Parker 1999; Baron 2008; Pollard 2008). It focuses not only on the physical remains of maritime cultures, but also on cultural practices, cognitive systems, and toponyms. All these aspects have clear relationships with each other and the landscape to which they belong.

Studying the maritime cultural landscape often starts from a landscape perspective. Even when a single shipwreck is examined, the changing environment of a wreck-site could lead to the consideration of the landscape. Apart from the important task of examining the ship construction and creating reconstructions, focus should be on the location of the wreck-site by conducting archaeobotanical, geomorphological, geological, and dendrochronological research, making the landscape a salient factor in maritime and nautical archaeology (Törnqvist 2013: 28; Westerdahl 2015: 229). The quote 'man in landscape—landscape in man' (Löfgren 1981; Westerdahl 1992: 5) could also be applied to wrecks: 'a wreck in landscape—the landscape in a wreck'.

This landscape exists at the intersection of culture and space, consists of material (*e.g.* morphology, subsoil, vegetation, settlements) and immaterial aspects (*e.g.* ideas, images, oral traditions, folklore) and is related to disciplines such as archaeology, history and geography (Kolen 2005; Ford 2011: 1); however, one should not confuse the landscape with terms such as 'land', 'nature' or 'space' (Ingold 1993: 153). There are many interpretations of the concept, depending on the perspective from which it is analysed and for what purpose: a landscape can, for example, be experienced, painted, studied, seen, or remembered. When studied, the approach and interpretation of the concept differs with each discipline. Even from an archaeological point-of-view only, there is wide variation in uses and definitions (Anschuetz *et al.* 2001: 158). Ingold describes the landscape as 'the world as it is known to those who dwell therein, who inhabit its places and journey along the paths connecting them' (Ingold 1993: 156). Gosden & Head (1994: 114) state that human action/culture creates landscapes, and landscapes then shape human action. Significantly, Anschuetz *et al.* (2001: 161, 190) define the landscape as 'a mirror of a community' or an 'arena of a community's activities'. Ford (2001: 4) summarizes a landscape as the physical environment perceptible to an individual and his or her perception of that environment. Duncan (2006: 7) considers the landscape as an arena within which a group's cultural interaction with the environment, other individuals and communities define and redefine cultural identity and practices and vice versa. These definitions share an important perception: 'landscape' suggests the presence and/or influence of people. One could say that all landscapes are experienced culturally and therefore all are cultural in character (Jasinski 1999: 17; Duncan 2006: 15).

The above-mentioned cultural landscape concept definitions are derived from archaeological studies that apply the concepts. As the number of (maritime) cultural landscape studies increased from the 1990s, (maritime) cultural landscape concepts became somewhat vague as many studies lack clear definitions. Recent works on maritime landscapes, such as *The Archaeology of Maritime Landscapes* edited by Ford (2011) and *Ships and Maritime Landscapes* edited by Gawronski *et al.* (2017) contain for example some articles that claim to target the maritime (cultural) landscape, but might more accurately be termed regional archaeological studies. So, what does it take to truly examine the maritime cultural landscape?

First, the concept of the maritime cultural landscape encompasses both physical (material) remains and cognitive (social and metaphysical) aspects (Duncan 2006: 13). Studies that only target material (archaeological) remains of the maritime cultural landscape should be termed as maritime archaeological landscape studies, rather than maritime cultural landscape

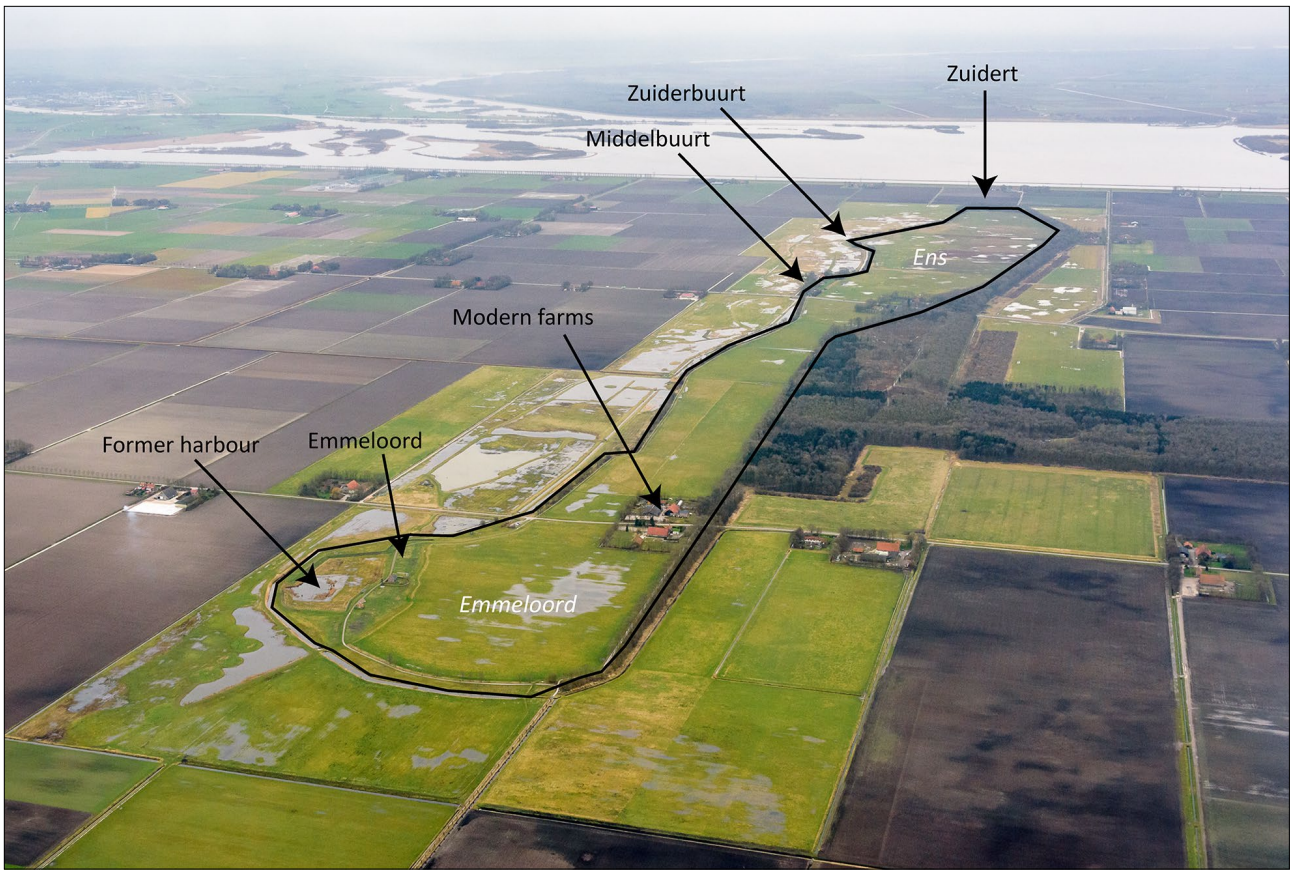


Figure 3.3. South facing aerial photograph of the Noordoostpolder region, depicting the modern day polder landscape (arable fields and farms) and the former island Schokland (black outline) with its abandoned settlements. Photo: Jan Willem Schoonhoven; edited by the authors under licence CC BY-SA 4.0. https://nl.wikipedia.org/wiki/Schokland#/media/Bestand:Schokland_luchtfoto.jpg

studies. Originally, however, the definition of the maritime cultural landscape was exclusively focused on material remains (Westerdahl 1978), as a way of protecting physical aspects of maritime cultural heritage, without analyzing them (Westerdahl 1994: 266). Westerdahl soon adapted his definition stating that 'a natural way of discovering the maritime cultural landscape is by way of the cognitive perspective of local tradition' (Westerdahl 1992: 5–6).

Second, and related to the first point, an interdisciplinary set of data sources is needed to apply the concept. One should not only use archaeological sources (material, spatial), but also historical, geological, geomorphological and cartographic data sets, and consult ethnography, folklore and oral history (Duncan 2006: 19; Duncan & Gibbs 2015: 27). It is here where a distinction can be made between the concept of maritime landscape and the concept of maritime cultural landscape. The first can be studied within different disciplines based on physical areas or regions, but the latter is bound to an interdisciplinary perspective based on cultural and social aspects of the people being studied. This should lead to a holistic representation of the maritime cultural landscape: incorporating every aspect of culture and its material expression (Westerdahl 2017: 7). Approaching the concept holistically also has disadvantages: it can cause the methodology to become vague, making it applicable to almost everything; however, it goes against the ambiguous nature of the concept to work with just one accepted approach (Duncan 2006: 37). Instead, the methodology used should be clearly defined and the implicated aspects of each research project specified.

Reflecting on the MCL of the Zuyder Zee

The perception that landscapes are continuous and in a constant state of change is certainly appropriate for the Zuyder Zee area in the Netherlands. It might be hard to accept that the modern polders, with their large farms and open fields were once controlled by the Zuyder Zee, but both must be considered parts of the same cultural landscape. When this observation encourages a detailed study of the region, the connection between the past and present situations becomes clearer: many present-day material and intangible remains (such as pottery sherds, bricks, and toponyms) testify to past maritime cultural landscapes.

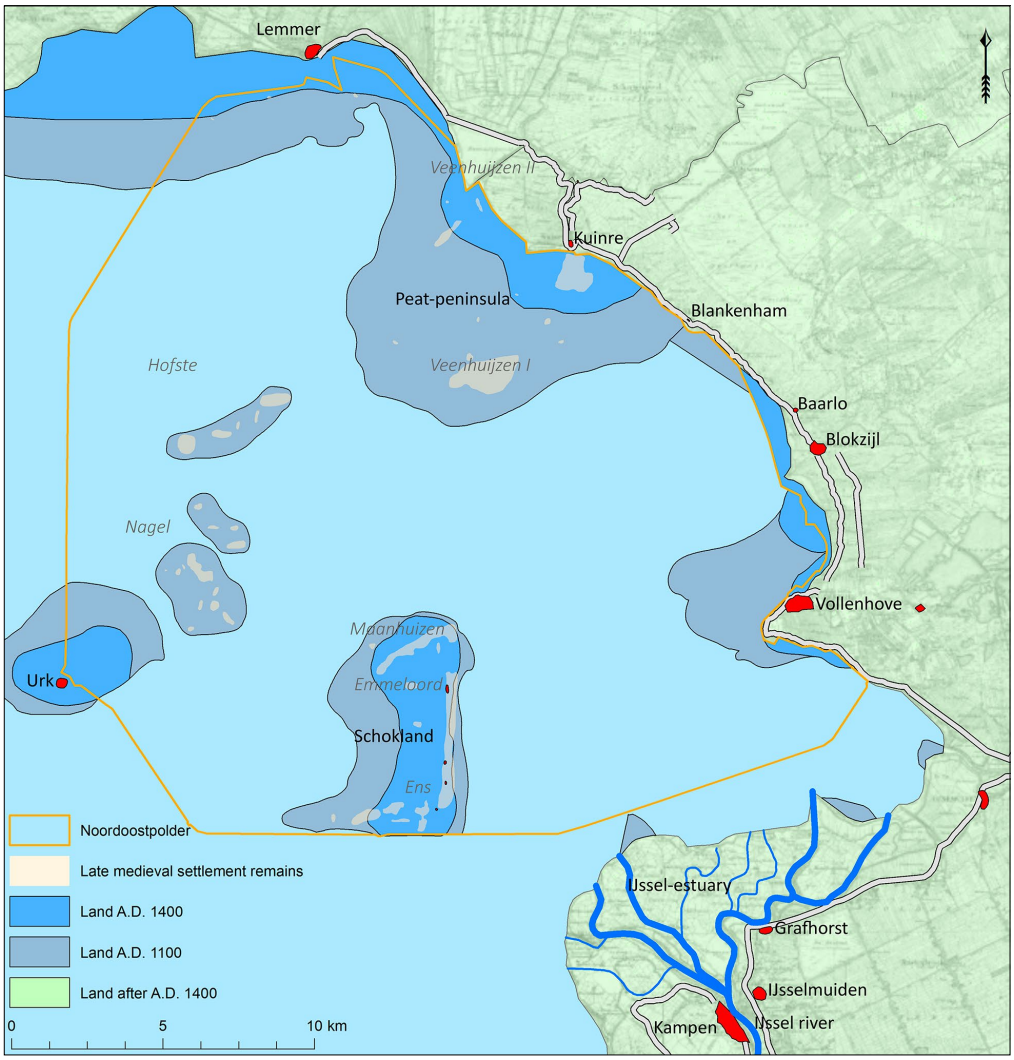


Figure 3.4. Simplified palaeogeographical map of the research area, depicting the land loss in the Late Middle Ages and the presumed locations of drowned settlements. The grey 'italic' names represent relevant toponyms and place names.

It would be hard to recognize the northeastern Zuyder Zee region of the Late Middle Ages in its modernday appearance (Fig. 3.3). The sea dominated the northwest, whereas it was artificially controlled in the northeastern part of the region. There was a coastal zone stretching from the north via the east to the south, with small settlements close to water, but protected by small dykes. A journey along this coastal peat area would have lead through the small settlements of (from north to south) Lemmer, Kuinre, Blankenham, the small chapel of Baarlo, the first houses of what would become Blokzijl, and finally Vollenhove (Fig. 3.4). To the south of Vollenhove, the IJssel River discharged into the Zuyder Zee with a rapidly expanding delta (Cohen *et al.* 2009: 90–92; see also Chapter 2). About 6km upstream on the IJssel River, the largest and most influential town within the research area, Kampen, could be found. A peat peninsula stretched westwards of Kuinre into the sea and contained several more settlements, of which Veenhuizen (Fenehuysen) is the only one known by name (Van Popta 2017a: 135).

From the most western point of the peninsula, several islands must have been visible on the horizon, of which Urk was the largest one. Its Pleistocene boulder-clay base withstood the eroding power of the Zuyder Zee (Geurts 2005: 18). The other islands, no more than vestiges of the peatlands that once covered the whole region, housed small settlements that were taken by the sea at the end of the Late Middle Ages. Nowadays, only some disturbed remnants (such as pottery sherds and bricks) the Noordoostpolder testify to these once-inhabited islands. One peat island did survive the eroding power of the Zuyder Zee: Schokland. The island can be found between Urk and Vollenhove and is now a UNESCO world heritage site. Its present shape, a thin north-south orientated piece of land, is but a small reflection of its late medieval size, which once stretched much further to the west and south. Archaeological research has proven that the inhabitants of Schokland Island lived on small artificial mounds (for example Geurts 1999; Van Popta & Aalbersberg 2016). The northern part of the island was called Emmeloord

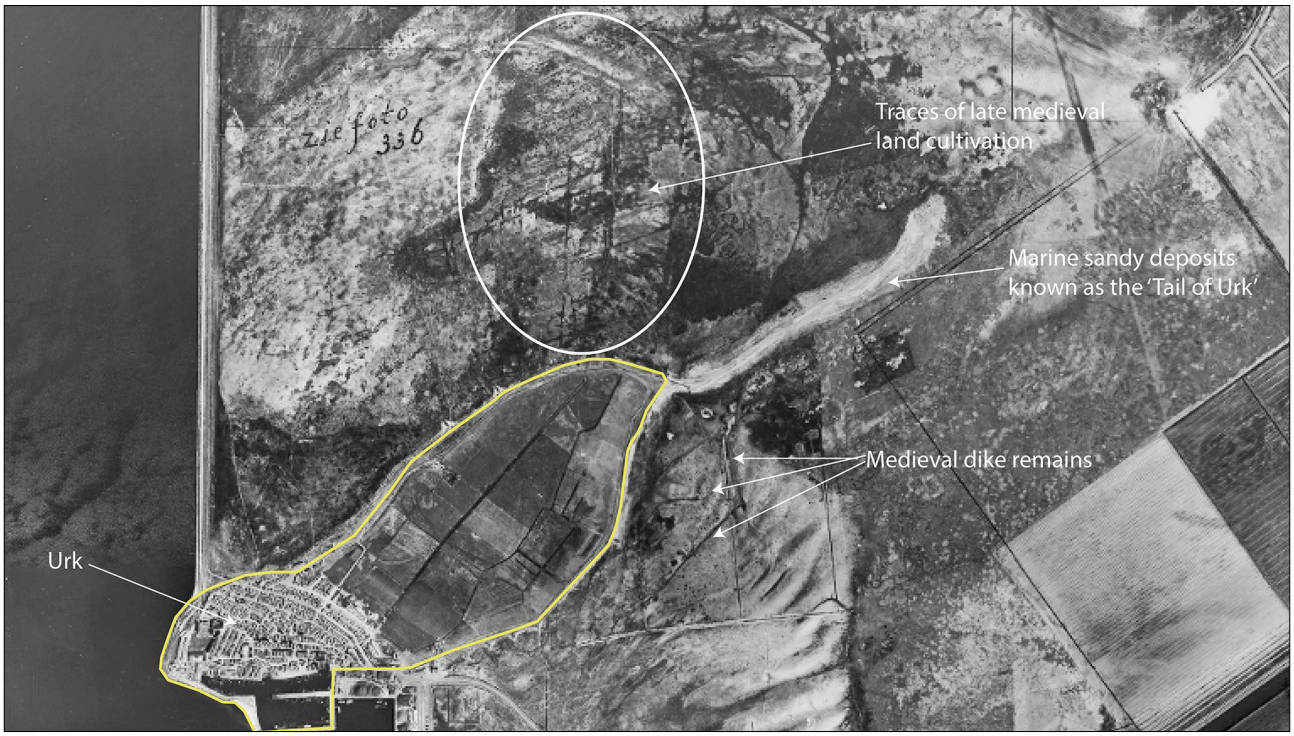


Figure 3.5. Historical aerial photograph (1949) of the island Urk, taken shortly after the reclamation. Traces of land use are clearly visible to the north of the former island, while several medieval dike remains can be seen to the east (after Kadaster and Province of Flevoland).

and the southern part was known as Ens. The late medieval habitation on the island was not concentrated in just one spot, but could be found all along the sheltered eastern side of the island. Recent research has revealed that the lands to the north of Emmeloord were also relatively densely populated and might be related to the historical toponym of Maanhuizen, of which the part *huizen* (houses) refers to the presence of a settlement (Van Popta & Aalbersberg 2016; Van Popta 2017a). In no more than a few centuries, most of the peatlands in the northeastern Zuyder Zee region disappeared entirely. The islands Urk and Schokland were drastically reduced in size, leading to limited possible habitation sites, while the other islands, the peninsula and the coastal zone were completely washed away (Fig. 3.4). Based on historical maps, it is estimated that the Zuyder Zee gained and maintained a more-or-less stable area after AD 1600, although small-scale land erosion continued until the large-scale reclamations of the 20th century.

Theoretical concepts of the MCL

There are several theoretical concepts that can be associated with the maritime cultural landscape, although the application of some are time-bound and historical in nature. An overview is presented here of the most relevant concepts and aspects that are related to the late medieval Zuyder Zee region.

Maritime culture

One way of defining maritime culture is by comparing it with inland (agrarian) culture; one should be conceptually different from the other. Maritime culture requires a relationship between humans and the sea, in which water can be considered both as a resource and as a barrier or a threat (Washburn & Lancaster 1968: 294; Erlandson 2001: 288; Westerdahl 2013: 745). Using the water as a resource can require aquatic adaptations, often depending on local traditions and related to the usage of boats (Westerdahl 1992: 5). However, agriculture was also part of the landscape: it is unlikely that past maritime cultures were fully dependent on marine resources and instead also took advantage of agricultural resources (Duncan 2006: 298; Westerdahl 2013: 744). The opposite is also unlikely, that is agrarian coastal communities that completely depended on agricultural resources. When projecting these assumptions onto the late medieval northeastern Zuyder Zee region, it becomes clear that the islands in the study area were also dependent on both types of resources: the remnants of medieval land parcels (ditches) on the islands testify to land cultivation, while the presence of harbours and the wrecks of fishing vessels and cargo vessels prove 'the use of the sea' (in Swedish *sjöbruk* or in Dutch *zeegebruik*, a term invented by the Swedish maritime ethnologist Olof Hasslöf) (Fig. 3.5 and 3.6).

Figure 3.6. Two archaeological examples that testify of the use of the sea: the remains of a fishing vessel (top; Batavialand) and a freighter (bottom) that both wrecked on the Zuyder Zee (IFMAF).

Maritime cultural centres

Concentrations of material remains and relevant toponyms that (for example) refer to settlements, harbours and sea ports should be interpreted as 'centres' (Westerdahl 2013: 738). The northeastern Zuyder Zee region contains several examples of these maritime cultural centres, of which some are still preserved, such as Lemmer, Vollenhove, Kampen, while others have completely eroded away and are only known from historical sources, such as Nagele and Marcnesse. As a result of the reclamation of the Zuyder Zee and the polder construction, the shoreline shifted 20–25 km to the west. This caused many of the remaining settlements to lose their status as maritime coastal centres and their maritime functions, although in some cases the maritime identity remains.

Urk is a good example of a maritime cultural center that refused to give up its identity, despite the surroundings changing drastically. The island is now part of the mainland, with forest and meadows on its northern and eastern side, whereas the western and southern sections now border a lake instead of a sea (Fig. 3.7). Urk is nevertheless still an active fishing community, with a fishing fleet that now operates on the North Sea (Geurts 2005). One can still experience the distinct behavior and culture of the community when visiting Urk as the settlement radiates seclusion and its inhabitants cherish their dialect and customs. This is illustrated, for example, by the fact that one should not say 'I am in Urk'. Instead, 'I am **on** Urk' is used, as when Urk was still an island. The words of Greverus (1999: 63) are especially suited to describing Urk: 'it takes a long time before one

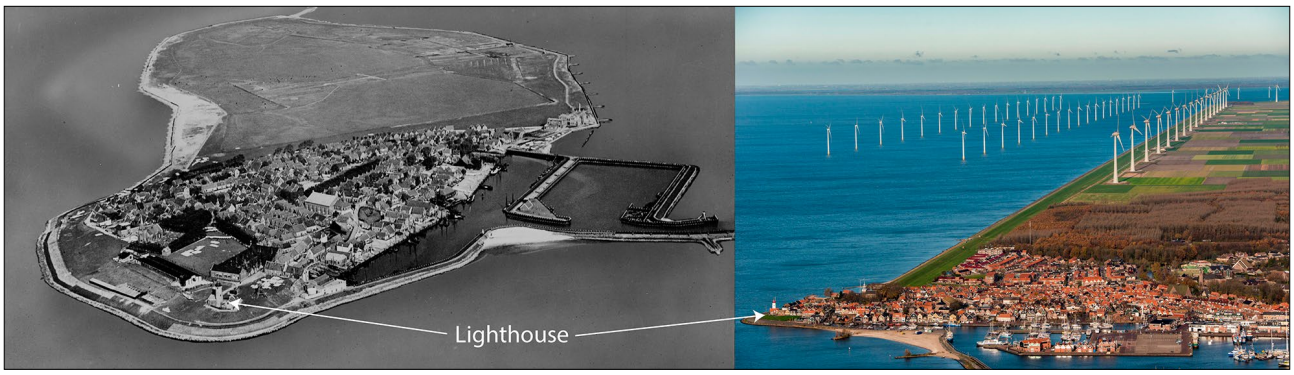


Figure 3.7. The island of Urk before (left: photo collection Nederlands Instituut voor Militaire Historie, No. 2011-0511, Wikimedia) and after (right: Persgroep1.net) the reclamation of the Zuyder Zee. The iconic lighthouse is clearly visible on both photographs.

can become an "islander", if it happens at all'. Urk should therefore be considered a cultural island, even though its physical appearance is no longer that of an island.

Maritime cultural areas

Maritime cultural areas are zones with distinct maritime cultural characteristics that supersede other borders and can be distinguished by elements such as settlement structures, boatbuilding traditions, ship types and place names (Westerdahl 2013: 738). The Zuyder Zee region should not be interpreted as just one distinct maritime cultural area, although there are some similarities between the different parts of the region, with regard to social behaviour and character of the maritime centres. However, when focusing on the region, differences in maritime culture are visible between its different parts. For example, the northern part of Schokland Island, Emmeloord (Fig. 3.3), at first belonged to the bishop of Utrecht, as recorded in 13th-century historical charters, and was ruled by the Lords of Kuinre in the first half of the 14th century (see also Chapter 6). The southern part of the island, Ens, is not mentioned in the historical charters and may have developed separately from Emmeloord, although sharing the same island territory. Especially during the 16th century, the division between the southern and northern halves of Schokland was accentuated, with the northern side remaining Catholic and focused on Amsterdam; whereas the southern part joined the Reformation, became Protestant, and focused mainly on Kampen and the east shore (Van Hezel & Pol 2008: 64).

Transport zones

The zones of transport geography are also known as transport zones (Westerdahl 2013: 748). These zones need cognitive recognition in order to exist, and can be visualized in a spatial way. A transport zone does not equate to a single path or a coastal sailing route, instead a transport zone is revealed by distinct relationships between aspects such as toponyms, vessel designsand their adaptations (such as flat-bottomed for shallow waters), shipping systems, the character of coastal settlements, and vocabulary (see also: Westerdahl 1998; Duncan 2006: 28; Westerdahl 2013: 747–748; Caporaso 2017: 8). Transport zones, to a large extent, are influenced by the borders of maritime cultural areas and *vice versa*. Westerdahl, therefore, divided transport zones into seven different types that can overlap and interconnect (Westerdahl 2000; 2013). In this case, the northeastern Zuyder Zee region should be treated as the fifth type: an estuary lagoon zone, connecting the North Sea to the Dutch, Belgium and German hinterland (Westerdahl 2000: 15; Westerdahl 2013: 749). The region connects with zones based on river valleys (such as the IJssel River) and the coastal transport zones of the North Sea and the Baltic Sea (Fig. 3.8). It highlights the importance of the Zuyder Zee, for many ships used it as the transport route in order to reach important (Hanseatic) towns like Kampen, Zwolle, Deventer, Hoorn, and Amsterdam. It is important to keep in mind that transport patterns, although culturally embedded, should be considered as corridors that exist naturally in the environment.

Transport enclaves

Transport enclaves are concentrated, perennial settlements of maritime-based societies that have a strong focus on the various means of sea transport. These enclaves have distinct harbour functions and the majority of their inhabitants are involved in maritime activities, serving for example as stevedores, dockworkers, skippers, and crews (see also: Westerdahl 1994: 267; Westerdahl 2000: 17; Westerdahl 2013: 749). It is hard to prove a strong maritime focus for settlements in the Zuyder Zee region. On the one hand, many of the settlements in the research area depended partially on agricultural resources and did not focus solely on maritime pursuits. On the other, the connection with

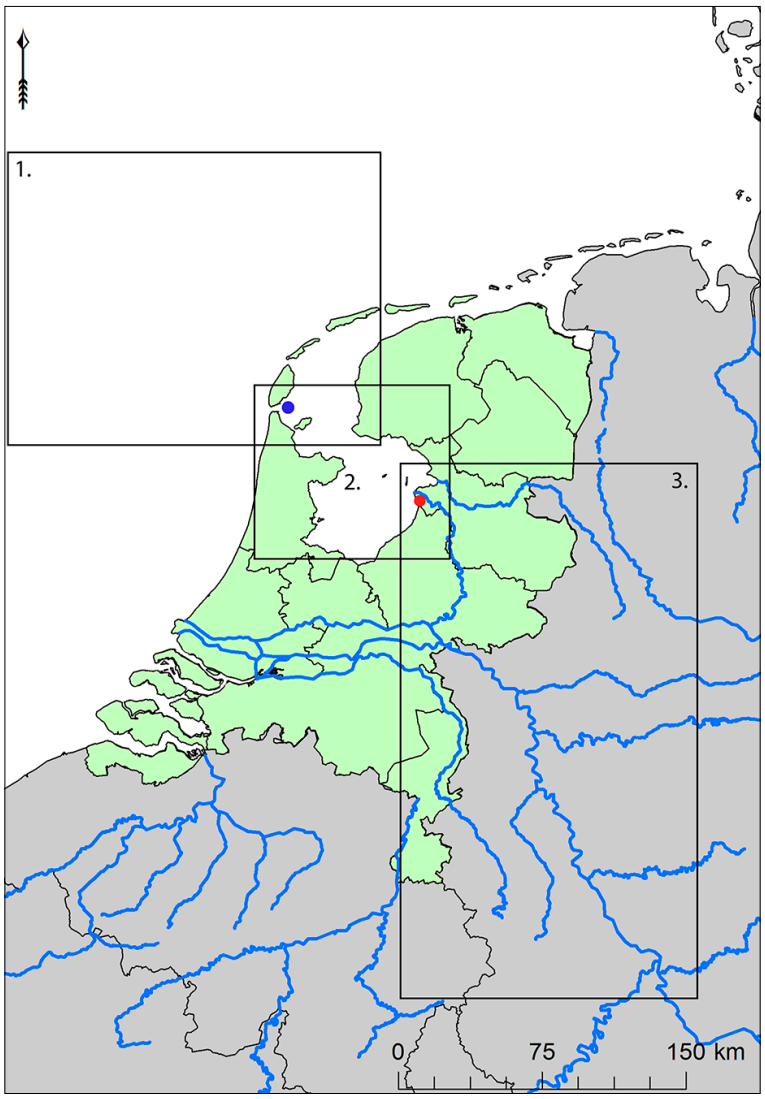


Figure 3.8. Spatial representation of the three relevant transport zones: 1. Zone of the open sea, 2. Estuary lagoon zone, 3. Zones based on river valleys. The blue dot represent the transit point 'roadstead of Texel' (between zones 1 and 2) and the red dot represents the transit point 'city of Kampen' (between zones 2 and 3)

water (fishing, transport, sea resources) must have been there for most of the settlements. Against this, settlements such as Fenehuysen have tended to move away from the water (see Chapter 5), rather than staying close to the shore. Nonetheless, in a maritime zone such as the northeastern Zuyder Zee area, there have been enclaves that monopolized maritime activities within the zone (Westerdahl 2008). The most influential transport enclave in the Late Middle Ages would have been Kampen, due to its focus on Baltic trade and its position near the IJssel river mouth. In fact, Kampen pops up predominantly in late medieval Scandinavian texts and treaties, underlining its influential position (Wubs-Mrozewicz 2008: 38; Jager 2015: 114). Other settlements within the research area, such as Urk and Schokland, eventually gained a strong focus on maritime activities as a result of decreased agrarian possibilities, for example decline of arable fields due to storm floods (Geurts 2005: 76). In the 17th and 18th century, settlements like Blokzijl and Zwartsluis focused on peat trade making them more-or-less transport enclaves.

Transit points

Transit points can be found in between zones including rivers and inland waters (Westerdahl 1992: 6; 1994: 268). They highlight the transition between transport zones. In the study area, the city of Kampen can be considered as a transit point, due to its location near the IJssel river mouth where the estuary lagoon zone meets the zone based on river valleys. In the Late Middle Ages, large cargo vessels, such as the cogs of the Hanseatic League, would sail from the North Sea across the Zuyder Zee to Kampen where they delivered their goods. Smaller (flat-bottomed) ships, such as barges and small cogs, would then transport goods upstream on the IJssel River to other settlements and smaller rivers in the Dutch, Belgian and German hinterland (Robijn 2005: 181; Weststrate 2008: 251; Van Holk 2010: 135; Weststrate 2010: 152; Jager 2015: 113). In the 17th century, the large and fully loaded cargo ships of the flourishing Dutch East India Company were unable to sail across the shallow waters of the Zuyder Zee towards Amsterdam, Kampen, Hoorn, and other large ports. As a solution, a

new transit point was created at the roadstead of Texel, the most westerly island in the Wadden Sea region. From that moment onwards, imported goods were transshipped to small lighters, such as *kaag*, *wijdschip*, and (in some cases) the *waterschip,* which transported the cargo to harbours along the Zuyder Zee coast (Petrejus 1971: 20; Haalmeijer & Vuik 2006: 93). Although transit points highlight the transition between transport zones, these transitions should not be considered as borders. This can be illustrated by the fact that the late medieval cog vessels (freighters) were able to sail in all kinds of transport zones: open sea, along the coast, in intertidal lagoons, and on rivers, as is proven by the wrecks that have been found in all these different types of waters (Van Holk 2010).

MCL aspects and archaeological remnants

A maritime cultural landscape can be divided into different aspects in order to systemize and understand the remains studied using the concept (Westerdahl 2011: 339; Caporaso 2017: 3). Each of these aspects has its own way of representing the cultural component in a maritime landscape and can be the subject of an entire study. Each of the aspects is first introduced in general, before it is related to the Zuyder Zee region.

Economic landscape (sustenance)

Economic landscapes are especially important for small (isolated) maritime communities to be able to support themselves. Study of these landscapes should not only focus on fishing, hunting and gathering, but also on coastal agriculture (Westerdahl 2013: 746). In the northeastern Zuyder Zee region, coastal agriculture and fishing must both have been important for the maintenance of the inhabitants of the small maritime communities, although they might at first not have been in perfect balance. There are several arguments in favor of strong agrarian influence in the late medieval northeastern Zuyder Zee region. First of all, there are only a few surviving traces that testify to fishing activities, such as several historical charters that mention the fishing rights (Geurts 2005: 41). It should, of course, be remembered that fishing must have been a commonly undocumented activity, although this implies small-scale activities. Furthermore, the inhabitants of several settlements, such as Fenehuysen, tried to flee from the water, rather than searching for it. This might, of course, also be caused by the lack of a proper coastal defense (see also Chapter 5). Finally, archaeological research has led to the discovery of late medieval systems of coastal land parcels, likely used for arable farming and grazing (Van Popta 2017a: 135) (Fig. 3.9). Altogether, and from

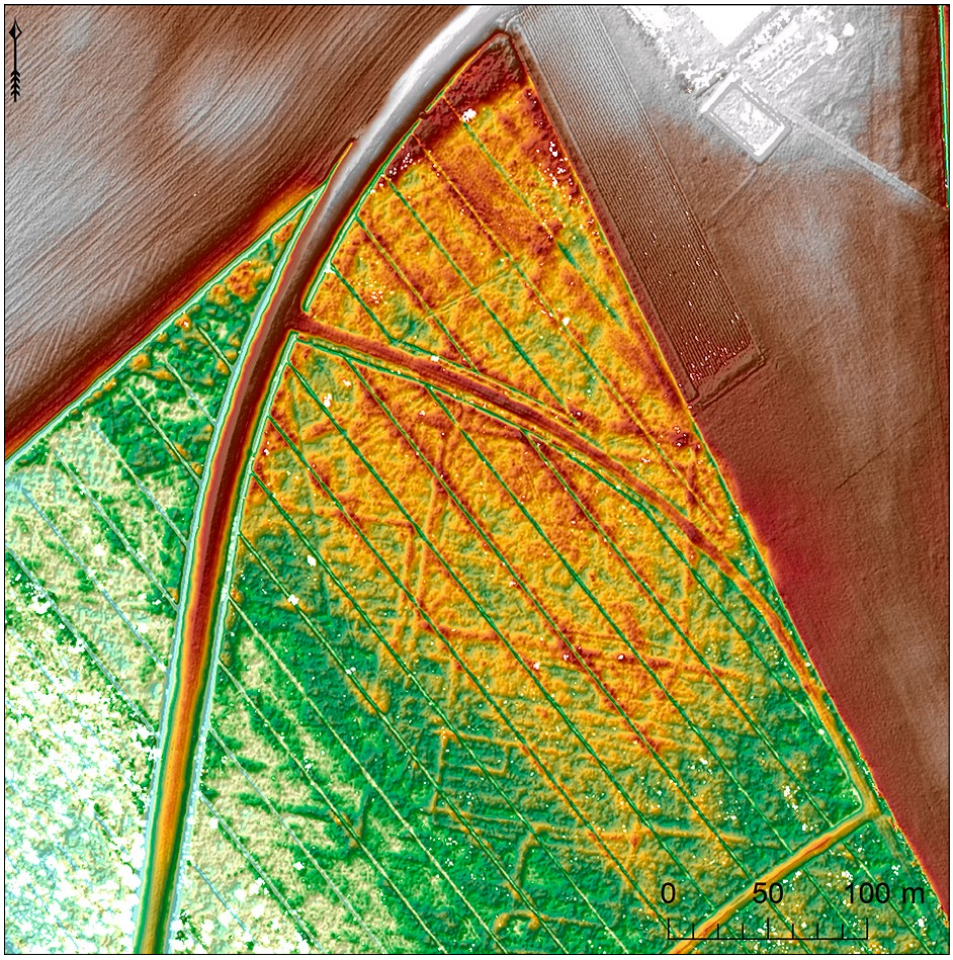


Figure 3.9. Detailed LiDAR-data, depicting late medieval and early modern traces of land cultivation (network of ditches), close to the eastern shore of the Zuyder Zee (AHN2).

an economic landscape aspect, a part of the inhabitants in the research area could be characterized as 'maritime farmers'.

Transport (communicative) landscape

In general, transport landscapes can include all kinds of transport entities such as routes, seamarks, pilotage, harbours, roads, and portages. These landscapes are affected by human choices that are made while travelling through the landscape. These choices depend highly on the means of transportation (by foot, by ship) and familiarity with the region. The dynamic and ever-changing nature of the area must have made navigation an important yet difficult factor. Nowadays, little remains of the late medieval nature of the research area, making it hard to estimate which specific entities were used. The most constant navigation factors must have been the skies, (church) towers, and wooden beacons. As a matter of fact, these were still used as important navigation factors in the final era of the Zuyder Zee (1800–1932; see for example Havard 1874).

Relocation of maritime communities, bringing their own cultural baggage (Chapter 6 targets these aspects in more detail), has also been an important factor in transport landscapes, as is proven by studies on transported maritime cultures (Gosden & Head 1994; Miller 2002; Westerdahl 2003; Duncan 2006; Duncan & Gibbs 2015). The cause of the relocation of a community can however differ as people may have chased resources (food, raw materials), economic wealth, or had to flee from the water and were searching for new land. The first can be associated with coastal fishing communities (chasing fish) and small island communities with insufficient resources and surplus, such as 19th-century Schokland. The island was completely abandoned as the inhabitants were no longer able to support themselves, lacking space and arable lands. They literally took their own houses and rebuilt them in other towns along the Zuyder Zee coast (Van Hezel & Pol 2008: 212). Chasing economic wealth has also occurred in the Zuyder Zee region, for example, inhabitants of the island of Urk migrated to the flourishing town of Kampen in the 14th century (Geurts 2005: 41). Meanwhile, residents from Kampen owned estates on Urk (De Vries 1962: 47). The last seems to hold water for the small coastal communities of maritime farmers (for example Fenehuysen) in the Zuyder Zee region that were on a constant move from the water, although their way of land cultivation (dehydrating the peat) might actually have turned against them, as it caused rapid erosion and compaction of the peat and consequential increased influence of the sea.

The outer resource landscape

The outer resource landscape is considered mainly for shipbuilding and the equipment of vessels. Due to the poor peat grounds of the northeastern Zuyder Zee region, the local resource landscape for shipbuilding and vessel equipment was very limited. Timber for shipbuilding (especially oak) came, in many cases, from the Northern Netherlands, Germany, the Baltic, or Scandinavia, where appropriate timbers were available in profusion (Van Holk 2010: 138). Several cog wrecks from the Zuyder Zee (NM 107, OG 77, ZC 46, ZO 36, ZN 43) contain timbers that come from the Netherlands and/or Westphalia (Germany), indicating that the ships were built in close proximity to the Zuyder Zee region. The city of Kampen owned its own cogs, but they were not built in the city itself: in many cases, merchants must have purchased the ships from larger cities, such as Hamburg or Lübeck (Jager 2015: 377).

The inner resource landscape

The inner resource landscape represents production of surplus, for trade and for the maintenance of shipping and ship expeditions. In the study area, agricultural production was extremely efficient in the Late Middle Ages, and a prerequisite for an early development of trade. Urk, for example, profited from arable farming since the 10th century AD. Its lower lands were used as meadows, while higher ground was suitable for crop cultivation of, among others, carrot, beet, and rye (Kerkhoven 2003: 59). German Emperor Otto I (AD 912–973) donated fields on Urk to several monasteries, which underlines the value of farming in the Late Middle Ages. One of these, the St Odulphus monastery of Stavoren, even owned an agrarian manor on Urk (Geurts 2005: 40). The surplus from the fields that belonged to the manor must have been shipped across the Zuyder Zee towards Stavoren itself. The city of Kampen also gained its wealth in the Late Middle Ages as a result of trade, but it mainly focused on the long-distance trade of goods and surplus from the whole of northwestern Europe (Frankot 2012: 77). Regionally available resources and surplus, the inner resource landscape, therefore played a less important role in the economic focus of the settlement.

The territorial landscape

This aspect of the maritime cultural landscape merges into the 'power landscape': the landscape of ownership, control, and allegiance. Both landscapes are often coupled with a landscape of defiance or internal resistance. In the Late Middle Ages, the study region was part of the Holy Roman Empire and managed by the bishop of Utrecht, although several parts of the area were gifted to monasteries (Vreugdenhil 1999: 15–17; Geurts 2005:

32; Henstra 2010a: 8). In the 13th century, the bishop of Utrecht tried to effectuate his authority by appointing *ministeriales* to control specific regions (De Boer & Geurts 2002: 33; Geurts 2005: 35). One of these *ministeriales* was the so-called 'Lord of Kuinre'. In the 14th century, his descendants became more-or-less independent earls: they started minting their own money, lived on a strategically placed castle site near Kuinre, and started controlling 'their' territory by charging a toll and possibly privateering on the water (De Boer & Geurts 2002: 42). In the same period, more *ministeriales* tried to become independent earls, causing the territorial landscape to divide and disintegrate.

The cognitive landscape

The cognitive landscape is the most specific aspect of maritime culture, besides the economic basis and the transport aspect, and the factor that makes the maritime landscape cultural. This element contains references to all other aspects (by way of tradition of usage, and place names). In a way, it is possible to state that many medieval maritime cultural aspects of the study area belong to the cognitive landscape due the violent erosion of the Zuyder Zee. Historical charters mention for example several place names of medieval settlements that eventually drowned and physically disappeared. They are, however, still part of the cognitive landscape due to historical and modern references: a few of modern-day polder settlements, such as Nagele, Emmeloord, Ens and Marcnesse, carry the same name as their late medieval predecessors (Fig. 3.10).

Inhabitants of the northeastern Zuyder Zee region were also able to create mental maps of the late medieval region. This can be illustrated by the case of the somewhat mysterious drowned medieval settlement of Nagele. The name of this settlement is mentioned in several late medieval charters and other historical written texts, meaning that it must have existed somewhere within the research area. However, after the 20th-century reclamations, no archaeological remains were recovered in the former seabed that pointed directly towards Nagele. Local folklore led nevertheless to the creation of mental maps that pinpointed Nagele: for centuries, fishermen told stories of their nets getting snagged on grave stones on the seafloor, or that on stormy nights they could hear church bells ring in the middle of the sea, and that during extreme low tide brick walls of the drowned settlement could be spotted above the water (Reinsma 2009). Of course, these tales should be taken with some skepticism, but they did lead to the origin of the toponym '*De Nagel*', indicating a large shallow in the Zuyder Zee to the northeast of Urk. It is as yet unclear whether this shallow is the actual location of the settlement of Nagele, but there are strong archaeological indications (concentrations of archaeological material) that a late medieval settlement was indeed situated in its proximity (Van Popta 2016: 85).

There can also be an enormous wealth of place names denoting very small places along, for example, the shorelines. This wealth of names can be retrieved through oral histories and toponyms, for example from maps, or it can depend on a living landscape where all place names still carry a very relevant significance among maritime (and other) people. They disappear when shores recede, but only slowly. Some remain at the same spot. Shore names might for some time appear in a permanently inundated area or for that matter former territorial (inland) names as designations for shallows, fishing grounds, or bottom areas. This is illustrated by a

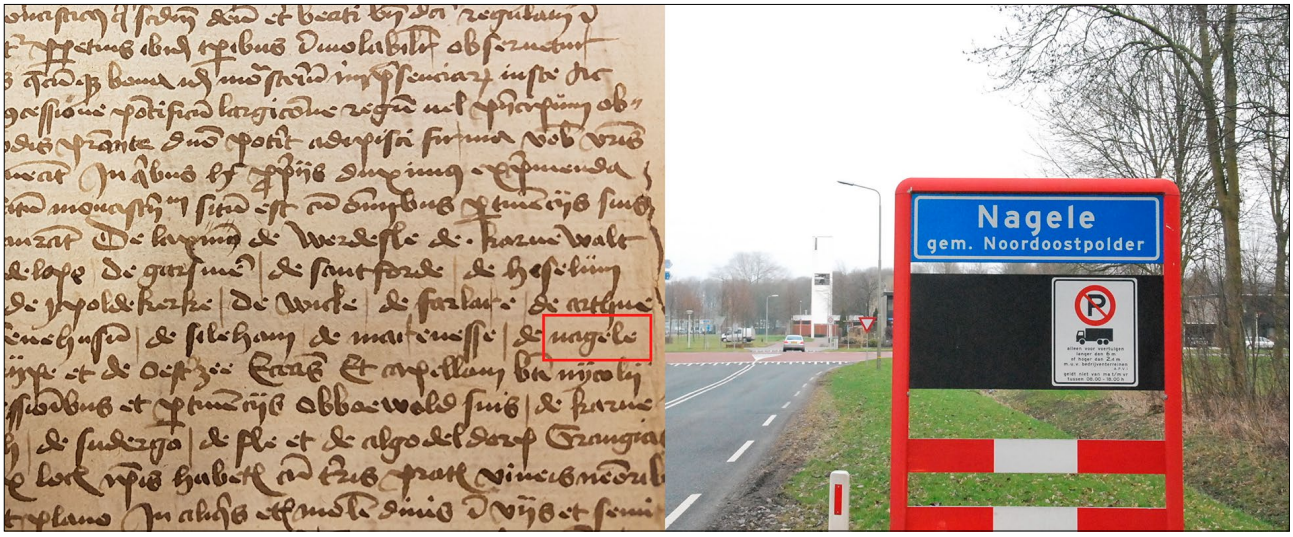


Figure 3.10. The place name 'Nagele' (red outline) mentioned in a copy of a 13th-century cartulary (left; after Tresoar), and the nameplate of the modern village Nagele, of which the name refers to its medieval predecessor (Dorpsbelang Nagele).

16th-century map (Christiaan Sgroten) of the research area, which depicts the name '*Hofste*' (house) on a shallow in the Zuyder Zee, possibly referring to one of the late medieval drowned settlements in the region that eventually became a shallow.

The ritual landscape

The ritual landscape is often degraded as superstition, but often forms a consistent system of beliefs: rather than names and behaviours being taboo, a system based on what is normal ('Noa' to use the Maori term) can be seen for (place) names and the socially conditioned ways of tackling the vicissitudes of maritime life. These can be seen primarily on board vessels but are also applicable at the shore and in the liminal area of land, however that is defined. A well-known ritual activity is the custom of the seaman's baptism, or initiation for seaman novices, that certainly originated on the coasts of Europe, although mostly connected with the open sea and the Line (the equator). Little is known of the ritual landscape of the Zuyder Zee, and the rite of passage occurs relatively far from the region, but there are some examples that testify to a consistent system of beliefs. The first focuses on the submerged settlement of Nagele, which has already been introduced as part of the cognitive landscape. The settlement disappeared tragically after several major floods in the 13th and 14th centuries, not only physically, but also in written sources. However, in one oral story handed down through the ages, Nagele is described as a dark place, a place that brings no luck. The story started with two men fighting in a pub at Emmeloord, not far from Nagele. A priest tried to separate the fighters, but instead he was stabbed in the heart. Before he died, he shouted out loud that the ill-fated settlement of Nagele would be taken by the sea and that fishermen would have their nets destroyed on its remains (Van Hezel & Pol 2005: 44). The fact that this oral story is still told means that it must have had a great impact on the people that sailed on the Zuyder Zee.

The most commonly known taboo attributed to northwestern European maritime communities is probably taking women on board, as it was considered to bring bad luck (Westerdahl 2005: 9); however, many shipwrecks and historical sources prove that at a certain moment in time — definitely from the 18th century and onwards — whole families lived on ships that sailed across the Zuyder Zee. During archaeological excavations of shipwrecks, items have been found that can clearly be related to the presence of children and women, such as toys, small leather shoes, jewelry, dresses and women's leather shoes (Van Holk 1996). Furthermore, historical newspapers mention on several occasions that complete families (father, mother, children) drowned as a result of disasters on the Zuyder Zee. In contrast, there was also a positive connection between females and ships, as many skippers would name their ships after their wives. When studying 19th-century newspaper notifications of ship disasters on the Zuyder Zee, many ships are mentioned with Dutch female names, such as *Catharina* (wrecked AD 1894), *Eva* (wrecked AD 1885) and *Lutina* (wrecked AD 1888; Fig. 3.11) (Newspaper Archive Royal Dutch Library).


Belooning van f 10

wordt uitgeloofd aan den vinder van de lijken van JAN KISJES Rz., schipper, en REINDER TULP, knecht aan boord van het schip *Lutina*, in den avond van Dinsdag den 20 Nov. jl. tusschen Urk en Schokland gezonken.

Zuidwolde (Dr.), 24 November 1888.

H. KISJES.

Figure 3.11. An example of the use of female ship names in the Zuyder Zee region. The wreckage of the ship Lutina, named after the shipper his wife, was mentioned in a 19th century newspaper (bottom; Koninklijke Bibliotheek). The wreck of the ship was eventually discovered in Eastern Flevoland in 1976 (top; Batavialand).

Leisure landscape of today

Knowledge of the cultural history of the study area can now be experienced or better enjoyed in many ways. The reclaimed land of the Zuyder Zee is, however, not the most popular destination for tourists and day trippers. The tourists that do visit Flevoland often search for spacious camp sites and nearby water for recreational purposes. Interest in local culture is often missing. A first step would be to make tourists aware that the surface they are on is actually a former seabed. The tourist business has thought of some ways to illustrate the maritime history of the region. Many of the wreck-sites have been accentuated with specific signs and the contours of the former island of Schokland are, for example, highlighted

Figure 3.12. The lighthouse Oud-Kraggenburg, once an isolated location at 6 km from the mainland (left; Emmeloord.info), now part of the mainland and completely surrounded by meadows (right; photo Bayke de Vries, https://commons.wikimedia.org/wiki/File:Oud-Kraggenburg.jpg, public domain).

by trees that were planted after the reclamation. Former moles and jetties of several harbour towns (for example Kuinre and Vollenhove) have been restored and can still be visited by the public, as well as some traditional (fishermen's) houses on Urk, Schokland, and in the former coastal towns. An typical 19th-century lighthouse keeper's house, *Oud-Kraggenburg,* stands on a 6 m-high mound, 6 km from the former shore, now surrounded by meadows and fields (Fig. 3.12). These tangible examples demonstrate the cultural history of the region, but their meaning becomes much stronger when combined with the cognitive aspects, derived from all kinds of sources (for example photographs, maps, folklore, myths, and tales).

To continue: connecting aspects

One might say that, based on the aspects, facets, and examples discussed above, the most useful way to examine the true nature of the maritime cultural landscape is by combining datasets and connecting them to the landscape aspects to which they belong. The maritime cultural landscape concept is, however, still being developed and, due to its multi-facetted nature — which has the unfortunate effect of watering down its strength — it would be incorrect to state that there is only one (methodological) suitable approach. This article underlines that there are many concepts and aspects within and beyond the concept of the maritime cultural landscape that help understand a region of study. In many cases a maritime cultural landscape study will start with a collection of archaeological remains, historical documents, or a set of memories from the local community. In this study, they testify to a drowned maritime landscape, with several settlements and hundreds of shipwrecks. However, they do not directly inform us about the way people managed to live in the landscape, how they named their places of residence, which routes they took to travel to other places, and how they experienced their dynamic environment. Widening the scope, by looking at different aspects of the maritime cultural landscape and using data from other disciplines does help in answering these questions.

In this article, first steps are taken in understanding the nature of the northeastern Zuyder Zee region. They are meant to strengthen the interpretations and understanding of the study region, but provide a starting point rather than a conclusion. In the section on the economic landscape it is stated that the region of study consisted of a fair amount of land in the Late Middle Ages, cultivated and exploited to a large extend by farmers. Further interdisciplinary research will lead to an appropriate and detailed late medieval palaeo-geographical perception of the region. This paper also provides first insight on the location and nature of the late maritime cultural centres, transport enclaves, and transit points in the region. Further research will pinpoint the exact locations of these settlements and their nature. In fact, each of the above-mentioned concepts

and aspects of the maritime cultural landscape could be the subject of a detailed and interdisciplinary study of the region. However, it is most important to eventually connect and combine them in order to understand the nature of the late medieval maritime cultural landscape of the northeastern Zuyder Zee region, characterized by maritime farmers, international maritime trade, and an ongoing battle against the water. Let us not consider this as the conclusion of the research, but as the starting point.

4 No country for men

Searching for late medieval submerged settlements in the northeastern Zuyder Zee area, the Netherlands

*Yftinus T. van Popta**

Abstract
This article focuses on the maritime cultural landscape of the former Zuyder Zee (ad 1170–1932) in the central part of the Netherlands. Since the large-scale reclamations from the sea (1932–1968), many archaeological remains have been discovered, revealing a submerged and eroded late medieval maritime culture, represented by lost islands, drowned settlements, cultivated lands and shipwrecks. Especially the northeastern part of the region, known today as the Noordoostpolder, is testimony to the battles of the Dutch against the water. By examining and combining different datasets from the region, it is possible to give a new interpretation of this late medieval maritime cultural landscape. Spatial distribution and densities of late medieval archaeological remains are analysed and compared to historical data and remote sensing results. This interdisciplinary approach has led to the discovery of the remains of the drowned settlement of Fenehuysen.

Keywords
Submerged settlements, Late Middle Ages, Zuyder Zee, maritime cultural landscape, Fenehuysen, the Netherlands.

Published
2019, European Journal of Archaeology 22.4: 567-587**

* I would like to thank prof. Theo Spek for his supervision and dr. Bas van Geel, dr. Stijn Arnoldussen and an anonymous reviewer for their insightful comments. I am also grateful to Robert McKenzie, Sander Tiebackx, and Harold Broekmans for their support. Finally, I would like to thank the students of the University of Groningen who participated in the Kuinderbos excavation.

Introduction

Up to the early 20th century, the central part of the Netherlands was dominated by the hazardous Zuyder Zee (Southern Sea), a large inlet of the North Sea that reached as far inland as Amsterdam. It served as a transport zone, fishing ground and battlefield (Fig. 4.1). For centuries, the inhabitants of this maritime region were plagued by rapid floods, storm surges and consequential land loss (Van den Biggelaar *et al.* 2014; Vos 2015; Chapter 2). The Zuyder Zee also brought much prosperity to the Netherlands, as a traffic junction connecting different regions (transport landscape) and as a fishing ground supplying fish for food and trade (resource landscape; Westerdahl 2013; Van Holk 2017a; Chapter 3). At the beginning of the 20th century, the Dutch State decided to build a large dam (*Afsluitdijk*) that would close off the Zuyder Zee from the North Sea and Wadden Sea. The construction was completed in 1932, and soon after parts of the former Zuyder Zee were reclaimed, cultivated, and populated. This led to the creation of four major polders: Wieringermeerpolder, Noordoostpolder, Eastern Flevoland, and Southern Flevoland, of which the latter three constitute the province of Flevoland. The reclamations dramatically changed the nature and focus of the region, from maritime to terrestrial and from fishing to agriculture (Fig. 4.2). The northeastern part of the former Zuyder Zee, now known as the Noordoostpolder and the study area presented here, clearly illustrates these changes: the islands and coastal settlements became part of the mainland, leading to a substantial loss of the region's maritime identity (Geurts 2005: 263, 283).

A close examination of the present-day landscape of the Noordoostpolder shows that it is still possible to gain insights into the maritime past of the region. For example, the former island of Schokland in the southern part of the region is now completely surrounded by land, being an island on dry ground. Schokland was the home of the Schokker community for many centuries, and in its heyday the island was inhabited by more than 600 people who lived on three large artificial mounds (Geurts 2005; Van Hezel & Pol 2008; Van Popta & Aalbersberg 2016). The island suffered from many floods that reduced its size and number of inhabitants. For centuries, the Dutch province of Overijssel spent much money on the island to maintain the coastal defences and support its inhabitants. In the second half of the 19th century, it was decided to evacuate the island as the inhabitants were no longer able to support themselves (Van Hezel & Pol 2008: 201). Today, the island is uninhabited, and only the lighthouse, church, an old quay, and several small fisherman's cottages remind visitors of the once densely populated mounds.

The example of Schokland is one of the most obvious examples of 'experiencing the maritime past' of the northeastern Zuyder Zee region. Other appropriate locations in the region are the past maritime cultural centres (see Westerdahl 2013: 738), Urk island and sea-

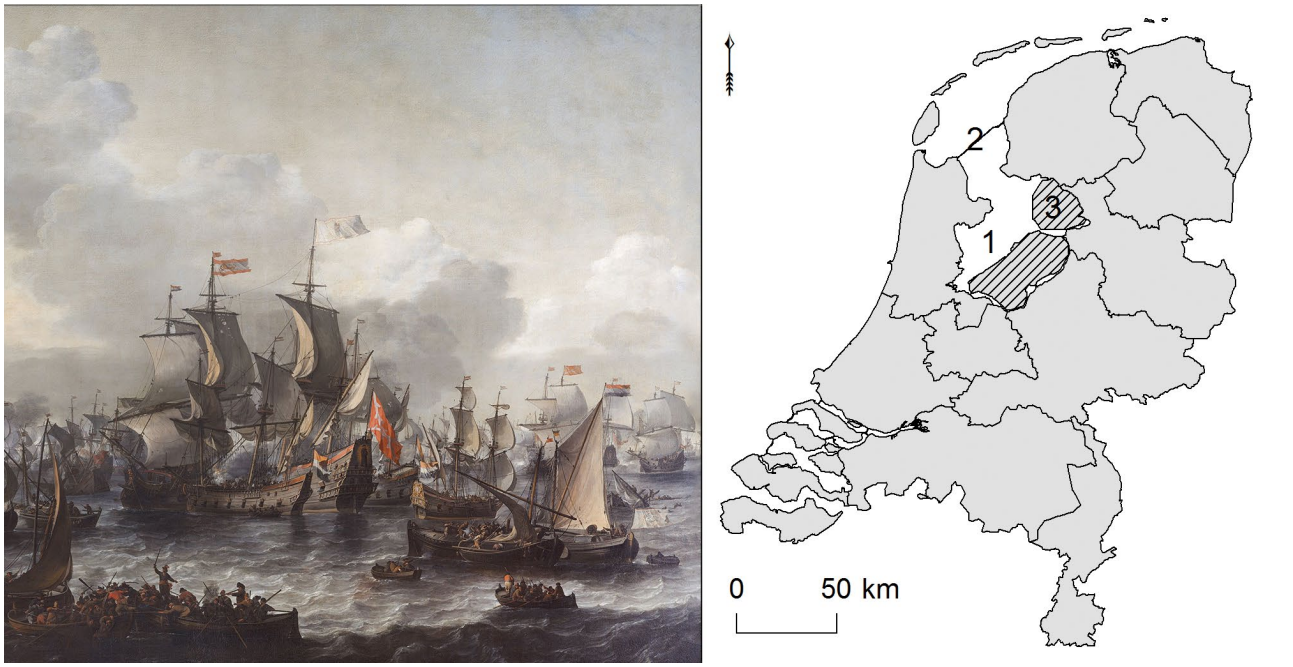


Figure 4.1. Left: an impression of the Zuyder Zee during the Battle on the Zuyder Zee between the Dutch and Spanish fleet (Jan Theunisz Blanckerhoff, 1663, Rijksmuseum Amsterdam). Right: the former Zuyder Zee in the central part of the Netherlands (1), separated today from the North Sea by a large dam (2). The research presented in this article focuses on the Noordoostpolder region (3), which is part of the reclaimed province of Flevoland (hatched lines.

Figure 4.2. The church of Ens on the island Schokland surrounded by the Zuyder Zee in 1850 (painting by Hermanus Koekkoek, Zuiderzeemuseum) and photographed as it appears today. Painting of the church at Ens reproduced with permission of the Zuiderzeemuseum.

ports such as Kuinre, Vollenhove, or Blokzijl along the former eastern shore of the Zuyder Zee. These past 'maritime cultural centres' are the 'tip of the iceberg', being easily accessible physical evidence of maritime culture. The lower and larger part of the 'iceberg' consists of evidence including pottery scatters, field boundaries, or remains of dikes, and of historical maps and charters, place names, folklore, and oral history. The objective of the present article, is to recognize and characterize the submerged and eroded cultural remains, their locations, and their visibility in other sources. The discovery of remains of the drowned late medieval settlement of Fenehuysen (*Fene* = *veen* = peat, and *huysen* = *huizen* = houses) constitutes the main result.

Research area: from the Zuyder Zee to the Noordoostpolder

The Noordoostpolder comprises the northeastern part of the Zuyder Zee region: a large tidal lagoon of the North Sea surrounded by inhabited peatlands. In Roman times, the region was described by Pomponius Mela (*Chorographia* III, 24) as an area of peatlands with several lakes: *Lacus Flevo*. During this period, no marine influence affected the region. In the Early Middle Ages, the name of the region changed to *Almere* (all lakes), referring to even larger bodies of fresh water in the region (see Vos 2015; Van Zijverden 2017). Human interference in the natural landscape, in the form of cultivation and peat reclamation causing subsidence through oxidation and erosion of the peat, is considered the main reason for the landscape changes (Vos 2015: 67). Massive floods in the 12th and 13th century AD eventually breached the remaining peat barrier between North Holland and Frisia that separated the *Almere* from the Wadden Sea and Vlie, resulting in the Zuyder Zee (Fig. 4.3; *e.g.* Cohen *et al.* 2009; Vos 2015: 324; see also Chapter 2). As a consequence, the North Sea started eroding the peatland in the area more often and over larger areas than before (Van den Biggelaar *et al.* 2014; Vos 2015; Pierik *et al.* 2016; Chapter 2).

It is commonly accepted that the Zuyder Zee existed since approximately AD 1170 (the year of the cata-

Figure 4.3. Map of the Zuyder Zee region, c. 1666. by Pieter Goos (Geheugen van Nederland). The circle marks the study area (Noordoostpolder region). Map reproduced with permission of Geheugen van Nederland / Koninklijke Bibliotheek.

strophic All Saints' Flood) and up to 1932 (building of the *Afsluitdijk*), but its appearance changed over time. Parts of the peatlands that were mentioned by Mela in the 1st century AD still existed in the Middle Ages. The largest surfaces could be found in the northeastern Zuyder Zee region (Van Popta 2016). Recent research has shown that large parts of these peatlands were cultivated in the Middle Ages, but that people were driven inland by the water (see Chapter 2). Habitation was certainly possible on the island of Urk (a Pleistocene boulder clay outcrop), but probably also in other parts of the research area (Fig. 4.4). However, heavy storm surges in the 13th and 14th centuries flooded and buried most of the medieval peatlands, leaving only small parts of Urk and Schokland exposed. The size of the Zuyder Zee remained more or less stable from the 17th century onwards (also because of the many dikes that were constructed along the shore) until the construction of the *Afsluitdijk* in 1932. Large-scale reclamations then transformed the eastern part of the sea into land, and thus the province of Flevoland was created.

Approach

The maritime cultural landscape

The analysis of submerged late medieval settlements in the Noordoostpolder region fits the concept of the maritime cultural landscape, as introduced by Scandinavian maritime archaeologist Christer Westerdahl in the late 1980s and early 1990s (Westerdahl 1992; 2013; Duncan 2006). It was conceptualized to bridge the boundaries between the terrestrial and maritime counterparts and relate maritime culture to both. At first, the concept focused only on the physical aspects of maritime culture like shipwrecks, harbours and related structures (Westerdahl 1978). Soon, it was realized that the maritime cultural landscape should be treated as a more holistic concept, also including cognitive data under the following definition: 'The whole network of sail-

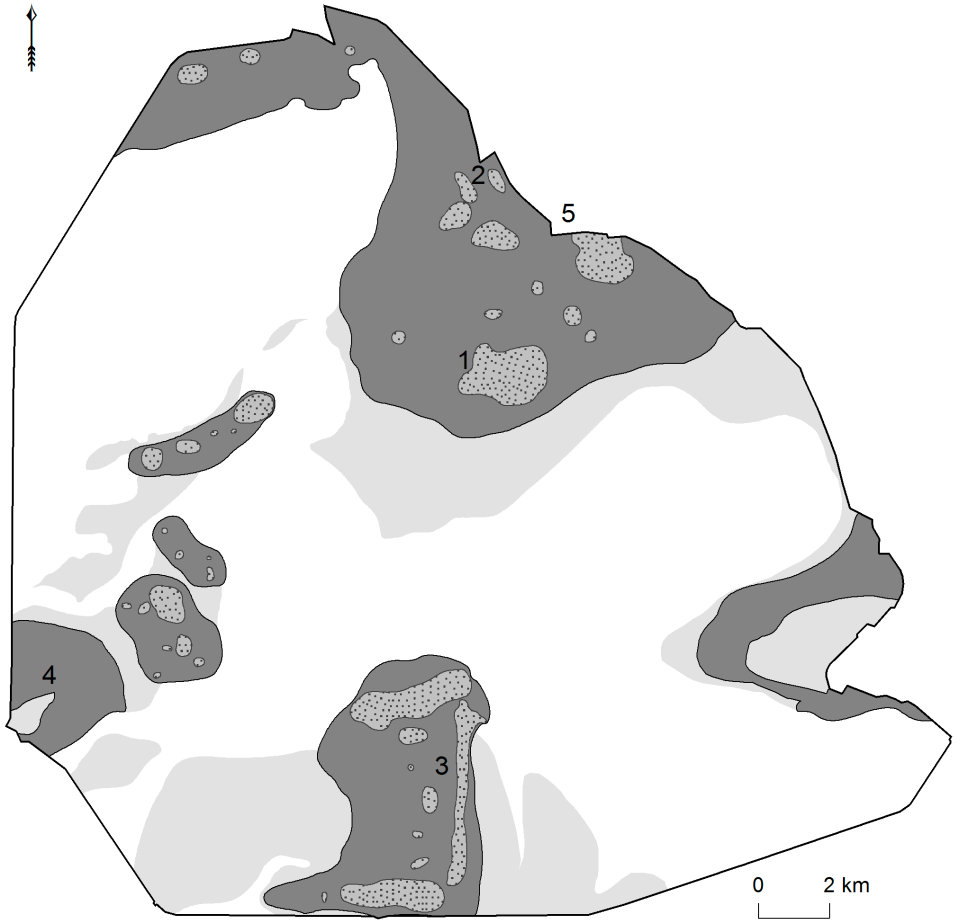


Figure 4.4. Reconstruction of the northeastern Zuyder Zee region in medieval times (c. AD 1100). Dark gray represents land (light gray represents submerged land), dotted areas represent traces of habitation, white represents water. 1: Fenehuysen I; 2: Fenehuysen II; 3: Schokland; 4: Urk, 5: Kuinre.

ing routes, with ports, havens and harbours along the coast, and its related constructions and other remains of human activity, underwater as well as terrestrial' (Westerdahl 1992: 6; 2008: 212; 2011: 339; 2013: 744-45).

The notion of a maritime cultural landscape had a deep impact on maritime archaeology worldwide, as attested by numerous studies that followed in its footsteps. However, as Duncan (2006) demonstrates, many studies claim to study the maritime cultural landscape while in fact they only address part of it (in many cases the physical remains), making them archaeological landscape studies rather than maritime cultural landscape studies. Furthermore, it is important to keep in mind that the datasets used are analysed from a modern point of view. Past perceptions may differ: landscapes are multivalent, and perceptions depend on perspective and personal and communal experience (Ingold 1993; Westerdahl 2004; Duncan 2006; see also Chapter 3).

Materials

In this article, datasets from several disciplines (archaeology, (landscape) history and (palaeo)geography) are combined to retrieve the locations of late medieval submerged settlements. The most important dataset is the Medieval Settlement Database of the Noordoostpolder (MSD; Open Access publication): it contains an overview of all late medieval archaeological objects found in the research area, primarily thousands of pottery sherds, bricks, roof tiles, and animal bones. The data are compiled from the Dutch National Archaeological Database (ARCHIS), the archaeological repository of the province of Flevoland, archaeological distribution maps, and relevant archaeological literature such as the archaeological series 'Quarterly updates on the Zuyder Zee constructions' (Ministerie van Verkeer en Waterstaat, 1920–1976). The latter source provides an overview of the earliest archaeological finds in the region encountered during the reclamation works. The precise number of late medieval archaeological objects in the entire region is unknown, as some primary sources do not mention exact numbers. The distribution map made by the archaeologist Van der Heide, drawn in the 1950s, and the oldest distribution map of the region, illustrate late medieval high-density areas, but lack quantities of objects. Furthermore, only part of the ARCHIS database contains exact numbers of archaeological finds; in many cases, no quantitative information is given. It is known that many archaeological sites contain hundreds of late medieval objects and that several archaeological sites contain over 2000 objects (lots NP 14

and NP 23, based on records in the repository of the province of Flevoland). It is expected that many other archaeological finds have never been recorded because (1) they were found by land owners who simply threw them away, (2) they were considered 'archaeological noise' (see below), or (3) they were found in the early days of archaeological research in the Noordoostpolder when a recording system had not yet been developed. In addition, hundreds of archaeological objects are found yearly by amateur archaeologists who search the arable fields after ploughing, indicating that late medieval remains are still present in the soil. To summarize, tens of thousands of late medieval objects have been discovered in the Noordoostpolder and there are many more objects preserved in the former seabed.

Several historical charters were also used, including a copy of a 13th-century charter of the St Odulphus monastery near Stavoren (province of Frisia). This charter describes the possessions of the monastery (chapels and goods) in a region that encompasses the area of study (Mol & Van Vliet 1998; Mol 2011). Several 16th- and 17th-century historical maps (*e.g.* one of the oldest and quite accurate map of the entire Zuyder Zee region made by Christiaan Sgroten in 1573) provided further evidence about the final stages of land erosion and settlement within the research area (Figs. 4.3 and 4.4). One should, however, keep in mind that these maps depict the research area after the submergence of many late medieval settlements. Finally, modern remote sensing datasets including (historical) aerial photographs, Digital Elevation Models, and satellite images were analysed for archaeological traces such as historic dikes, ditches and mounds.

Method: Localizing and characterizing submerged settlements

The tens of thousands of late medieval objects in the MSD indicate human presence in the Noordoostpolder region, but in a number of cases these have been misjudged to just represent "noise" or "ships' waste" (see *e.g.* Teekens & Spoelstra 2009). This meant that late medieval settlement areas remained unrecognized, and as a consequence areas with abundant late medieval archaeological findings in the Noordoostpolder currently lack a protected status. To establish a listing of such sites, pinpointing their location and ranking them so that decisions on protected status and prevention of further damage could be made, the current project determined that several criteria must be met. To label a late medieval 'settlement area', first, it has to contain a certain number of objects. It is assumed that most of the archaeological objects originally were contained in common late medieval settlement traces such as ditches, wells and pits that were later on disturbed by marine erosion and ploughing. Nevertheless, all isolated, single objects found in the study area are disregarded: they cannot be interpreted as settlement remains because the once inhabited lands have been highly disturbed by marine erosion, making it likely that small archaeological objects were transported and redeposited. Even though high numbers Second, the number of archaeological objects from a potential settlement site has to be significantly higher (say, factor 10) than the number of objects in the surrounding area. In other words, the site must be visible as a high-density area on an archaeological distribution map. Third, the composition of the archaeological objects representing a submerged settlement should be diverse and not limited to just pottery. There should be a combination of sherds, animal bones, and preferably bricks and/or roof tiles. Especially encountering bricks and roof tiles should be considered a strong indicator of former buildings. It is assumed that regular late medieval houses in the research area were made of wood, and that important buildings such as a church or chapel were mainly constructed from bricks (IJssel and Zuyder Zee clay) and occasionally natural stone (Eifel tufa).

This three-step-methodology led to the creation of a map that indicates the presence of all archaeologically recorded late medieval settlement areas (see below). The settlement areas on this map were compared to historical sources (such as charters and maps) that provide information on their existence and location. Furthermore, remote sensing techniques were applied to possible site locations to document physical remains, and finally an archaeological excavation was conducted at one settlement location with clear archaeological and historical traces.[1]

Results: submerged settlements

Rediscovered settlement locations

In order to identify the location of late medieval submerged settlements, all registered late medieval archaeological findspots in the Noordoostpolder with a minimum number of six objects (therefore excluding isolated finds) were selected from the MSD. The density of the archaeological objects from the MSD was then analysed in ArcGIS, using Kernel Density and Point Density to highlight areas with a high findspot density (Fig. 4.5). Most of the archaeological findspots contain at least some late medieval pottery, typically late medieval wares like Globular pottery, Pingsdorf ware, Paffrath pottery, Andenne ware and Proto-stoneware (Bartels 2011). The majority of these sherds date between the 12th and 14th century, which implies that the settlements were built from AD 1100 onwards and were abandoned in the 14th century (though a more thorough study of these dates would be desirable). As said, it is

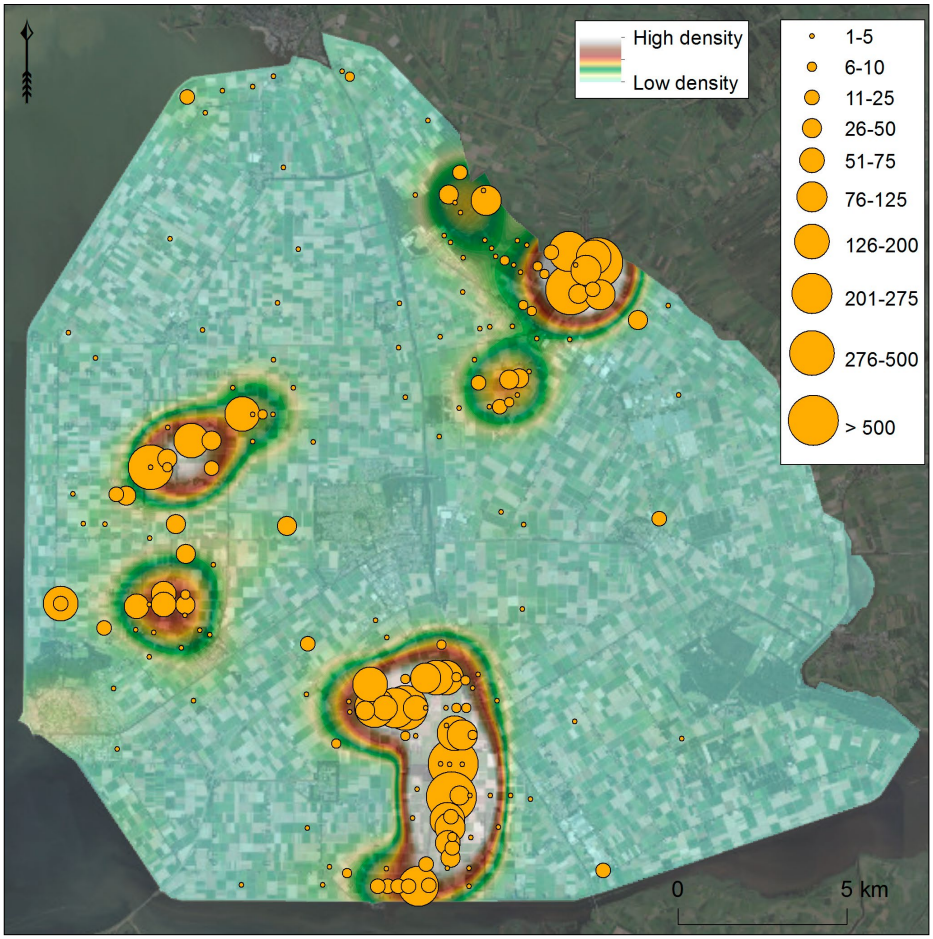


Figure 4.5. Combined archaeological density and distribution map, based on the content of the MSD database.

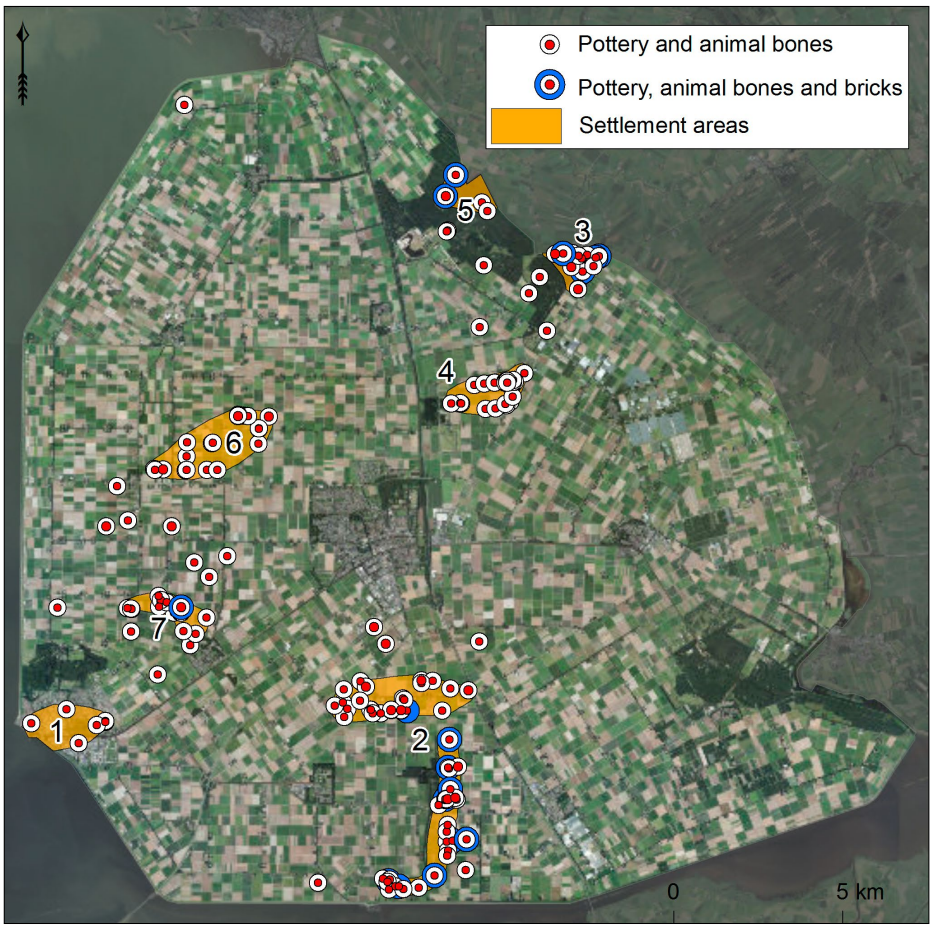


Figure 4.6. Distribution map of archaeological finds, only showing sites that contain at least two object categories.

the combination of materials that provides the strongest indication of the presence of a late medieval settlement. Therefore, an overview was made of the sites that contain at least two object categories, removing all sites that contain only one object category (Fig. 4.6).

There are seven potential settlement clusters that meet the criteria of a high-density area with a varied composition of archaeological material (see Fig. 4.6). Three of these areas were well-known before this study: they are the islands of Urk (1) and Schokland (2), and the former coastal town of Kuinre (3). Note that Urk is underrepresented in Figure 4.5 as the location of the late medieval settlement is expected to have been further to the west: this part of the former island is still submerged and therefore lacks detailed archaeological data. Four settlement areas in the research area represent previously unknown locations of late medieval settlements. Two of them (4 and 5) are located in the direct vicinity of Kuinre, while the other two are to the north of Urk and Schokland (6 and 7).

St. Odulphus monastery Charter

For attaching medieval historical names to the archaeologically rediscovered settlement locations, a copy of the 13th-century St. Odulphus monastery charter is of great importance, as it mentions the names of almost 30 chapels and goods (settlements) in a clear geographical order (Fig. 4.7). Many of these names refer to still existing settlements, except for Nagele, Marcnesse and Fenehuysen, which should be located within the study area according to the geographical order. The charter does not mention the exact location of these settlements, hence the oldest historical maps of the study area needed to be checked. The name Fenehuysen, meaning 'houses on peat', appears on several historical maps of the Zuyder Zee region (the oldest dates to 1573). The settlement is shown in these maps along the coast of the Zuyder Zee, to the north-west of Kuinre. This location corresponds to archaeological settlement area 5. Interestingly, a 17th-century map mentions the name Veenhuijsen (a corruption of Fenehuysen) twice: one location corresponds to settlement area 5 along the coast, the second is written on the waters south of Kuinre. Above this name, there is a small icon of a building (probably a church tower) sticking out of the water. It seems that the map maker intentionally wanted to illustrate a submerged settlement, but the question remains whether the depiction and toponym are correct. From an archaeological point-of-view, the depicted location corresponds closely to settlement area 4, lying on the south-eastern tip of a large peatland peninsula in the northeastern part of the research area. Due to intensive marine erosion, modern ploughing, and peat compaction, no *in situ* physical evidence is expected on the present-day location of the site. Based on pottery finds, it is estimated that this settlement submerged before AD 1400 and that its inhabitants probably moved further inland. So, the location of the submerged church tower (suggesting a drowned settlement) on the historical map is definitely correct. The question remains whether the toponym 'Fenehuysen' is also correct. If so, the location would represent a former location of Fenehuysen; to keep things clear, this location is referred to as Fenehuysen I — the location along the coast to the northwest of Kuinre (area 5) is referred to as Fenehuysen II. The names Nagele and Marcnesse

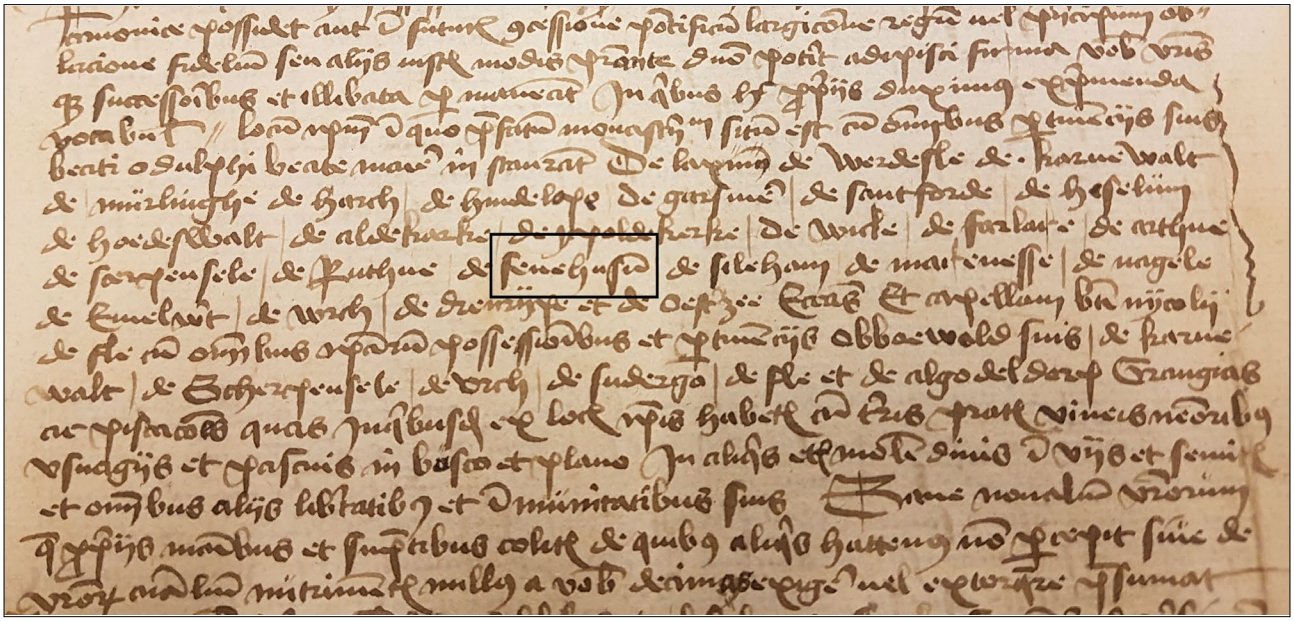


Figure 4.7. 15th-century copy of a 13th-century charter of the St Odulphus monastery that mentions Fenehuysen (outlined in rectangle; after Tresoar).

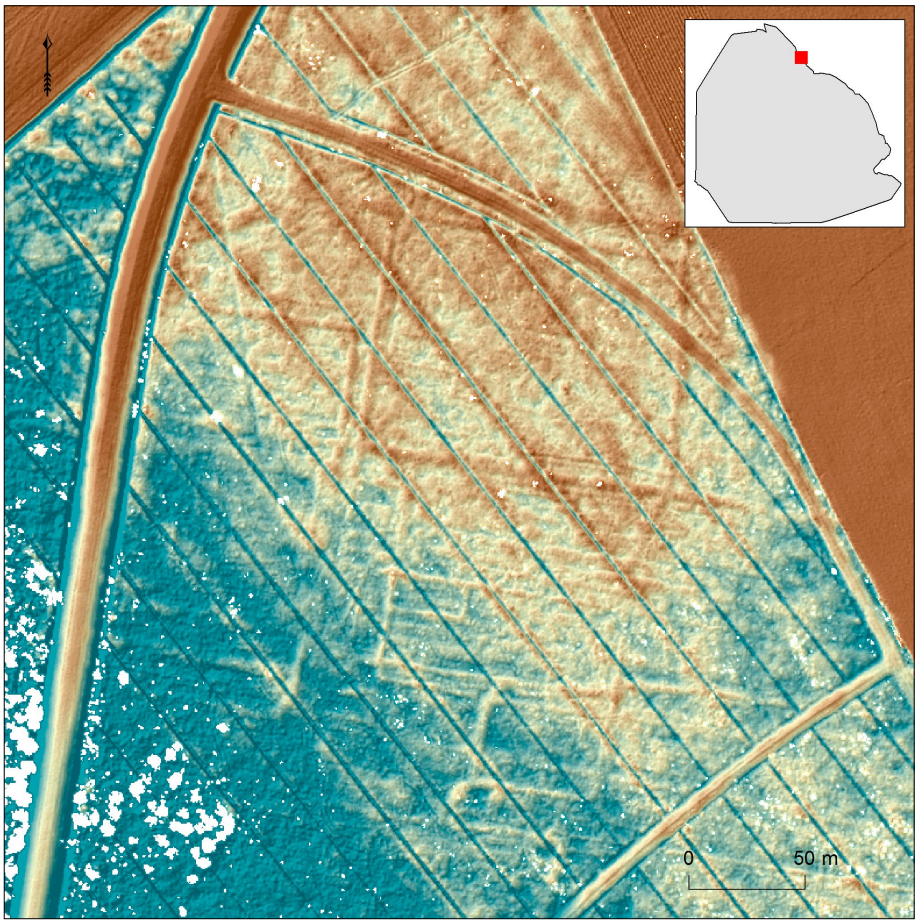


Figure 4.8. A dense network of linear structures is visible on the LiDAR surface topography data (AHN2) of the Kuinre Forest (area 5 in Fig. 4.6).
The northwest-southeast oriented blue lines are modern drainage ditches (blue is low, red is high).

are not mentioned on any of the historical maps, but it is possible that they belong to settlement areas north of Urk and Schokland (areas 6 and 7).

Further examination of the four unknown settlement areas through the analysis of remote sensing datasets (aerial photographs, satellite images, and LiDAR data) did not reveal new evidence for three locations (4, 6, and 7). Extensive ploughing has levelled the former seabed and thoroughly disturbed the archaeological remains, leaving only dense scatters of archaeological objects on the surface in these areas. However, settlement area 5, that of Fenehuysen II, had been turned into forest directly after the reclamations, leaving the former seabed largely intact. Therefore, this settlement area was considered most suitable for further in-depth research.

Finding Fenehuysen II within area 5: interdisciplinary evidence

The accuracy of the location Fenehuysen II (area 5) can be further improved because it is depicted on several 16th-century maps near the northeastern shore of the Zuyder Zee in an area that is nowadays covered by the Kuinre Forest. In the MSD, no clear concentrations of late medieval archaeological objects are known from the forested parcels, but this could also be the result of limited soil disturbance since the reclamations compared to the rest of the Noordoostpolder. Other datasets were consulted for evidence of medieval habitation and land cultivation. The first category of evidence came from the analysis of aerial photographs. The oldest consulted were made by the Royal Air Force (RAF) during the Second World War; they show the area after the reclamations but before forestation. Some northwest-southeast oriented linear discolorations are visible on these photographs, stretching along a part of the eastern shore of the Zuyder Zee that includes settlement area 5. More recent aerial photographs did not add to this, as they only depict the treetops of the forest. But more advanced remote sensing methods allow us to create Digital Elevation Models (DEMs) of the forest soil by using LiDAR (Airborne Light Detection and Ranging; Davis 2008). Detailed LiDAR footage of the Kuinre Forest soil not only confirmed the presence of the linear structures that were spotted on the aerial photographs of the RAF but also revealed far more of these structures on the forest soil, which modern aerial photographs and satellite images could not detect.

Further analysis of the LiDAR data revealed that one particular area of the forest contains a dense network of linear and rectangular structures with a slightly higher elevation than the surroundings (a difference of *c.* 30–50

Figure 4.9. Photograph of a section of one of the test trenches dug through a historical ditch in the Kuinre Forest (area 5 in Fig. 4.6). Note the clear cut of the ditch (greyish clayey fill) into the peat (brown).

cm in height). These traces had not been noticed before and were therefore of interest for further archaeological research (Fig. 4.8). What exactly do they represent, and would an archaeological excavation reveal the remains of Fenehuysen II?

Archaeological excavation

In May and June 2017, archaeological investigations by the University of Groningen were conducted in the area with dense linear structures in the Kuinre Forest (Van Popta 2019b). The excavation consisted of eight test trenches, varying in length from 2 to 8 m, dug through a selection of linear structures. The purpose was to analyse and document their sections. In addition, over 30 cores were taken throughout the excavation area to obtain information on the natural stratigraphy and to compare the natural stratigraphy with sections of the linear structures. GPS and a Total Station were used for locating the linear structures, although many could be spotted with the naked eye. All trenches were dug through the Holocene sediments into the Pleistocene subsoil. In general, the Holocene substrate of this region consists of a thick layer of peat (the top dates to the Middle Ages), covered by different layers of sandy and clayey sediments from the Zuyder Zee phase (Late Middle Ages to *c.* AD 1942; Wiggers 1955).

Studying the sections of the eight test trenches clearly revealed the nature of the linear structures: they represent a network of ditches that were dug into the peat before the area was overtaken by the Zuyder Zee. The linear structures, nowadays slightly higher than their surroundings, represent the lowest parts of the organic clayey sediments once deposited (Fig. 4.9 and 4.10). During the Zuyder Zee phase, major parts of the peatlands in the study area were flooded and/or washed away. From the natural stratigraphy in the excavation area it was evident that the lower parts of the peatlands have survived, *i.e.* the Zuyder Zee has only washed away the top of the peat layer. It also meant that the exact dimensions of the ditches could not be documented as only the deepest parts were preserved. After the Zuyder Zee had taken hold of the area, marine sediments were deposited on top of the remaining peat and the clayey fill (fresh water deposits) of the ditches.

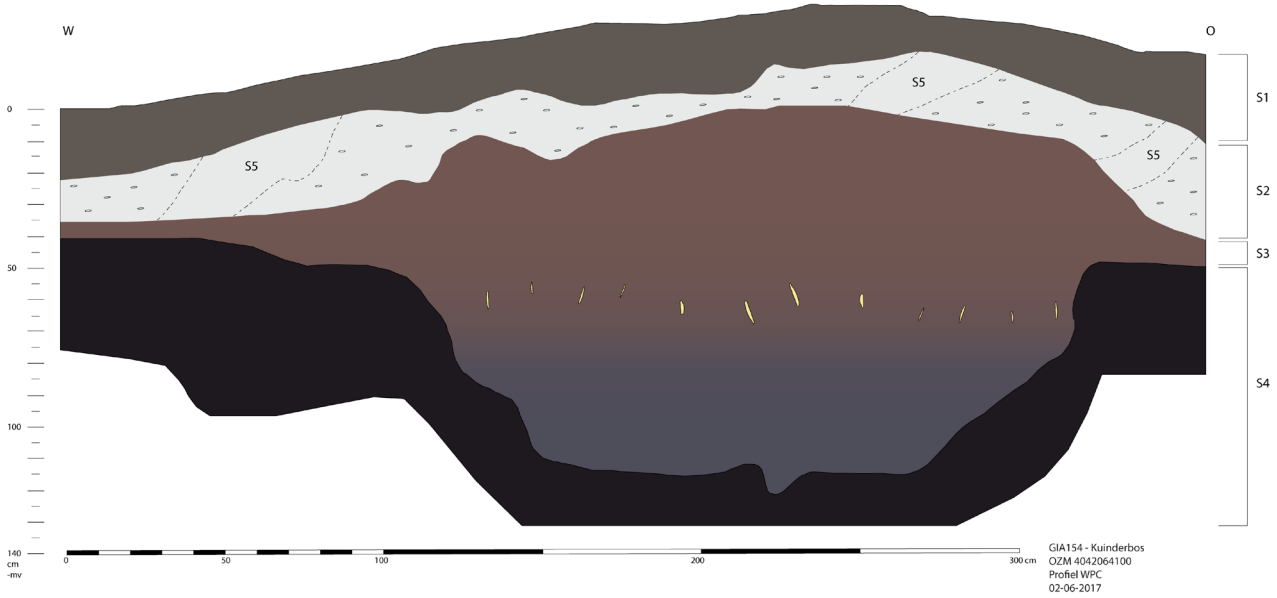


Figure 4.10. Profile drawing of one of the test trenches from the Kuinre Forest. S1: top soil, S2: Zuyder Zee deposits, S3: ditch fill, S4: natural peat, S5: plough marks.

Figure 4.11. Overview of the ditch-network field boundary system (blue lines) in the Kuinre forest (area 5 in Fig. 4.6) and the historical inland field system depicted on the 1850 Topographical Military Map.

After the reclamation of the northeastern Zuyder Zee, a continuous process of dehydration and oxidation of the former seabed started. It caused soil compaction, especially for the layers of peat that remained after the marine phase in the region. The weight of the clayey fill of the ditches had already compacted the underlying peat before and during the Zuyder Zee phase, creating a clear contrast between the ditches (limited compaction) and their surroundings (more substantial compaction). As a result, an inversion of relief occurred: the ditches became visible on LiDAR as small elevations in the landscape. Several larger main ditches can be distin-

guished from other minor ditches in a network, based on their greater width (5–6 m versus 2–3 m) and north-west-southeast-orientation. Interestingly, these larger ditches have the same orientation as an inland ditch network visible on historical maps and LiDAR data (Fig. 4.11).

It suggests that the ditches in the excavation area were part of a larger system of field boundaries that served to drain the peatlands, on which Fenehuysen II was built. Although no intact remains of the settlement have yet been found, several rectangular areas (measuring *c.* 30 × 15m) surrounded by small ditches have. There is a good chance that these represent small medieval farmsteads with space for a single house and/or barn. The clayey substrate of numerous ditches contained large amounts of archaeological material, consisting of yellow and red bricks, pottery and stoneware sherds, animal bones with butchery marks, burnt daub, peat bricks, and rye (*Secale cereale*) pollen (Fig. 4.12). The presence of the latter indicates that rye, one of the most frequently grown medieval cereals in the Netherlands, was also grown on the peaty soils near Fenehuysen II (Van Geel *et al. 19*83; Behre 1992; Ettema 2005). The assemblage clearly refers to the leftovers of a settlement as described in the methods section above. It is assumed that the objects were either deposited in the ditches on purpose (waste) or deposited in the ditches by the eroding force of storm floods. As the test trenches only targeted the ditches, no information is available for the small areas enclosed by the ditches. Several other ditches with almost no archaeological objects must represent ditches that were further away from the farmsteads. Clearly, more archaeological research is required to find out whether *in situ* settlement structures, presumably belonging to Fenehuysen II, are still present. As the top of the peat was washed away by the Zuyder Zee, it is unlikely that small *terps* (artificial mounds of clay and peat on top of the natural peat) and the foundations of houses survive *in situ*. Only the deepest parts of features like wells and pits might still be present. Archaeological research has shown that in some parts of the northeastern Zuyder Zee region people lived on the small mounds (Schokland island) and protected themselves against the water by constructing dikes. It remains unclear whether this also goes for Fenehuysen II: some dike remains (discolorations on aerial photographs) have been found to the north-west of the former settlement, but there is no proof for mound remains (see Van Popta 2017a).

The main category of archaeological objects from the ditch fills is that of pottery sherds and bricks. The earliest identified sherds date to the 12th and 13th century (Globular pottery, Paffrath pottery), while the latest sherds date to the 17th century (redware, early stoneware). No intact objects were found, but many sherds belong to jars and plates and the majority of the material dates to the 16th and 17th century. The bricks are either yellow or red and some have a rounded surface owed to water erosion. These bricks, together with fragments of burnt daub, are likely to represent the remains of buildings. The ditches also contained a relatively large number of animal bones. Many bones, mainly belonging to cattle of different ages, had clear butchery marks, indicating that they are consumption waste. Altogether, the assemblage in the ditches represents the remains of a settlement that was threatened by marine erosion. As only small parts of the ditches have been examined, many more objects remain in the clayey fill of the ditches.

Fenehuysen I, II and III: a shifting settlement?

The archaeology of the submerged settlement Fenehuysen highlights the dynamic nature of the north-eastern Zuyder Zee region and the erosive force of the Zuyder Zee. 17th-century historical maps confirm that the Fenehuysen II settlement at that time lay along the actively eroding Zuyder Zee coast (in area 5, northwest of Kuinre, Figs. 4.8-11). This settlement is estimated to have been densely inhabited between AD 1500 and 1700, based on the ages of pottery sherds and stoneware fragments, although first signs of habitation date back to the 14th century. The settlement was likely abandoned in the 2nd half of the 17th century and the inhabitants of Fenehuysen II started living behind the dike at Fenehuysen III. This is illustrated on 18th- and 19th-century maps. During this period, the word Fenehuysen was still used as a place-name, but its appearance must have been that of a hamlet: a couple of farms spread in the landscape. Historical archives mention the existence of five farms in 1763 and one remaining farm in 1793 (Kamman 1985: 80). The topographical maps of 1850 and thereafter no longer mention the name Fenehuysen, although the descriptions *Achterveen* (behind peat, just onshore) and *Veenhoek* (peat corner, just offshore) have been used in the vicinity of Fenehuysen III (for toponyms, see the Topographical Military Map of 1850 and the *Bonnebladen* maps of the 19th–20th century). Now, all that remains of Fenehuysen III is a small circular elevation in the fields, also visible on 19th-century maps. This site has not yet been archaeologically examined, although local people claim to have found sherds and bricks on the surface. Archaeological investigations on this site may indeed reveal the final remains of Fenehuysen.

Clearly, Fenehuysen II in name and location must also have had a predecessor as it is mentioned in charters that are far older than the beginnings of archaeological traces in area 5. It is hard to say whether the settlement

Figure 4.12. A selection of archaeological finds from the clayey fill of the late medieval ditch network in the Kuinre Forest (Fenehuysen II subarea (area 5 in Fig. 4.6). From top to bottom: bricks, animal bones, red ware.

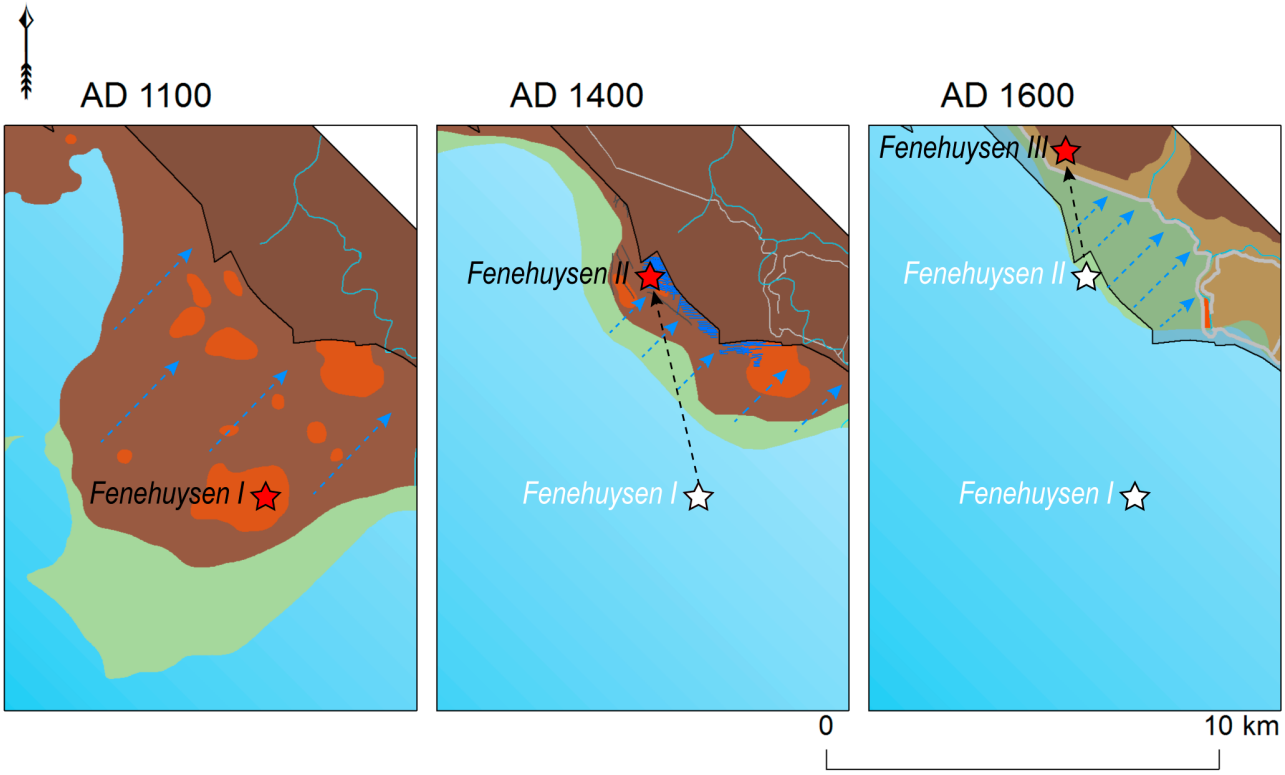


Figure 4.13. Reconstruction of the shifting nature of Fenehuysen. Brown: peatland; green: drowned peatland; orange: settlement remains: blue: water; grey: dikes. Fenehuysen I: tentatively located. Fenehuysen II and III: proven locations.

of area 4 (Fig. 4.6) should be considered to be this predecessor based on current archaeological and historical data. Lack of detail prevents drawing evidence-based conclusions at the moment. From an archaeohistorical point of view one might argue that the high density of archaeological objects in area 4, combined with information from the 17th century historical map (depicting the submerged settlement of what would be Fenehuysen I) provide enough evidence to identify Fenehuysen I. Combining these archaeological and historical results points to the following reconstructed event line (Fig. 4.13): the first site of Fenehuysen, possibly in area 4, was left to the mercy of the waves in the 14th century. There might even be a specific event responsible for the destruction of Fenehuysen I: on 10 October 1375, a massive storm hit the coasts of the North Sea, Wadden Sea, and Zuyder Zee (Buisman 1996). As a consequence, the inhabitants might have moved further north (inland) to found Fenehuysen II in area 5. However, from a landscape-historical point of view, one might argue that such a relatively long-distance north-eastward shift (5 km) seems rather farfetched and hard to prove, especially as no remains of land cultivation and infrastructure (*e.g.* waterways, rivers, roads) appear to have been preserved in area 4 and between area 4 and 5 (owing to erosion and sea floor reworking by the Zuyder Zee since the 14th century). Therefore, it is reasonable to state that, at this moment, insufficient evidence prevents drawing strong conclusions on the identification of Fenehuysen I and linkage with area 4. That said, neither can we exclude the possibility that indeed settlement area 4 embeds the remains of the first location of the unfortunate inhabitants of the first Fenehuysen.

The shifting nature of Fenehuysen (from location I to II, from location II to III) is but one example of shifting of late medieval settlements in the Netherlands. There are more settlements along the inland peat rim of the Zuyder Zee, such as Rouveen/Staphorst and Elburg and even Vollenhove and the nearby castle of Kuinre (see also Chapters 2 and 6), that experienced a similar shift for similar reasons (Bos 1988; Spek *et al.* 1996; De Boer & Geurts 2002; De Bont 2008).

Also, for the ditch network evidence of medieval reclamations preserved in former lagoon and lake beds such as the Noordoostpolder, there are more examples in other such deep polders in the Netherlands (*e.g.* the Beemster, Scheemer and Purmer polders), below the water (*e.g.* Hoornse Hop, Markermeer) and the wider eastern North Sea coast (*e.g.* De Polders in Belgium, Nordstrand in Germany). In addition, remains of medieval and early modern submerged settlements can be found in other parts of the Netherlands, like northern Frisia and Groningen (many artificial settlement mounds), Zeeland (Verdronken land van Saefthinge and Reimerswaal), and further afield (*e.g.* Jomsborg and Vineta).

Conclusion

The aim of this chapter has been to recognize and characterize the submerged and eroded cultural remains in the Noordoostpolder region, with focus on lost late medieval settlements. Several criteria for identifying submerged settlements among the large number of archaeological objects from the region were defined and tested by searching for the submerged historic settlement of Fenehuysen. Although the datasets consulted are of a different nature, the innovative use of spatial and predictive analysis by GIS proved effective in the interpretation of the anthropogenic traces discovered in the Kuinre Forest.

These traces, surrounding small rectangular terrains, are interpreted as a late medieval network of ditches that contained relatively numerous archaeological objects, clearly representing settlement waste. They belong to the second settlement of Fenehuysen that existed roughly between AD 1300 and 1700. The first settlement, discovered further south, was in existence until the 14th century. Fenehuysen was built for a third time to the north-west of the second settlement. The discovery of the late medieval network of ditches that contained the settlement remains of Fenehuysen II demonstrates that an interdisciplinary and methodological approach can be rewarding. Instead of merely focusing on archaeological data, an analysis of data such as archaeological remains, place names, information on historical charters and maps, aerial photographs, LIDAR-data and palaeogeographical interpretations proved valuable.

The settlement of Fenehuysen II needs to be explored further. Excavating the rectangular potential farmstead structures in the Kuinre Forest may show whether settlement remains like wells, pits, and foundations have survived *in situ*. There are also other settlements mentioned in historical charters like Marcnesse and Nagele that drowned in the northeastern Zuyder Zee region (Mol 2011; Chapter 2). Finding them may be even harder as much of the area is heavily eroded and disturbed. Remote sensing and archaeological research might not be sufficient, but historical records and maps, when thoroughly examined, can help pinpoint the locations of settlements and provide further information on their existence.

To conclude: the existence of the Zuyder Zee has influenced the life of people who inhabited the peatlands on which Fenehuysen was founded. Storm surges and tidal activity constantly threatened the small and vulnerable settlements, leaving their inhabitants no other option than to move further inland. This study illustrates the force of the Zuyder Zee and its influence on the late medieval lands: clearly 'no country for men' (to borrow from the book and film title).

Endnote

1 For this chapter, results of a test-trench excavation in the Kuinre Forest (one of the settlement areas in the region of study) are also included. The methodology used for this field research is in accordance with present-day methodologies in Dutch Archaeology and can be found in Van Popta (2019b).

5 Where are the shipwrecks of the Zuyder Zee?

A new version of the Shipwreck Database Flevoland (SDF 3.0), based on spatial and archaeohistorical research concerning wreck sites in the province of Flevoland

*Yftinus T. van Popta**

Abstract
For several decades, maritime archaeologists, authorities and maritime archaeological companies have worked with an out-of-date and inaccurate dataset (with regard to position and presence) of shipwrecks in part of the Zuyder Zee region. The information about these wrecks was scattered over several databases (both analog and digital) containing different numbers of shipwrecks in Flevoland. In order to gain a clear and accurate overview of the shipwrecks that were discovered in the former Zuyder Zee, the Shipwreck Database Flevoland (SDF) was made. The third version of the database is presented in this article and is mainly made to improve the knowledge of the present situation of shipwreck sites (wreck *in situ*, removed or unknown) and the accuracy of the coordinates that represent the location of the shipwreck (exact, estimated or unknown). The excavation documentation of the shipwrecks was used for retrieving accurate descriptions of wreck sites, although in most cases these descriptions referred to drain ditches and other local topography that have been removed or changed in time. Historical aerial photographs, LiDAR-data and satellite images were used for retrieving the locations of the relevant drain ditches and the exact locations of shipwrecks. Tens of wreck sites were discovered on the aerial photographs, either as a discoloration (disturbance) or as an excavation pit. These visible wreck locations correspond perfectly to the locations mentioned in the research reports and prove the accuracy and feasibility of the used methodology. The new version of the SDF therefore provides a more accurate distribution and density map of wreck sites in the province of Flevoland, which is of importance for spatial maritime archaeological research. Furthermore, the new information on the accuracy and presence/absence of shipwrecks can be adopted and used for archaeological heritage management purposes. Only then can the shipwrecks that are still present in the former seabed and of which the wreck location is relatively accurate be protected effectively.

Keywords
Zuyder Zee, the Netherlands, maritime archaeology, shipwrecks, spatial research, Late Middle Ages, Modern Era

Published
2018, Palaeohistoria 59/60: 191-227**

* I would like to thank prof. André van Holk for his supervision and dr. Martijn Manders and an anonymous reviewer for their useful comments.

** This chapter is a minor revision of the Palaeohistoria-article and reproduced with permission of the University of Groningen and Groninger Institute of Archaeology.

Introduction

The study of ships and especially those that have wrecked, that is nautical archaeology, is considered as the main subdiscipline of maritime archaeology (Bass 2013: 3). The maritime archaeological focus has however shifted from more or less isolated nautical studies towards interdisciplinary and spatial research in which the (maritime) landscape plays an important role. Especially the concept of the maritime cultural landscape has gained a lot of influence in maritime archaeology since it was coined by Westerdahl in the late 20th century (Westerdahl 1992; 2013). Within the boundaries of this concept, shipwrecks are still considered as major maritime features, but as part of the maritime landscape, rather than as isolated objects. The analysis of shipwreck locations in relation to the landscape can for example provide information on popular sailing routes and destinations, hazardous areas, the presence of water at a certain moment of time and therefore help to reconstruct the maritime cultural landscape. The presence of hundreds of discovered shipwrecks in this region provides information on the organization and layout of the maritime cultural landscape of the drained part of the former Zuyder Zee, today the province of Flevoland (see: Van Popta 2017a). This particular research focuses solely on the distribution of shipwrecks from the region and therefore contributes to the more broadly-based dissertation.

The Zuyder Zee, a large inland sea in the center of the Netherlands, existed from approximately AD 1200 until its partial reclamation in 1932 (Fig. 5.1). The Zuyder Zee was of great importance for the Low Countries as it was characterized by a lot of marine traffic, connecting different parts of the Netherlands with each other and to other parts of Europe. One could even state that this dense network of inland shipping, with the Zuyder Zee functioning as the main traffic circle and highway, was the basis of the Dutch 'Golden Age' (17th century; Van Holk 2005: 23). This is also reflected by the large number of shipwrecks that was found after the partial reclamation of this inland sea. Three large polders (Noordoostpolder, Eastern Flevoland and Southern Flevoland) were created and are now known as the 12th province of the Netherlands: Flevoland. Nowadays, Flevoland is famous as the 'largest ship graveyard on land' in the world. The unique situation of exploring and cultivating a former seabed provided a lot of work for the first archaeologists that worked in the polders. Especially in the early years of the Noordoostpolder, new shipwrecks were discovered almost weekly. In many cases, this was caused by the digging of parcel ditches, the laying of drainage systems (pipes) and the first ploughing of the polder. As soon as construction workers or farmers found pieces of wood (timbers) in the soil, it was almost certain that they encountered a shipwreck. The large number of discovered shipwrecks and the high work pressure caused the archaeologists to critically judge every discovery and to work selectively. Promising and relatively complete shipwrecks were completely excavated, documented and drawn in detail, while young (19th–20th century) and mainly iron-hulled shipwrecks were removed and written off without any proper documentation. Many other wrecks were, for varying reasons, briefly explored and 'reserved for future research'.

In due course, a large but very inconveniently arranged dataset was generated with information on shipwrecks in the province of Flevoland. At first, this dataset could only be consulted on paper, but most information was eventually digitalized and could therefore easier be accessed. The descriptions of shipwreck locations were transformed into modern day coordinates of the Dutch National Grid (Rijksdriehoeksstelsel, EPSG: 28992). The arrival of the digital era also resulted in the creation of the national archaeological database ARCHIS. The first version was launched in 1992 and anno 2018 archaeologists are working with version 3.0 (Wiemer 2002: 103). All available shipwreck data from the province of Flevoland was added to ARCHIS and the database is updated with new archaeological records. Research by Van Popta (2012b) has however proven that in the course of time, many errors concerning Zuyder Zee shipwrecks have sneaked into ARCHIS. This is caused on the one hand by the massive and inconveniently arranged database and on the other hand by the fact that non-specialists have entered and interpreted the data incorrectly (Van Popta 2012b: 97). For this reason, a new maritime archaeological database was created by Van Popta (2012a; 2012b; 2017b), the Shipwreck Database Flevoland (SDF), for the purpose of creating a conveniently arranged, reliable and up-to-date overview of shipwrecks in the province of Flevoland. The first two versions of this database have already been used by several archaeological companies, municipalities, provinces and archaeologists of the Dutch Cultural Heritage Agency. In this paper, the latest version of the SDF (3.0) is presented, developed and maintained by the first author.[1] The new version contains strongly improved information on the presence or absence of shipwrecks and the accuracy of shipwreck locations. The presence of shipwrecks has never thoroughly been examined as there is no overview of which shipwrecks are still present in the former seabed. The position of a wreck site also has never been checked and is of importance for spatial research (shipwreck distribution) and the protection of wreck sites. The threefold main question of this research is based on the following factors: how accurate are the locations of shipwrecks

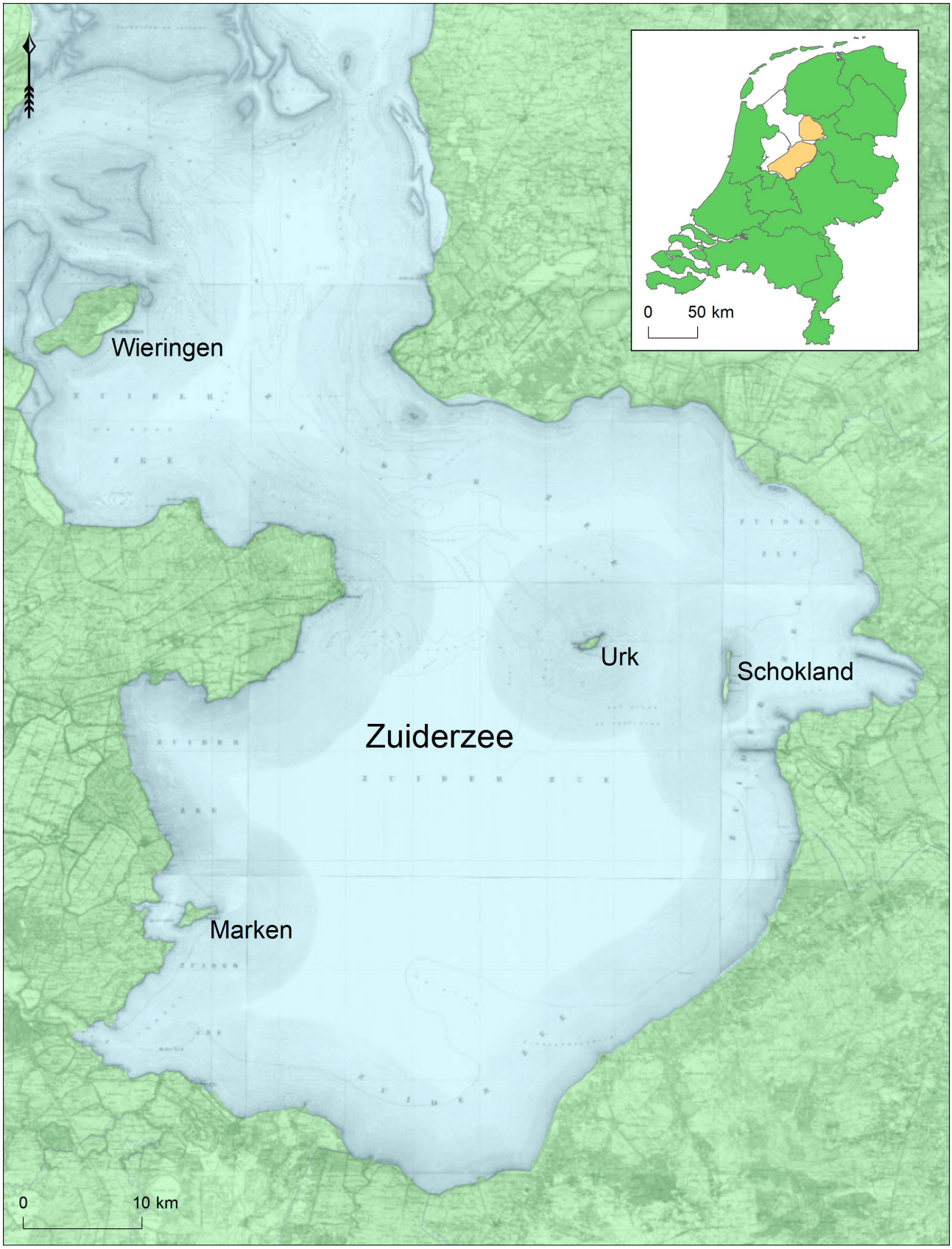


Figure 5.1. The Zuyder Zee region at the end of the 19th century. The inset depicts in orange the main research area, nowadays known as the province of Flevoland.

in Flevoland, how many shipwrecks are still present in the soil[2], and how relevant are the factors 'accuracy' and 'presence' for current maritime archaeological research in the Zuyder Zee region? The answer to these questions are of course linked to the scale of the questions asked (local, regional, national).

Previous research

Several datasets were consulted to assemble shipwreck-related information. First, all available digital scans of the shipwreck archive of Flevoland, kept by the 'Stichting Erfgoedpark Batavialand', were examined. The archive consists of thousands of pages from daily reports of shipwreck excavations, drawings, photographs (slides), wreck site descriptions, wreck site notifications, artifact inventories, correspondence, and official but unpublished archaeological reports. Together, these documents form the primary source of information on shipwrecks in the province of Flevoland. For the oldest excavations (1940s and 1950s) these are often the only available source of information. The second dataset that was used for this research is the so called Ship Catalog (*Scheepscatalogus*, latest version 2006) created by Rob Oosting and Gerard van Haaff of the Cultural Heritage Agency of the Netherlands (RCE). This database contains primary information on shipwrecks in Flevoland of which a great deal was retrieved from the shipwreck archive (primary dataset). The third exploited dataset is the national archaeological database ARCHIS. Using specific search terms (*e.g.* 'ESCH' as the complex type for shipwrecks), relevant data could be filtered from the massive number of overall data.

It is thought that at least 400 shipwrecks have been examined by archaeologists in the Zuyder Zee region, but the exact numbers differ for each of the datasets. Research by Van Popta (2012a) proved that information on shipwrecks from both the Ship Catalog and ARCHIS contains a large number of errors. The most commonly made mistakes are duplicated wreck notifications and contradictory information on specific wrecks. As a consequence, the 459 shipwrecks in ARCHIS and the 471 wrecks in the Ship Catalog were reduced to 423 wrecks (Van Popta 2012a: 98). In 2015, new research was conducted by the consultancy organization Periplus Archeomare (under the authority of the Nieuw Land Erfgoedcentrum, now part of Stichting Erfgoedpark Batavialand), in which it was tested whether known wreck sites and wreck remains could be detected by means of remote sensing (Muis & Van den Brenk 2015: 5). Side-scan sonar data, LiDAR-data (Airborne Light Detection and Ranging), historical aerial photographs and satellite images were combined and analysed. The outcomes were added to the SDF, mainly concerning (1) structures visible on LiDAR-images and historical aerial photographs and (2) whether shipwrecks were still present at wreck sites or not. It was concluded that locating wreck sites with the help of historical aerial photographs is harder than expected. Several causes were given: the resolution of the photographs was too low, wreck sites could not be distinguished from other phenomena such as tree stumps, and wreck sites could not be detected due to soil disturbance (*e.g.* ploughing) and vegetation cover (Muis & Van den Brenk 2015: 47). Based on the analysis of Periplus Archeomare, 23 wreck sites were added to the SDF and another 12 wreck sites were given new and more accurate coordinates.

Approach

The current analysis of wreck locations in the province of Flevoland is based on the previous version of the SDF (2.0; 2015) and uses a more detailed approach than the one conducted by Periplus Archeomare. The database (MS-Access) was connected to the Geographical Information System ArcGIS, so wreck locations could be visualized in a spatial environment, thus providing the opportunity to connect them with other spatial input. The most important ones are the Dutch LiDAR-model 'AHN' (*Actueel Hoogtebestand Nederland*; version 2), 25 cm-resolution satellite images of 2016 (available via ArcGIS-online), and a complete set of historical aerial photographs of the province of Flevoland.[3] The LiDAR-data of the AHN 2 has a resolution of 6 to 10 points per m^2 and the possibility to make grid cells of 50 x 50 cm (Van der Zon 2013: 6). In ArcGIS, the LiDAR-data was transformed into a Digital Elevation Model (DEM) for the whole region, in which ground-covered, pit-stored, removed and possibly present shipwrecks can be visualized as small hills or depressions in the land.[4] Modern satellite images (2016) reveal no wreck sites, except for the ones that are ground-covered or pit-stored (*in situ* preservation methods) in Southern Flevoland, but the images are of importance for orienting and georeferencing historical aerial photographs and relocating wreck sites that lack proper coordinates.

The historical aerial photographs of Flevoland provide a detailed and chronological overview of the development of the different parts of the province. The Noordoostpolder is the oldest polder and therefore has the largest collection of aerial photographs: 1947, 1949, 1960, 1971, 1981, 1989, 2000, 2003 and 2006. Aerial photographs of Eastern Flevoland are available from 1960 onwards as the reclamation of the region was finished in 1957. The aerial photographs for Southern Flevoland are limited to the period of 1971–2006 as the region was reclaimed in 1968. Especially the combination of historical aerial photographs and the information of the shipwreck archive of Flevoland turned out to be fruitful for discovering the locations of wreck sites.

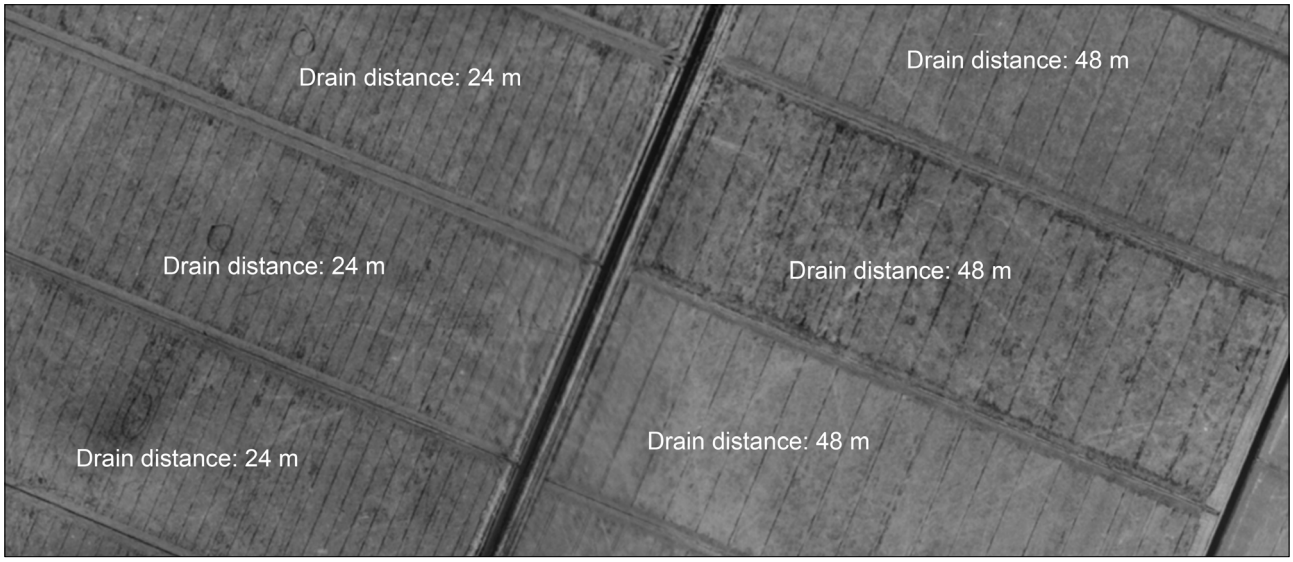


Figure 5.2. An example of different drainage systems in adjacent lots in Eastern Flevoland in 1960: the distance between two drains is 24 m on the left and 48m on the right (aerial photograph: Province of Flevoland).

The locations of the oldest known shipwrecks (collected in the 1940s and 1950s) are solely described in the same exact way, as is demonstrated by the following example:

"the wreck is positioned between the … (number) and … (number) drain ditch from the main watercourse (*tocht*) and is situated at approximately … (number) meters from the ditch (*sloot*) that separates … (lot number) from … (lot number)".

The distance between such a wreck site and such a ditch that separates two lots can be measured easily in the GIS based on satellite images. However, the distance from the main watercourse to the shipwreck, based on the number of intervening drain ditches, is problematic for several reasons. First of all, the description of wreck sites in the shipwreck archive always refers to the old network of drains and drainage ditches. These ceramic drains have since been replaced by a different system of synthetic drains, making the old system invisible and untraceable, because in many cases the old system is obsolete and as such not visible anymore in the field. The second problematic factor is the variable distance between two drain ditches: in general the interval between drains varied from 8-16 m in the Noordoostpolder and 24-48 m in the other parts of Flevoland. The system is however not standardized and old aerial photographs show a lot of variation in the distance between drains (even within the borders of a lot), especially in the eastern and southern part of Flevoland (Fig. 5.2). It is therefore not possible to multiply the number of drains with an average interval distance in order to retrieve the distance from the main watercourse to the wreck location. However, the oldest aerial photographs for each of the regions depict the newly reclaimed and cultivated soils, not yet disturbed by ploughing, with the old drainage systems in most cases clearly visible as soil or crop marks. For the Noordoostpolder region, the aerial photographs of 1949 turned out to be most suitable, while the aerial photographs of 1960 were best for Eastern Flevoland and those from 1971 for Southern Flevoland.

The first step in retrieving the distance from the main water course to the shipwreck is to precisely georeference the historical aerial photographs that depict wreck sites in ArcGIS. The location of the drain ditch that was mentioned in the documentation can then be found by counting all the ditches on the lot. This, together with the distance that was calculated from the ditch that separates two lots, leads to the exact location of the wreck site. The method is illustrated by the example of shipwreck NE 87 which, according to ARCHIS and the Ship Catalog, is located on lot NE 86, circa 250 m to the east of the Professor Brandsmaweg and 50 m north of the ditch that separates lot NE 86 from NE 87 (Fig. 5.3).

The documentation of the shipwreck suggests a completely different location for the wreck: it should be located along the 49th drain on lot NE 87 (counting from the Professor Brandsmaweg) and 90 m south from the ditch that separates lot NE 86 from NE 87. The old drainage system has likely been removed a long time ago and the 49th drain is therefore untraceable in the field and on recent satellite images. It is however clearly visible on historical aerial photographs from 1949. By georeferencing these in the GIS, it is possible to count the number of 'old' drainage ditches (visible as white lines) from the Professor Brandsmaweg towards the

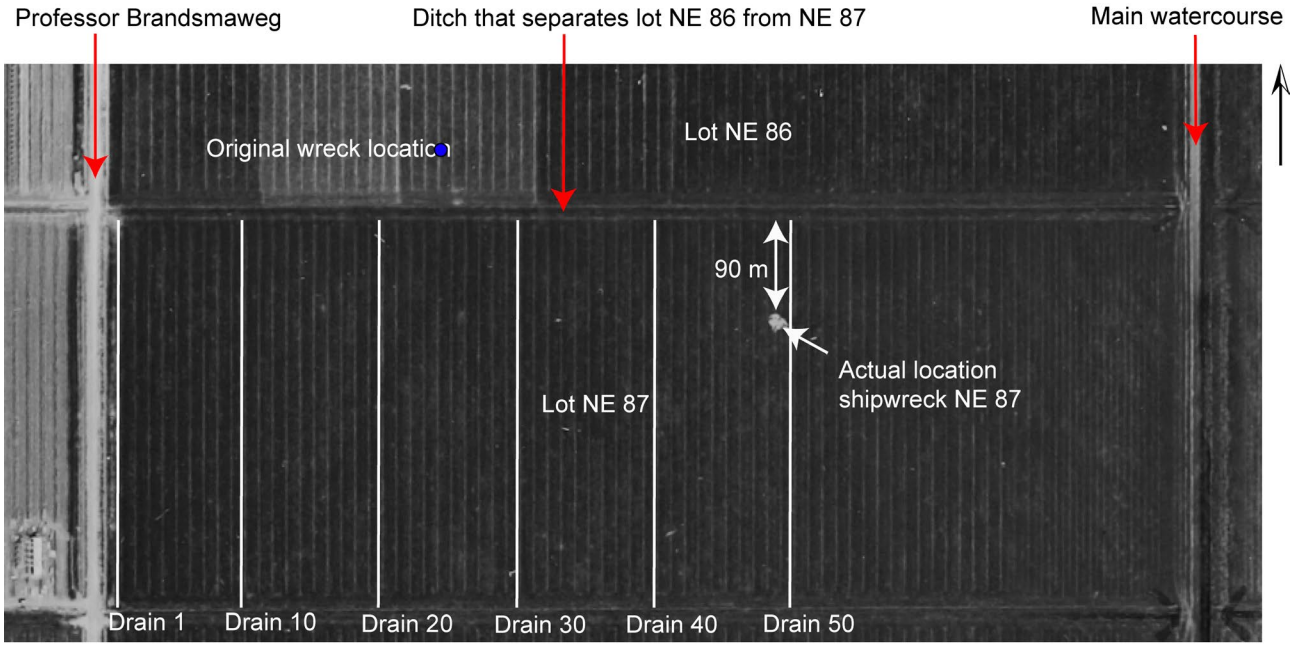


Figure 5.3. Aerial photograph from 1949; marked on it are the incorrect 'original' registered and (corrected) 'actual' wreck site locations for shipwreck NE 87 (aerial photograph: Province of Flevoland).

east, until the 49th drain is found. Then, the distance of 90 m from the NE 86 / NE 87-ditch towards the south can be measured along the 49th drain, providing the exact location of the shipwreck. Coincidentally, in this particular case the wreck site is visible on the aerial photograph as a large somewhat circular discoloration.

Not every wreck site is described in this way, however. In some cases local reference points have been used that cannot be traced anymore, like milestones/kilometer markers, changed or removed infrastructure (although these can be visible on historical aerial photographs) and mobile entities like crops and machines. In most of these cases, the description of the wreck location was intended for the archaeologists that had to examine the wreck, thus for temporary use only. In order to work with the variability of accuracy of wreck locations, it was decided to give each of the shipwrecks an accuracy score. A score of 1 means that the original wreck location in ArcGIS is the actual location of the wreck. In other words, the provided coordinates are positioned in the centre of the actual wreck location. A score of 2 means that it is likely that the shipwreck is or was located near the stated location. This goes for a wreck site description like: "the shipwreck is located in the utmost southeastern part of the lot", for which a random point in this area is chosen as the wreck location. A score of 3 means that the location of the wreck is unknown. As the name of a shipwreck in Flevoland in most cases refers to the lot on which it was found, a score of 3 indicates that it must be located somewhere on the corresponding lot, without knowing the exact location within. In those cases, center coordinates of the lot are used. Hence, if a wreck site appears to be in the center of a lot, it is important for the user of the database to check whether the accuracy score is 3, as several actual wreck sites (accuracy 1) are positioned in the center of the lot by coincidence.

Besides the accuracy of wreck sites the research has also focused on the question which shipwrecks are still present, and which ones have been removed in the past. The Ship Catalog contains a column in which information about the presence or absence of wrecks is noted, but it is unclear where this information is derived from. Especially those wrecks that are defined as 'given up' are confusing: it means that the primary information of these shipwrecks is incomplete, but not necessarily that the wrecks have been removed. Periplus Archeomare (Muis & Van den Brenk 2015) also tried to create an overview of the shipwrecks still present in Flevoland, but their data and interpretations are incomplete. Therefore, the results of a new study on the presence or absence of shipwrecks, based on the documentation in the shipwreck archive, have been added to the SDF 3.0. Especially the daily reports were of crucial importance as in many cases they mention, in the final entries of the excavation, whether a wreck was removed, shifted or covered up. Frequently encountered examples are "the timbers were disassembled and transported" (wreck removed), "the timbers were burned on the land" (wreck removed) and "the wreck was covered with cloths and the excavation pit was covered up" (wreck still present). There are however plenty of shipwrecks for which daily reports are missing, making it harder to figure out whether these wrecks were removed. In some cases, cor-

respondence between the archaeologists and the land users/tenants reveals further relevant information, as when mention is made that a wreck has been removed after inspection and/or excavation. In other cases it is only mentioned that a wreck is of little scientific importance and has been given up; it then depends on the actions of the land owner or tenant whether a wreck has been removed or not. Wrecks can also partially be present still if only the highest parts of the wreck were removed, for example when the deepest timbers were no obstacle to ploughing the land. This information can either be found in the excavation documentation or by carrying out a trial excavation. Each of the wrecks in the SDF is given a second score that indicates whether a wreck is still present or removed. When the presence or absence is uncertain, the score 'unknown' is used.

Results

The first version of the SDF (1.0, 2012) contained 423 shipwreck records, while the second version (2.0, 2015) contained 446 records after Periplus Archeomare added another 23 records to the database. The third version of the SDF, presented here, contains 449 records (for data, see: Van Popta & Van Holk, 2018). Although there appears to be a difference of only three records between the second and third versions, in fact 23 records were removed and another 26 added to the database (Table 5.1). Also, the locations of 218 wreck sites were corrected; this amounts to almost one incorrect shipwreck location for every two records and an average error of approximately 356 m for each of the adapted wreck sites. The corrections of wreck site locations can be divided in (1) records with center coordinates, (2) wreck sites that were depicted on the wrong lot, (3) wreck sites with incorrect coordinates due to typing errors, and (4) wreck sites with incorrect coordinates due to the use of estimated or random coordinates (Table 5.2).

Centre coordinates were often used to pinpoint wreck sites on regional topographical maps for those wrecks of which the actual location was not known. The

Table 5.1. Overview of the records that were removed or added to the third version of the SDF.

Removed from SDF	**Reason**
NA 23	Not a shipwreck
NA 90	Not a shipwreck
NC 35	No wreck found
ND 2	No wreck found
ND 22	No wreck found
NE 46	No wreck found
NG 62	No wreck found
NH 7	The same as NK 7
NK 12	No wreck found
NK 16/17	No wreck found
OG 158	Mentioned twice
OG 33	The same as OG 34
OK 48	The same as OH 48
ON 6	The same as ON 6-I
ON 23	The same as ON 59
OP 71	The same as OP 72
OU 112	The same as OU 113
OZ 36	The same as ZO 36
ZC3	The same as 3Z6
ZK 46	The same as ZK 45/ZK 46
ZN 3	The same as ZN 103
ZN 13	The same as ZN 113
IJH-01	The same as IJsselmeer Houtribsluizen 1
Added to SDF	**Ship type**
3Z6 De Vliegende Hollander	Unknown
Blocq van Kuffeler	Likely a Volendammer kwak
De Onderneming	Unknown

Table 5.1. Continued.

Added to SDF	Ship type
IJsselmeer Urk con-1	Fishing vessel
IJsselmeer Urk con-2	Unknown
IJsselmeer Urk con-3	Unknown
IJsselmeer Urk-roeisloep	Flatboat
James Stewartstraat Almere	Split tree trunk with metal fittings
Johanna	Unknown
Hanzerak West	Pram/tjalk
Ketelmeer West	Freighter
NC 87	Unknown
ND 86-II	Unknown
NE 103	Unknown
NE 133	Unknown
NP 32	Unknown
NP 34	Unknown
OH 49 (Beverweg)	Unknown
P.I. 65	Unknown
Vijf Gebroeders	Pram
Markermeer sonarcontact 109	Unknown
Markermeer sonarcontact 137	Tjalk
Markermeer sonarcontact 149	Unknown
Markermeer sonarcontact 31	Unknown
Markermeer sonarcontact 35	Unknown
Markermeer sonarcontact 71	Unknown

only certainty provided was the name of the shipwreck, referring to the toponym that was used for a specific lot: shipwreck NR 4 refers to Noordoostpolder (N), R-section, lot number 4. As a consequence of using center coordinates, an artificial appearance of accuracy was created, and many of these locations were adopted in national databases and never checked afterwards. Based on the new methodology, it was possible to accurately reposition 36 wreck sites with center coordinates. The smallest adjustment measured only 50 m, indicating that this shipwreck by coincidence was lying near the center of the lot. However, the majority of these wreck sites (n=20) have a deviation of 200 to 400 m. The largest adjustments came from wreck sites from the southern part of Flevoland and measured in three cases more than 800 m. This is no coincidence: it underlines the differences in size of the lots in the three regions. The lots of the Noordoostpolder and Eastern Flevoland are much smaller (10-40 ha) than those of Southern Flevoland (30-90 ha, Table 5.3). It means that, when using center coordinates for unknown wreck locations, the chance of a large deviation is bigger for the southern part of Flevoland than for the other regions. In general the deviation cannot extend beyond 900 meters as the largest lots in Southern Flevoland have a length of approximately 1800 m: in these cases the actual shipwreck should be laying at the beginning or far end of the lot, while the provided coordinates represent the center of the lot (Fig. 5.4).

The deviation of shipwrecks depicted on wrong lots is far larger than for those with center coordinates: a total of 27 wreck locations were adjusted with a total deviation of approximately 30 km (Table 5.2). A third of them has a deviation of more than one km, and there are two major exceptions: shipwreck NA 8 was depicted 5,3 km from its actual location and the coordinates of shipwreck OY 96 were positioned 6,5 km to the northwest of the actual wreck site. There is no general explanation for the errors that were made. Many of them are presumably caused by inattention and typing errors.

These errors can have a large impact on archaeological heritage management, especially in those cases when it is decided to protect a wreck site: not only would a piece of land be protected that lacks wreck remains, it would also wrongfully limit the possibilities of the landowner. A total number of six shipwrecks was misplaced merely due to errors with a total deviation of 4500 m and an average deviation of 750 m (Table 5.2).

Table 5.2. Overview of the 218 adjusted shipwreck locations, divided into deviation and distance categories. Each of the deviation categories has an average deviation (per wreck site) and overall deviation.

Category	Deviation (m)	Number
Center coordinates	0-100	1
	101-200	5
	201-300	10
	301-400	10
	401-500	4
	501-600	1
	> 600	5
	Average deviation	362
	Total deviation	13040
	Total shipwrecks	36
Wrong lot	0-200	3
	201-400	5
	401-600	3
	601-800	5
	801-1000	2
	> 1000	9
	Average deviation	1113
	Total deviation	30050
	Total shipwrecks	27
Error	0-1000	3
	1001-2000	1
	2001-3000	1
	> 3000	1
	Average deviation	750
	Total deviation	4500
	Total shipwrecks	6
Estimate/random	0-100	59
	101-200	34
	201-300	18
	301-400	16
	401-500	10
	501-600	4
	601-700	3
	701-800	3
	> 800	2
	Average deviation	199
	Total deviation	29705
	Total shipwrecks	149

Although this category corresponds closely to the wrecks that are depicted on wrong lots, an error does not necessarily mean that the shipwreck is attributed to a different lot. This is illustrated by the wrecks on lot ZA 87, of which two are switched due to a misinterpretation of the toponyms of both wrecks: ZA 87-II is positioned on the wreck site of ZA 87-III and vice versa. The total error measures 235 m for both wrecks and is within the boundaries of the lot. The shipwreck on lot OH 101 is originally also depicted in the wrong location within the boundaries of the lot due to a misinterpretation of the description of the wreck site. The actual description

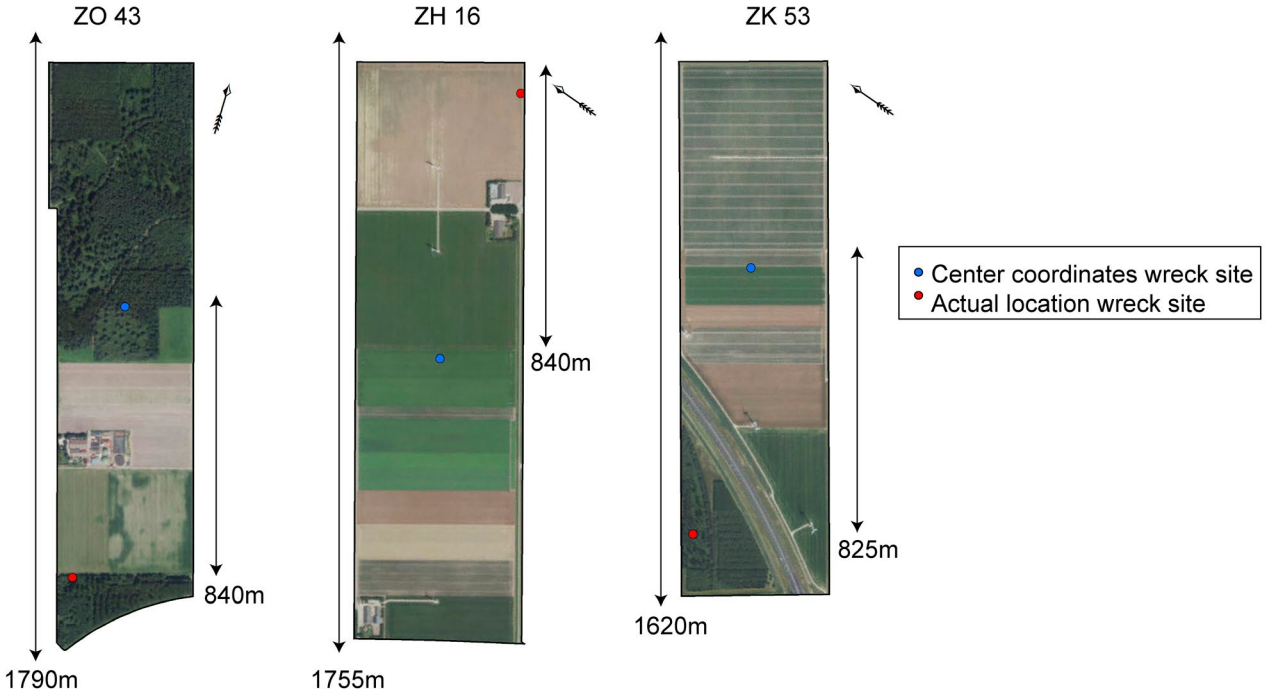


Figure 5.4. Examples of large-scale deviations, due to the use of lot-centre coordinates, between incorrect recorded locations and reconstructed actual wreck site locations in Southern Flevoland.

Table 5.3. Overview of lot sizes for different parts of the province of Flevoland.

Size lot (ha)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	> 100
Noordoostpolder	177	412	1428	38							
Eastern Flevoland	162	417	925	221	37	4		4			
Southern Flevoland	6	24	47	84	56	71	35	44	50	8	2
Total	345	853	2400	343	93	75	35	48	50	8	2

says that the wreck is positioned at 550 m from the main water course and 25 m from the ditch that separates the lots OH 101/OH 102. Instead, the wreck is depicted at 500 m from the main water course and 25 m from the ditch on the other side of the lot, causing a deviation of 250 m (Fig. 5.5). Two other shipwreck locations (NC 51 and NA 59) have a much larger misplacement due to type errors: the X-coordinate of NC 51 is 523860 while it should be 526577, causing a difference of 2,7 km between the depicted and actual wreck site. Shipwreck NA 59 is depicted 200 km north of its actual location as the Y-coordinate was misspelled: 737040 should have been 536870.[5]

The use of random or estimated coordinates has caused the largest number of deviations of wreck sites in Flevoland. In total, 149 wreck locations have been adjusted with a total error distance of almost 30 km (Table 5.2). Looking at the deviation for each of the wreck sites, it is clear that the majority (60%) have an error of less than 200 m. A total of 32 wreck sites have seen only small adjustments (a maximum 50 m) of the wreck location, for example when coordinates were used of a fixed point in the direct proximity of the shipwreck (*e.g.* corner of excavation pit), instead of the center of the wreck itself.

The average deviation for each wreck site amounts to almost 200 m. The majority of these deviations is caused by the fact that many locations have been estimated at the beginning of the digital era, for example for the development of the national database ARCHIS. The question is why estimated or even random coordinates were used to indicate wreck locations instead of an accurate positioning. The lack of a clear approach and the availability of only very basic digital tools seem to cover one side of the explanation. Furthermore, wreck locations might have been digitalized from distribution maps on paper of which the accuracy is limited to the regional level (scale 1:50.000). In general, the wreck locations on these maps are represented by dots of which the drawn size represents already 50 to 100 m. So, the scale of the first paper maps also partially determines the accuracy of later digitized maps. However, it

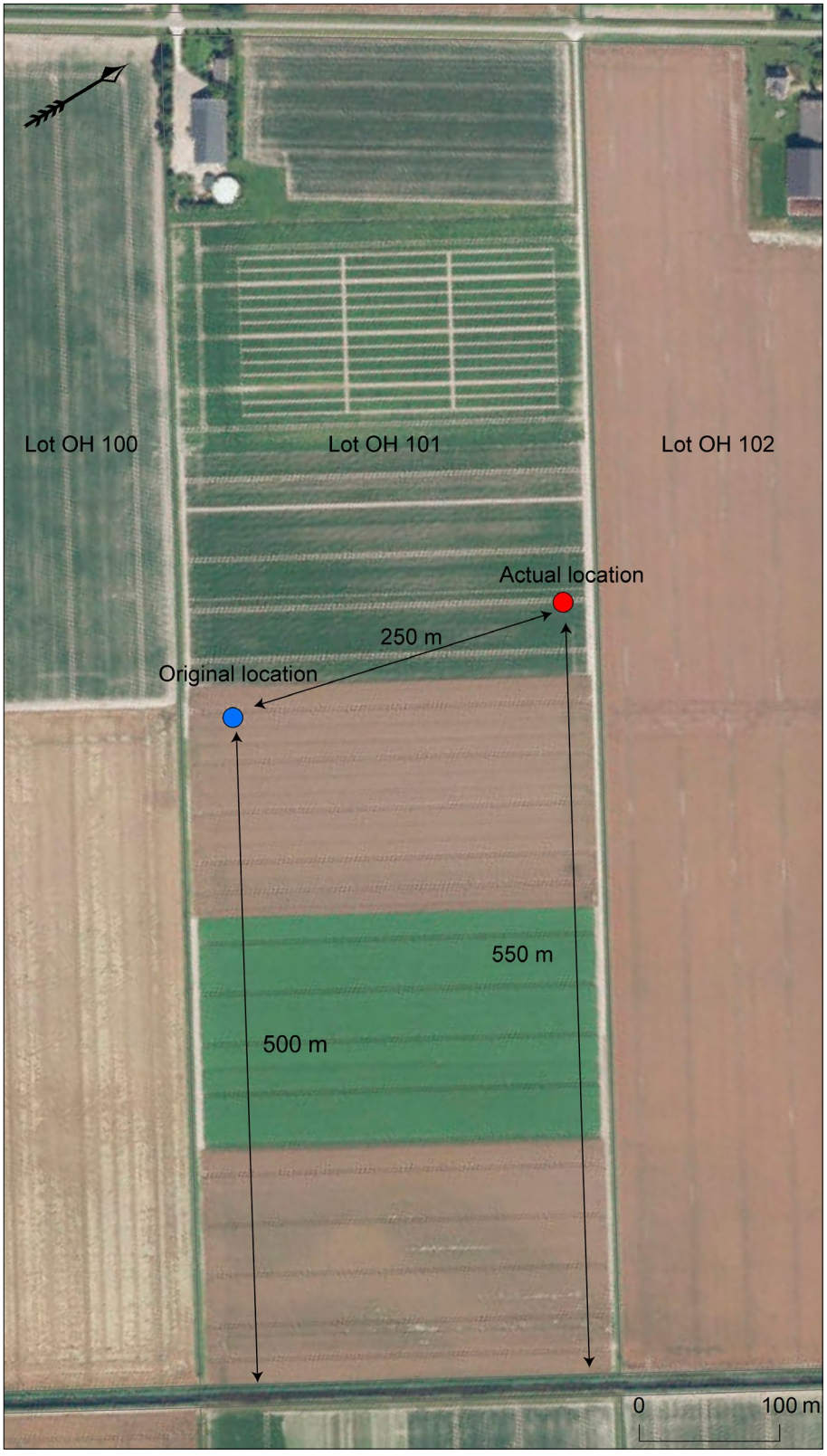


Figure 5.5. An example of a misinterpreted shipwreck location. Originally, the wreck was marked close to the ditch that separates lots OH 100 and OH 101, while it should be close to the ditch that separates lot OH 101 from lot OH 102.

does not explain why in some cases shipwrecks seem to have complete random coordinates. This can be illustrated by looking at the case of shipwreck ZM 8: the location of the wreck site is described as "183 m from the ditch that separates ZM 7 and ZM 8" and "165 m from the Roerdompweg", which should be in the northeastern part of the lot (Fig. 5.6). For some reason, the wreck location is, according to ARCHIS and the Ship Catalog, depicted in the southwestern part of the lot, 435 m from the ditch that separates ZM 7 and ZM 8, and 820 m from the Roerdompweg. The official report even provides the correct coordinates of the wreck

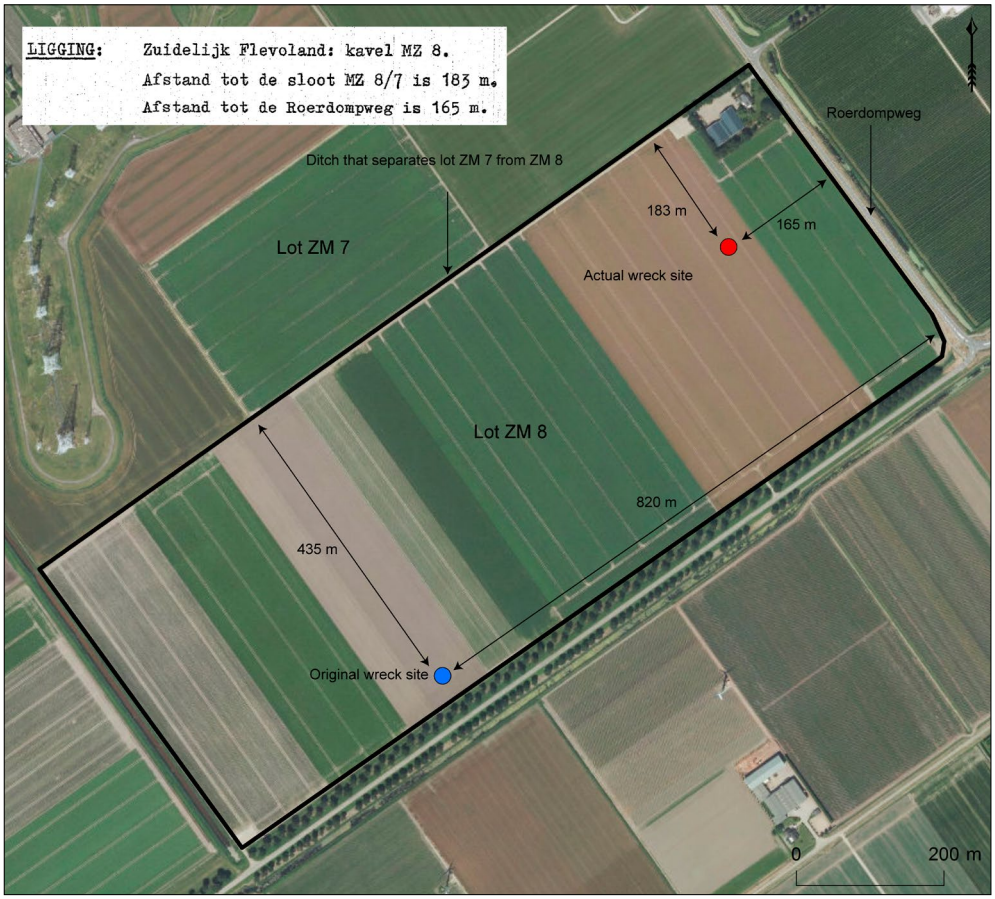


Figure 5.6. This figure shows the actual wreck site of shipwreck ZM 8 (red dot) and its recorded location (blue dot). The use of random coordinates, while an accurate wreck site description was available, caused a deviation of 700 m.

site, but they have been neglected in both databases. As a result, a deviation of 700 m existed between the depicted wreck site and the actual location of the wreck.

Wreck sites on aerial photographs and LiDAR-data

Aerial photographs were primarily useful for searching the relevant old drainage ditches that were used to mark the locations of wreck sites. Nevertheless, it turned out that the photographs have a second function, as in specific cases they depict the actual wreck sites in different ways. First of all, some aerial photographs depict shipwreck excavation pits as, by coincidence, the photographs were taken during archaeological research. At least 15 excavation pits are visible on aerial photographs, of which 6 can be seen in Figure 5.7. A thorough study of aerial photographs might even lead to more visible excavation sites (an exercise which has not been done yet). Second, wreck sites can also be visible as discolorations on aerial photographs (Fig. 5.8). Especially when the land was ploughed for the first time and no crops were planted yet. The discolorations are often caused by the disturbance of sediments near the wreck site due to (post-) depositional processes. For example, the wreckage of a ship can cause a rapid flow of water when the wreck sticks out of the seabed. As a consequence, relative large amounts of sand and shells are deposited as a thick layer of sediment next to the wreck site. After the reclamations and the first phase of land cultivation, these sandy wreck sites differ from the natural clay sediments in composition and colour and become visible under the right circumstances. All depends of course on variables like the local composition of sediments, the size and completeness of the wreck and the thickness of the sediments that cover the wreck.

The analysis of LiDAR-data, providing a height overview of the present surface of the former seabed, has proven to be ineffective when searching for wreck locations in Flevoland. One might expect that still present shipwrecks are visible as minor elevations in the land, as the soil on top and below shipwrecks (often with their keels on the Pleistocene subsoil) does not settle, while their surroundings continue to settle due to drainage. It would also mean that removed wrecks should be visible as depressions on the surface. However, fields are nowadays so intensively ploughed that small elevation differences are immediately leveled. Furthermore, former wreck site depressions have in many cases been filled with extra ground in order to keep the fields as flat as possible. It does not mean that all wreck sites are invisible: the wrecks that are ground-covered or pit-stored (most of them are from the southern part of Flevoland) are clearly visible on LiDAR-data (Fig. 5.9). As the

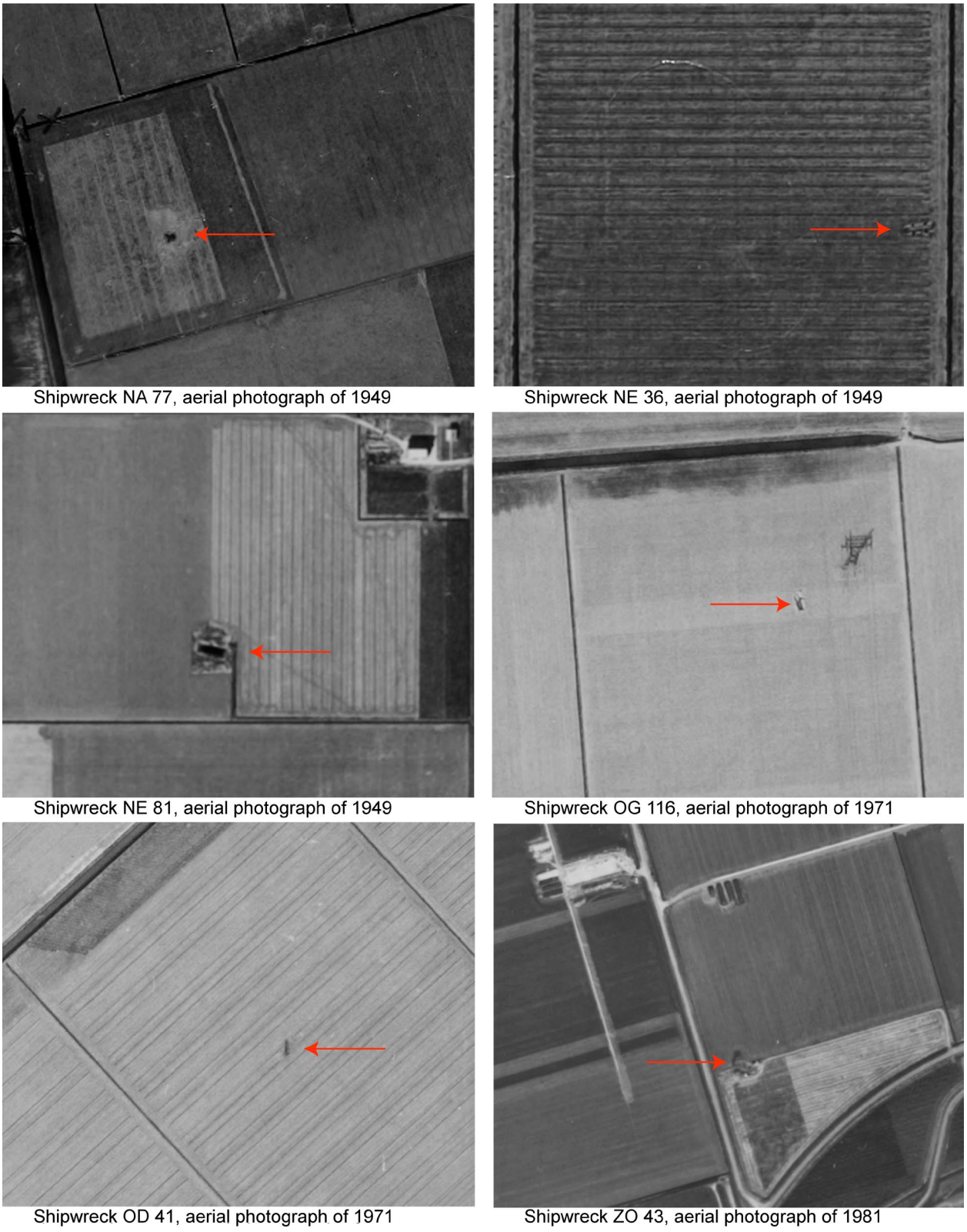
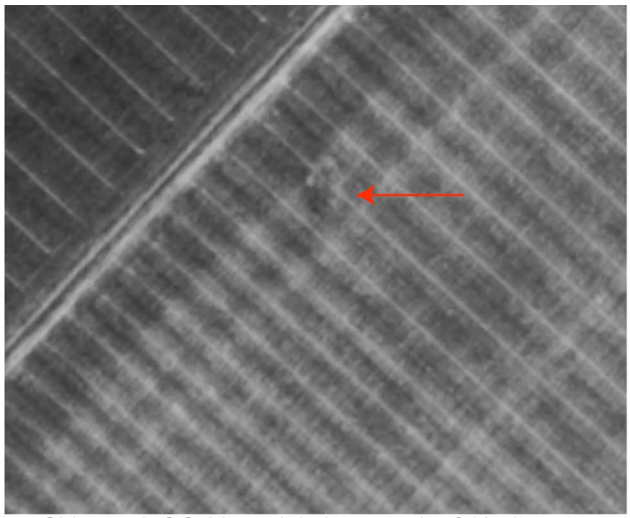


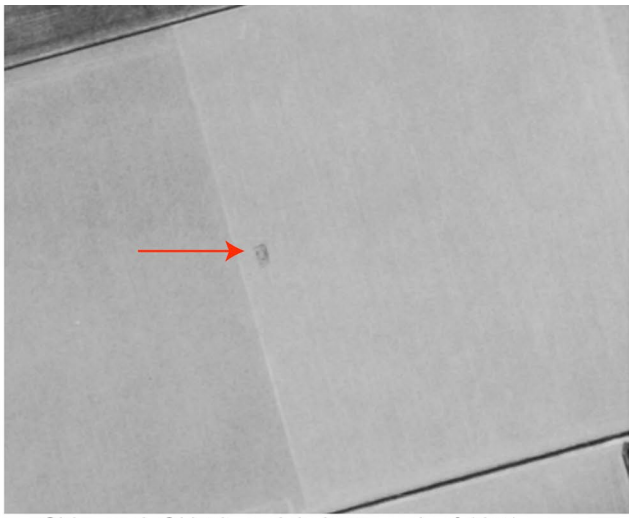
Figure 5.7. Six examples of excavation trenches that are clearly recognizable in historical aerial photographs (aerial photographs: Province of Flevoland).

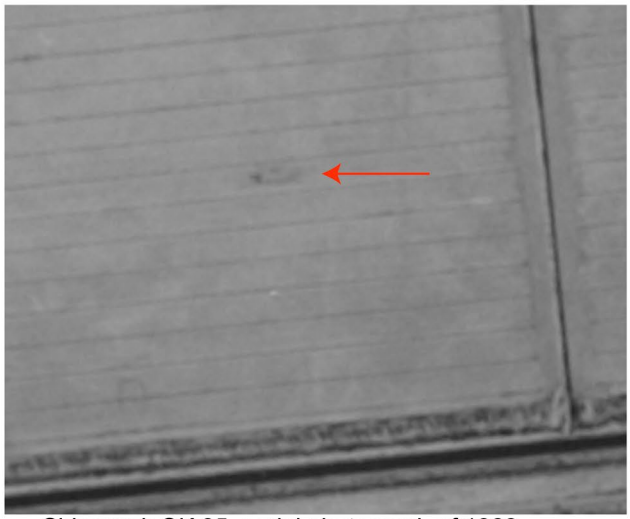
exact locations of these wreck sites are already known (recorded during the on-site conservation), LiDAR-data is only useful as a way of visualization.

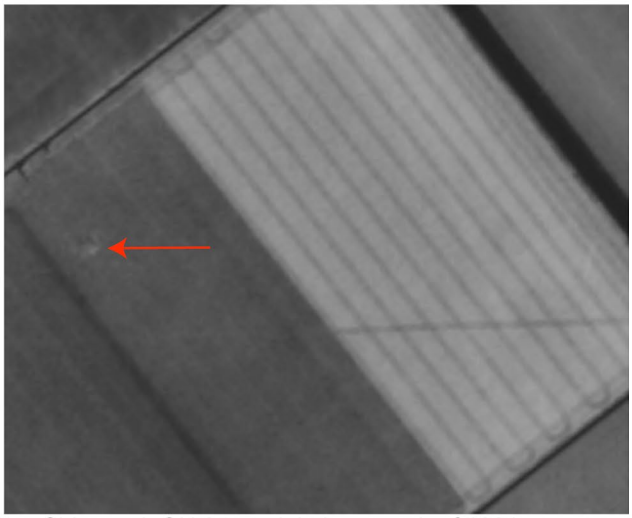
Presence and absence of shipwrecks

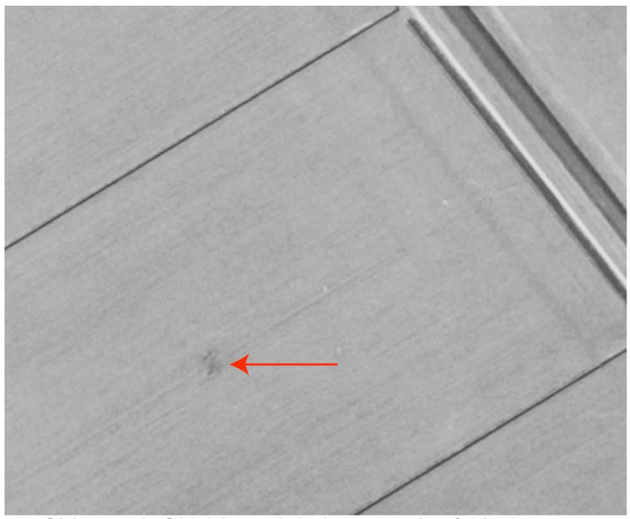
It is most important for cultural heritage management of shipwrecks in Flevoland to know the present state of


Shipwreck OG 33, aerial photograph of 1971


Shipwreck OH 48, aerial photograph of 1971


Shipwreck OK 35, aerial photograph of 1960


Shipwreck OU 34, aerial photograph of 1981


Shipwreck OU 86, aerial photograph of 1971

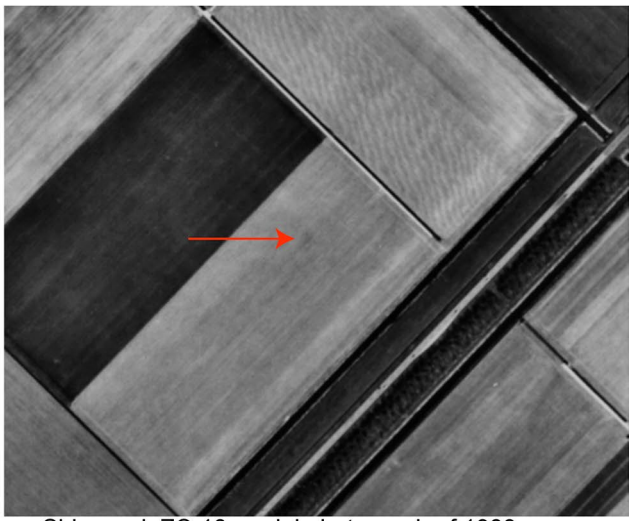

Shipwreck ZQ 18, aerial photograph of 1989

Figure 5.8. Six examples of wreck sites that can be recognized as discolorations in historical aerial photographs (aerial photographs: Province of Flevoland).

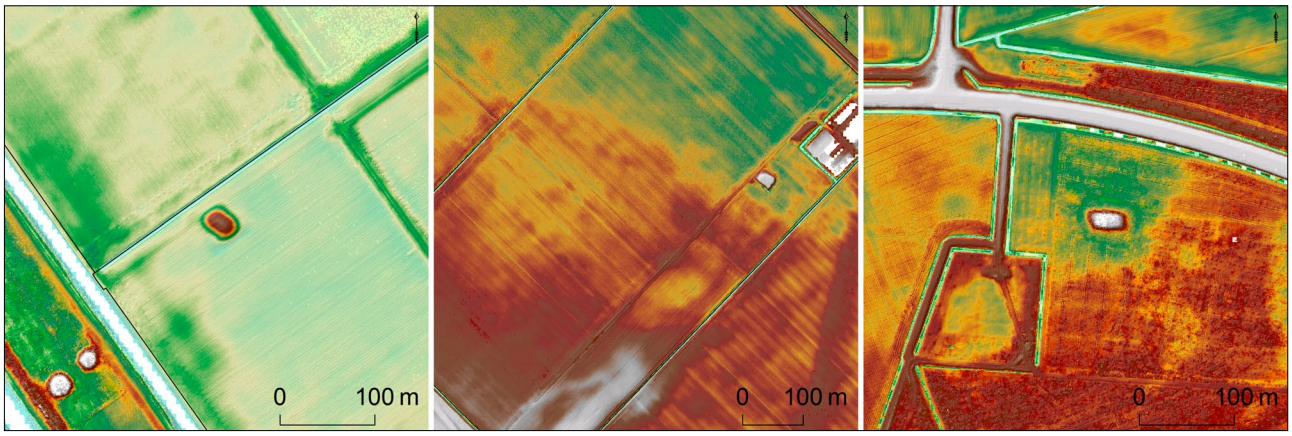


Figure 5.9. LiDAR data of three wreck sites with clearly recognizable soil-covered shipwrecks (after AHN2).

wreck sites. Those wrecks that are still present in the field should be protected (on the basis of a thorough assessment and validation of the site), while the wreck sites of already removed shipwrecks should not unnecessarily be legally protected (which does not mean that those sites cannot be commemorated by some sort of indicator). This would only create hinder for the owner and/or user of the land. Until now, a clear and complete overview of still present and removed shipwrecks in Flevoland was lacking. There were some lists with information about still present shipwrecks, but they focused largely on the most obvious ones (pit-stored and ground-covered). For the majority of the wreck sites in Flevoland the present status was unclear. For this research the documentation of the shipwreck archive was checked for relevant information on the possible removal of wreck parts. The results are as follows: at least 96 wrecks are preserved *in situ* and 271 wrecks have been removed. Of the 96 shipwrecks still present, 42 are lying in the former seabed with little or no protection, 24 wrecks are lying under water and 30 wrecks are either ground-covered or pit-stored.

There are 82 wrecks of which the present situation is uncertain. The uncertainty on their condition is mainly based on poor documentation (no daily reports, no site reports) and vague updates and notifications like 'wreck given up', 'not found during reconnaissance' and 'might be removed'. For some wrecks it is known that they have been excavated in the past, but it is not explicitly mentioned whether such a wreck has been removed afterwards. There is however an indirect way for this to find out: if a shipwreck is excavated and a detailed description is provided of the construction of the hull, it would mean that the ceiling and frames were removed (this is often mentioned). Therefore it indicates that the wreck was excavated in a destructive way, rather than aiming at preserving it *in situ*. So, even though such a report does not explicitly mention that a wreck has been removed, it is likely that the timbers have been removed, transported and deselected. If in any case a shipwreck has not been found during a reconnaissance and no further details are provided, the present situation of the wreck has been set to 'unknown'.

It is important to keep in mind that, if a shipwreck has been removed, it should not mean that this wreck site is archaeologically written-off. Maritime archaeologists focus mainly on the shipwreck itself, meaning the largest number of connected timbers. Loosely connected parts of the ship (rudder, mast, rigging, leeboards, deck construction) are often separated from a ship in the wreckage process and are rarely found during excavation. Even a whole side of the ship can drift away as soon as the ships' transverse construction elements break down. Therefore, limiting the research to the main wreck site can result in overlooking other wreck parts in the vicinity of a shipwreck. This can be illustrated by looking at the excavations of shipwrecks in Flevoland by the International Fieldschool for Maritime Archaeology Flevoland (IFMAF). In the summer of 2011 and 2012, a late 16th-century freighter (OE 34) was excavated near Lelystad (Van Holk 2017b). Preceding the excavation, a short geophysical research was carried out to test whether or not wreck parts would be visible on the maps that were generated from the geophysical data. As the results came in late, it turned out that several anomalies (parts of the wreck) were located outside the excavation pit (this is also caused by the fact that the excavation pit is kept as small as possible, to minimalize disturbance of land put to agrarian use). More or less the same thing happened during the excavation of the 17th century shipwreck OR 49 in 2015. At the end of the excavation campaign, the immediate surroundings of the excavation pit were examined with a metal detector. A strong signal was picked up close to one of the edges of the excavation pit and it was decided to excavate that area as well. It turned out that the signal was coming

Figure 5.10. The largely intact and well-preserved rudder of shipwreck OR 49 that was discovered outside the excavation trench.

from metal fittings and pintles (*roerhaak*) that were part of the largely intact rudder of the ship (Fig. 5.10).

Rudders are not often found as they easily get detached from ships during the process of sinking. This specific rudder also got disconnected from the ship but was deposited quite close to the wreck. If the archaeological research would have been limited to the excavation pit, this rare and relevant part of the ship would not have been found. Furthermore, it is likely that objects from the ships' inventory have been taken by the waves during wreckage and therefore are spread around the wreck site. The most obvious way to illustrate this is by looking at the eroded and disturbed sediments (*verspoelingslaag*) that surround shipwrecks: they often contain all kinds of objects belonging to the artifactual inventory of the shipwreck. This was also observed during the IFMAF-campaigns when dozens of objects were found outside and even partially underneath the wrecks. The main point is that even if the documentation mentions that a shipwreck has been removed after archaeological research, there is a chance that construction parts and objects belonging to the artifactual inventory of the shipwreck still remain in the vicinity of the wreck. Therefore, shipwrecks that are registered as 'removed' should be interpreted as: "the shipwreck is removed, but this is still a wreck site". So from a management point of view we should pay attention to these sites too. Distinction could be made between sites that have been excavated and afterwards left alone and sites that have been destroyed.

Discussion and comparison

This research is a further step in creating a more reliable dataset of shipwrecks in Flevoland, but the end has not yet been reached. There are still plenty of wreck sites of which primary information is (partially) missing. First of all, the exact location of 260 wrecks is now known, but there are still 90 wrecks of which the wreck site is estimated and 99 wrecks of which the location is completely unknown. Second, the present situation of wreck sites is still partially unclear: 96 wrecks are preserved *in situ* and 271 have been removed in the past, but this means that it is uncertain whether the remaining 82 wrecks are still present or have been removed. Archaeological fieldwork would be useful to improve the data even further by focusing on unknown and estimated wreck locations and the shipwrecks of which the present situation is unknown. The sites in question might have been deselected for various reasons in the past, but the reasons for deselection have been changed dramatically over the years, which legitimates renewed investment. The information from both categories (accuracy and presence-absence) can also be combined in order to select the shipwrecks that should be given priority (Table 5.4).

Shipwrecks from the categories A1 and C1 need no further attention as their locations are accurate and their present status (present or absent) is known. The wrecks belonging to the categories C2 and C3 are also of less importance (with the restriction, mentioned earlier, that the surroundings of the excavation pit might contain archaeological remains) as these wrecks already have been removed, although it would be useful if accurate wreck site locations were to be retrieved eventually.

The 82 wrecks that belong to the categories B1, B2 and B3 need to be examined more closely in order to find out whether the wrecks have been removed or are still present. Special attention should be given to the 32 wrecks that belong to category B3 as both their location accuracy and present situation are unclear. High priority should also be given to the two wrecks of category A3 that are still present, but of which the exact location is unknown. Both wrecks lie within the nature reserve Oostvaardersplassen and are presumably preserved under water. As ploughing and soil disturbance is not allowed in the region, the preservation conditions of both wrecks should be good, more so because the water saturated timbers are hardly affected by oxygen (although this should be checked in the field). So, although both wrecks are not threatened at the moment, this situation can change overnight. Moreover for monitoring purposes an exact location is also necessary.

Improving the quality of the SDF by creating a higher accuracy of wreck locations and making an inventory of still present shipwrecks suits not only scientific pur-

Table 5.4. Classification of shipwrecks based on the two main factors for maritime archaeological heritage management: presence or absence, and accuracy of wreck location.

Category	Presence or absence shipwreck	Accuracy wreck location	Number of wrecks
A1	Present (A)	Exact (1)	89
B1	Unknown (B)	Exact (1)	**26**
C1	Absent (C)	Exact (1)	140
A2	Present (A)	Estimated (2)	0
B2	Unknown (B)	Estimated (2)	**24**
C2	Absent (C)	Estimated (2)	67
A3	Present (A)	Unknown (3)	**2**
B3	Unknown (B)	Unknown (3)	**32**
C3	Absent (C)	Unknown (3)	70

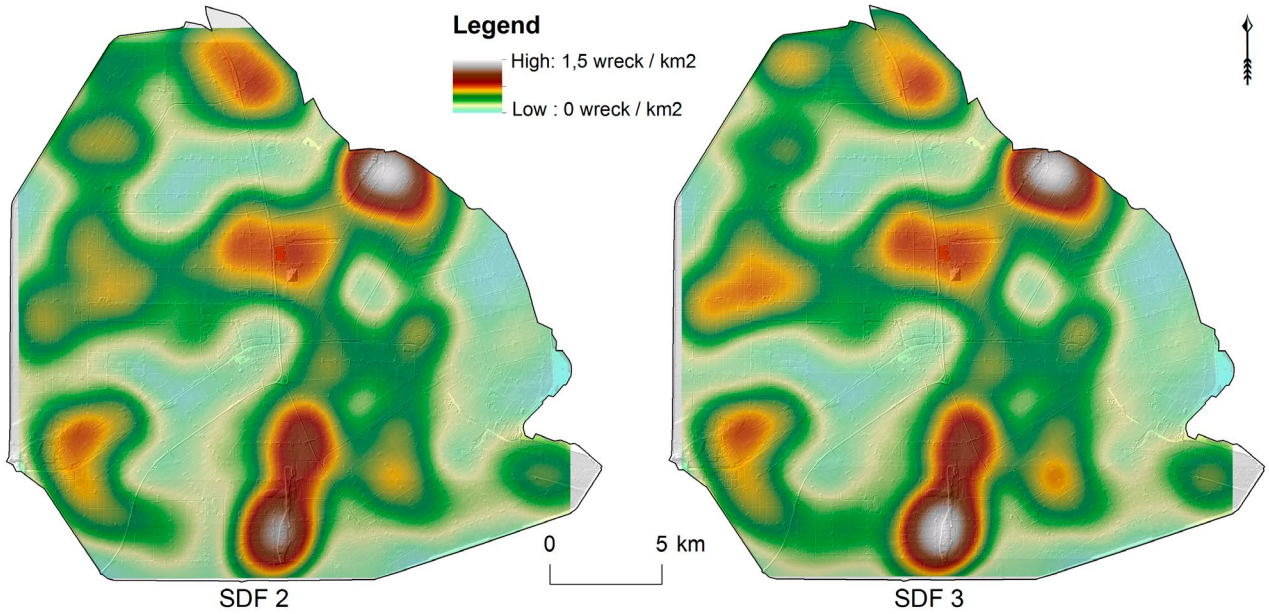


Figure 5.11. Density analysis (kernel density) of wreck sites in the Noordoostpolder, based on the SDF 2 (2012) and SDF 3.

poses but also archaeological heritage management. It results in more accurate distribution- and density maps of shipwrecks (scientific purposes) and helps in protecting the remaining shipwrecks in the right way (heritage management). For a regional and spatial wreck analysis it is important to keep in mind that the wreckage of a ship, for example due to a leak or a heavy storm, can take place at a random location, notwithstanding that some wreck locations could be more or less likely. On the other hand ships can wreck initially at a certain location and end up on the seabed at a different location, for example miles away. An average wreck location deviation of 200 m will therefore not change the general overview and interpretations of a regional spatial analysis. This can be demonstrated by comparing the old and new density- and distribution maps of shipwrecks, derived from the oldest and newest version of the SDF (Fig. 5.11).

The new density map has not changed much, although several high density areas are smaller or changed form. The spatial differences between the old (blue dots) and new (red dots) shipwreck locations are however clearly visible on the distribution map (Fig. 5.12). These differences are of particular importance for research on a local scale, for example when new archaeological finds are connected to known shipwreck sites, or when historical information about wreck sites (often given in latitude/longitude with Amsterdam as the prime median) is related to actual wreck sites. Furthermore, new results derived from distribution and density analyses might help to predict (on a regional scale) wreck locations in parts of the Zuyder Zee

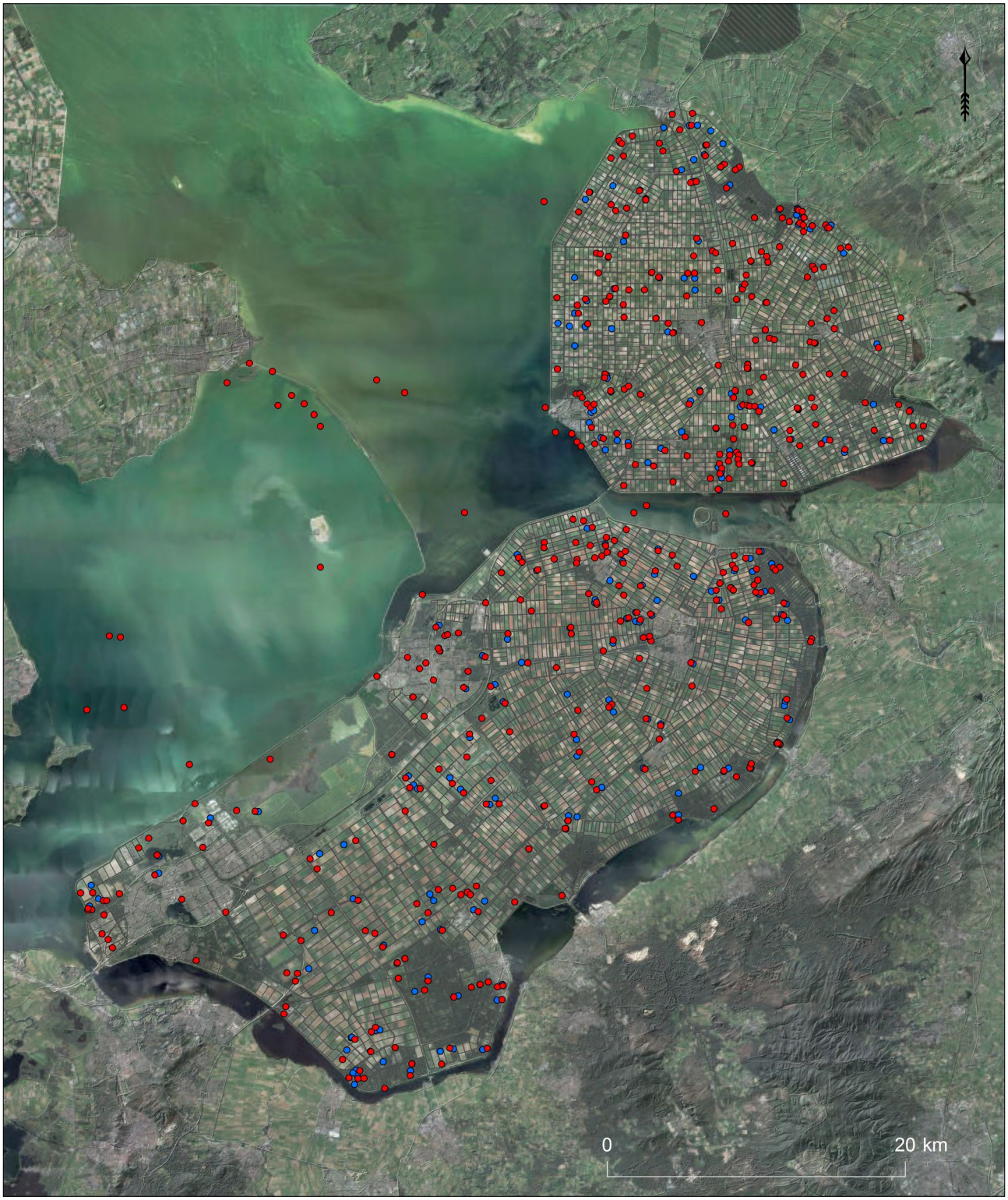


Figure 5.12. Distribution map of shipwrecks in Flevoland. The blue dots represent wreck sites of the SDF 2 that proved incorrect or spurious, the red dots represent the wreck locations of the SDF 3.

region that have not yet been thoroughly examined (*e.g.* Markermeer and IJsselmeer).

The new results are also of particular importance for maritime archaeological heritage management in three ways. First of all, the wrecks that are preserved *in situ*, of which the actual location is known, should receive the highest degree of protection (category A1). Second, the wrecks that have been removed with certainty (categories C1, C2 and C3) need no further protection, unless new wreck parts are found in the vicinity of the wreck location. The unnecessary protection of the site of removed shipwrecks would only be troublesome for the

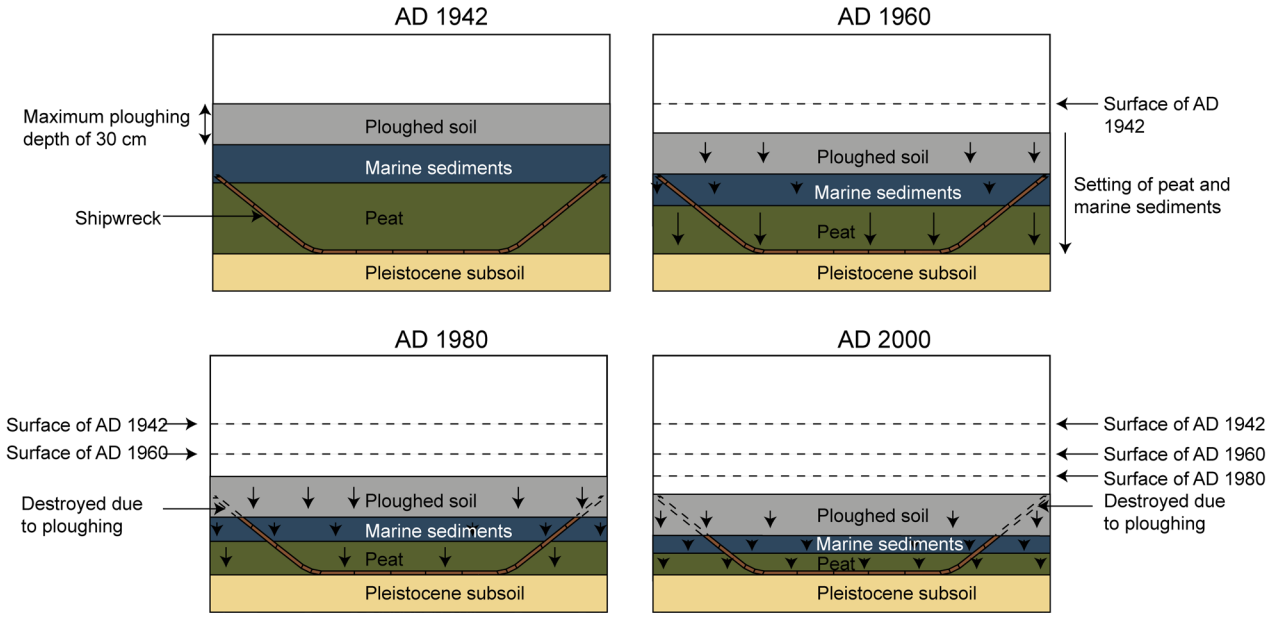


Figure 5.13. Simplified model of the effects of land subsidence and the gradual destruction of shipwrecks.

landowners. The wrecks of which the present situation is unknown and the location is exact or estimated (categories B1 and B2) should have minor protection until more details are available by archaeological reconnaissance. The (possibly) present shipwrecks of which the location is completely unknown (categories A3 and B3) cannot be treated by any kind of heritage management as it is too problematic for the users of the land (mostly farmers) to protect a complete lot. These advices have already been adopted by the archaeological firm RAAP Archaeological Consultancy while developing a new archaeological (policy) map of the Noordoostpolder municipality (Ten Anscher *et al.* 2017).[6]

They advised to protect the wreck locations of category A1 with a protective buffer of 50 m and the wrecks from categories B1 and B2 with a buffer of 100 m as the location is not exactly known (Ten Anscher *et al.* 2017: 71). Within this buffer, soil disturbance at a depth of more than 30 cm is only allowed when a permit is granted. However, one should keep in mind that a maximum ploughing depth of 30 cm is only a limited and partially inadequate way of protecting shipwrecks. Land subsidence of the former seabed will continue in the coming years, while the shipwrecks stay at the same depth, causing them to come closer to the surface (see: Van Tuinen & Van den Bersselaar 2005; De Lange *et al.* 2012).[7] As soon as the top of wreck reaches the ploughing zone due to land subsidence, every year a couple of centimeters of the top of the wreck will be destroyed by ploughing (Fig. 5.13). In most cases, the land user will not even notice that a shipwreck is being destroyed, as the highest parts of the shipwreck already are in a poor condition (oxygen can reach the wreck parts closest to the surface) and will pulverize after being hit by a plough. This theory is founded on evidence collected in the field: during shipwreck excavations in the province of Flevoland, the level of the highest parts of the shipwreck corresponded exactly with the maximum depth of the ploughing zone (Fig. 5.14). If no action is undertaken, a substantial part of the *in situ* 'preserved' shipwrecks will suffer from yearly erosion until whole wrecks are destroyed.

The results of the study on the location and presence-absence of shipwrecks in Flevoland can also be compared with the research of Periplus Archeomare (Muis & Van den Brenk 2015). Their research focused on the question whether known and unknown shipwrecks and wreck remains in Flevoland can be traced by remote sensing. Therefore, they used practically the same data as we did: historical aerial photographs from 1947-2006, LiDAR-data (AHN 2) and modern satellite images. In their conclusions they stated that finding wreck sites and shipwrecks by studying historical aerial photographs turned out to be harder than expected for three reasons. First of all, they presumed that wreck sites were most clearly visible just after the reclamations and before the former seabed was disturbed by ploughing and vegetation growth. The latter is according to them also responsible for making the landscape harder to interpret. Furthermore, the resolution of the aerial photographs was considered not to be high enough for spotting wreck sites. Last, as mentioned earlier, they stated that large parts of the former seabed contain other phenomena like tree stumps that cannot easily be distinguished from shipwrecks (Muis & Van den Brenk 2015: 47).

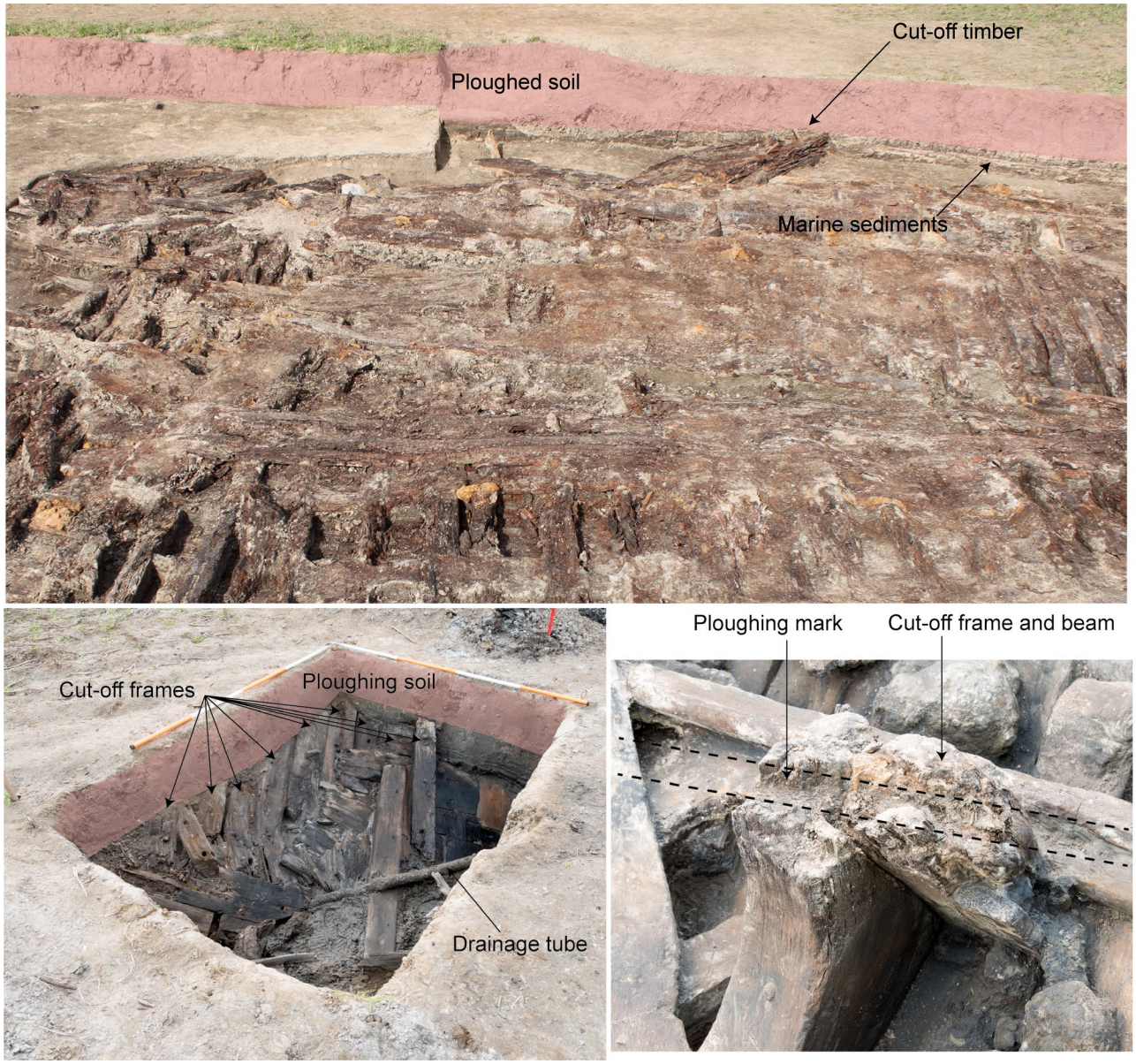


Figure 5.14. Examples of shipwrecks excavated in the province of Flevoland, parts of which have been destroyed by ploughing. The maximum depth of the plough soil corresponds to the cut-off wreck parts.

Then, for each of the wreck sites in Flevoland they described what could be seen on the oldest aerial photographs. This resulted in 7 possible objects (shipwrecks NA 57, NE 131, NE 157, NO 28, NQ 75, NT 57 and ZQ 48/49), 24 possible anchor trails and 415 wreck sites with insufficient evidence for the presence of a shipwreck (ploughed, disturbed, no traces, ditch, under water, no data). The analysis of the second dataset (LiDAR) also resulted in very limited evidence for visible wreck sites. The only wrecks that could be recognized were those that are pit-stored or ground-covered. It was noticed by Muis & Van den Brenk (2015: 36) that the coordinates of some of these specific wreck sites do not match the actual wreck location. Therefore, they recommended checking the locations of other wreck sites as well. This has not been done in their remote sensing research, despite their own warning. The present research has proven that half of the original wreck locations have a relative large deviation of at least 100–200 m. It means that 50% of the outcomes of the remote sensing analyses of Periplus Archeomare are based on incorrect and inaccurate wreck locations. A substantial part of the other 50% of the wrecks consists of wreck sites with artificial center coordinates of the lot, which makes the majority of their remote sensing analyses unfortunately unusable. The current research has proven that by checking the correct wreck locations, it is possible to recognize wreck sites on historical aerial photographs, either as a disturbance/discoloration in the field or as an excavation pit (photographed by coincidence).

Concluding remarks

The third and newest version of the Shipwreck Database Flevoland has provided a lot of new and detailed information on the present status of shipwrecks in the Zuyder Zee region (preserved *in situ*, unknown, removed) and the accuracy of the locations of these shipwrecks. Using the documentation from the shipwreck archive and several remote sensing techniques, it became clear that the locations of 218 shipwrecks had to be adapted. The total deviation amounts up to 77 km and the average deviation for each of the originally incorrect wreck sites is approximately 356 m. Most of the deviations were caused by the use of random and estimated coordinates: the only thing that really mattered was that each ship was placed on the right lot. A total of 27 wrecks was nevertheless depicted on the wrong lot. Other deviations were caused by type errors and the usage of centre coordinates of a lot. Due to the adjustments, the new version of the SDF contains 260 shipwreck records of which the exact wreck location is known. However, there are still 90 wrecks of which the location is estimated and 99 wrecks of which the location remains unknown: more work needs to be done in order to retrieve the exact locations of these wrecks as well. Examining the original excavation documentation also made it possible to present a list of preserved and removed shipwrecks. Until now, there was no clear overview of which of the Zuyder Zee wrecks are still *in situ*. It turned out that at least 96 wrecks are still present in the seabed of the former Zuyder Zee. This is a minimum number as there are 82 wrecks of which the present situation is unclear due to vague, incomplete or absent information. For 271 shipwrecks there is sufficient evidence to conclude that they have been removed from the former seabed.

The results of this research and the new version of the SDF provide a more reliable dataset for further scientific research. The large scale deviations of wreck locations and the new adjustments have no large consequences for spatial research on a regional scale, but one should keep in mind that solid spatial research, especially on a local scale, is only possible if the distribution pattern of shipwrecks is accurate and well-founded. The deviations will have consequences for archaeological research on a local scale, especially when studies are made of specific wreck sites in combination with archaeological, historical and geographical data. Furthermore, the current version of the SDF can be used for new archaeological heritage management within the Zuyder Zee region for the rightful protection of those shipwrecks that need to be protected. However, it should be realized that this rich maritime dataset is not of unlimited proportions. Most of the 96 wrecks that are still present in the former seabed, are in a process of constant degradation that will not be stopped by 'protecting' the wrecks with a maximum ploughing depth of 30 cm. New plans should be made to carefully protect these wrecks (after validation), as they are highly valuable for understanding the maritime history of the Netherlands.

To conclude, the third version of the SDF will most certainly not be the final version of the database, as there is still a lot of information that needs to be added to the database. First of all, the remaining wreck sites with partially unknown data about the present situation or wreck location should be examined more closely. Then, future research should also focus on other categories like 'ship type' and 'moment of wreckage' should be updated as well as improved. For now, the SDF 3 provides a largely improved and more detailed overview of the shipwrecks of the former Zuyder Zee that can be used by scientists as well as policymakers.

Endnotes

1 The X- and Y-coordinates of the wreck sites are screened in order to protect the wreck sites and are only available on request by contacting the Groningen Institute of Archaeology.

2 No figures are given for the expected total amount of shipwrecks in Flevoland, because that is not the topic of this contribution. On the basis of previous research by Van Popta (2012b) we can estimate the maximum amount of shipwrecks that have not been found until this day at about 90 wrecks (Van Popta 2012b).

3 The historical aerial photographs were derived from the website www.historische-luchtfoto.flevoland.nl and manually georeferenced in ArcGIS.

4 Someno shipwrecks have been preserved in situ after archaeological research by either pit-storage (inkuilen) or ground-coverage. In both cases, the shipwreck is covered by ground, but in the case of pit-coverage an artificial groundwater level is created by using large pieces of plastic to cover the ship and its immediate surroundings, except for a small opening for rainwater at the top.

5 The 200 km deviation of shipwreck NA 59 (due to a type error, at least of the first number (7), while the other errors might be the result of a mistake in the calculation of the coordinate) is neglected in the calculations of average and total deviation as it would create a large bias.

6 In addition, the archaeological firm ADC Archeoprojecten is currently using the content of the SDF 3 for heritage management aspects, as an actualization of the Archaeological Monuments Map of the province of Flevoland is needed.

7 'Ripening' of the soils in the freshly laid dry Zuyder Zee floor amounted for many decimeters of surface lowering in the period 1940-2000, its rates have since decreased but are still 1-3 mm per year (e.g. Bodemdaling.nl).

6 Lords, merchants and farmers

An archaeohistorical point-of-view on consequences of the expansion of the Zuyder Zee (AD 1100-1400; Noordoostpolder, The Netherlands)

*Yftinus T. van Popta**

Abstract
This paper examines the development of the settlements and the lives of their inhabitants of the northeastern Zuyder Zee between approximately AD 1100 and 1400. Not much attention has been paid to those that settled in the region of study and had to reclaim the vast peatlands while dealing with natural disasters like storms and floods. They are referred to as actors in a landscape, laying focus lies on who they were, how they lived, what choices they made and what the consequences were in such a dynamic environment. These human aspects are studied from an archaeohistorical perspective, meaning that insights of relevant archaeological and historical studies are combined and analyzed. The first part of the paper provides an overview of the general landscape development of the research area (the stage) for which mainly palaeogeographical and archaeological studies are used. In the second part the settlements and their inhabitants of the region of study are at the center. Four distinct settlements are studied in more detail, being Kuinre, Kampen, Urk and Nagele and illustrate that the inhabitants of the research area can be identified as lords, merchants and farmers and that their occupation, wealth and development highly depended upon several natural and cultural factors.

Keywords
Late Middle Ages, Zuyder Zee, settlements, peatland, coastal erosion, maritime cultural landscape

Submitted to
International Journal of Maritime Archaeology

* I would like to thank dr. Jeroen Benders, dr. Richard Paping, dr. Kim Cohen and several regional amateur historians for valuable comments and input throughout the writing process.

Introduction

Mankind can adapt to the landscape in which it tends to live, but more often it is the other way around: the landscape is adapted to meet required living standards. In The Netherlands, people have been altering/changing their landscape by cultivating lands, reclaiming wetlands by draining them and protecting them against flooding by dike building — and this practice goes back many centuries. Consequently, over one third of the present country risks inundation by the North Sea if dikes would fail. The fact that such areas include the economically important and densely inhabited west of the country, illustrates a dose of stubborn self-confidence: maintaining low dry land amidst surrounding water, despite potential vulnerability. A good amount of reclamation works were in fact reactions to the inundation and erosion of land by storm floods (*i.e.* to formative processes creating the Zuyder Zee embayment and Holland's coastal plain lakes Schermer, Wormer, Purmer, Beemster and Haarlemmermeer). Organizing and executing these challenging regional-scale landscape-change works occurred as soon as technological development allowed it: from risky smaller-scale first millennium AD interventions (ditches, dams, culverts, dug waterways), via larger-scale medieval dike and ditch network polder systems, to adopting windmill systems for water management in the 15th century, to 18th and 19th century (steam driven) pumping stations towards large-scale 20th century reclamation works.

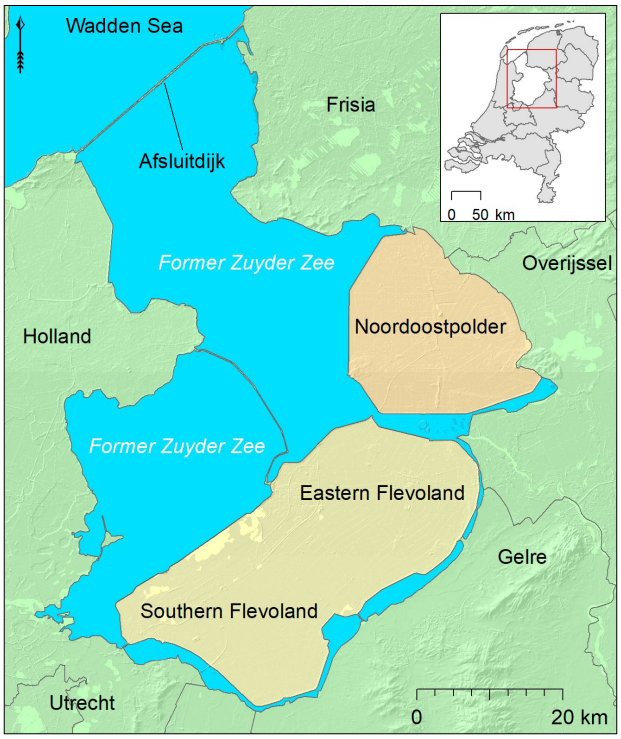


Figure 6.1. Topographical map of the Zuyder Zee region with historic names of entities governing the region between the 10th - 16th century over todays provincial boundaries. The highlighted parts (Noordoostpolder, Eastern- and Southern Flevoland) are the 20th-century reclaimed parts of the Zuyder Zee.

The most prominent example of the latter is the closure and partial reclamation of the Zuyder Zee (Southern Sea): a large body of water in the central part of the country that was denied access to the North Sea by the construction of the 32,5 km *Afsluitdijk* ('closure dam') in AD 1932. After that, a large part of the Zuyder Zee was reclaimed, cultivated and newly named as (the province of) Flevoland (Fig. 6.1). In essence, the initial impetus was given in the High and Late Middle Ages, before the invention of reclamation techniques and organizational forms, when major areal of cultivated peatlands were taken by the sea after several heavy floods in the 12th century (see: Vos 2015: 324; De Haas *et al.* 2017; Chapter 2).

Apparently, the high-medieval inhabitants were not sufficiently prepared for the major storm floods that would scourge their lands. In contrast with what the Dutch do today, their settlements were protected by small dikes, but these could only withstand minor floods (Van Popta & Aalbersberg 2016). Consequently people left their homes, settlements submerged and the peatlands were largely washed away (Van Popta 2017a; Chapter 2). The northeastern part of the Zuyder Zee region, now known as the reclaimed Noordoostpolder (northeastern polder of Flevoland) and the coastal region of the province of Overijssel, still contain traces that were left behind during the rise of the Zuyder Zee. The assemblage of these traces forms the crucial cultural component for a maritime cultural landscape study of the late medieval Noordoostpolder region. Earlier studies have focused on the dynamic history and landscape development of the area (see Chapter 2) and the distribution and interpretation of archaeological remains (*e.g.* De Boer & Geurts 2002; Van Hezel & Pol 2008; Van Popta & Aalbersberg 2016; also Chapters 2 and 5).

Problem definition and research question

The dynamic landscape development of the north-eastern Zuyder Zee region in the Late Middle Ages highly depended upon the presence of humans and their influence on the changing landscape. Material traces (*i.e.* dikes, terps, ditches, settlement remains and shipwrecks) and cognitive remnants (*i.e.* place names, toponyms, folklore and tradition) form useable and detailed sets of data that were already used in the previous chapters. As a result much more is now known of the progressive erosion of the late medieval peatland landscape, the locations of late medieval settlements in it, the role of shipping and the submergence of settlements and wreckage of ships (Fig. 6.2). However, less is

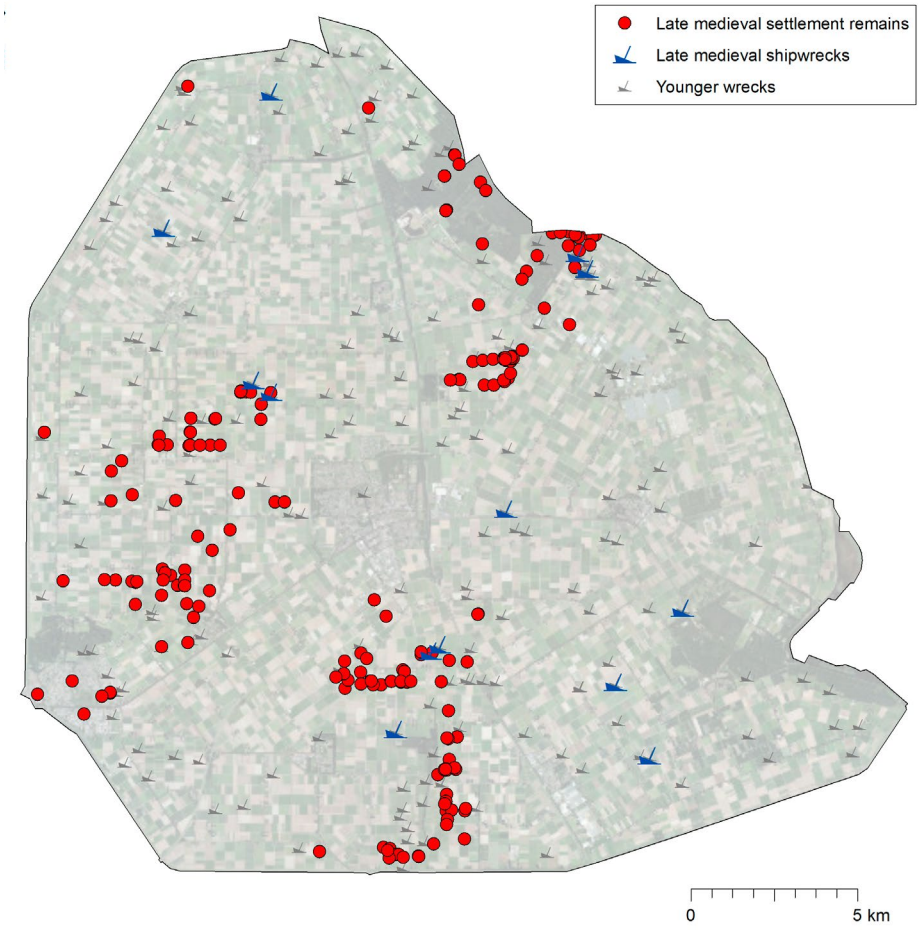


Figure 6.2. Distribution map of shipwrecks and late medieval objects within the borders of the Noordoostpolder. Source shipwrecks (Van Popta & Van Holk 2018), source settlements (Chapter 4).

known of those that inhabited and travelled through the region, beside the remains that testify to their existence. In this paper, they are considered as 'actors' as the focus lies on their actions, what choices they made and which roles that they played that left archaeological and/or historical traces behind. Their specific thoughts, ideas and individual actions are unknown, unless written on parchment or paper, but it is possible to create a general overview of whom they were, how they lived and on what stage they acted. Perhaps too often archaeologists try to stay in their comfort zone by only studying the material culture provided, leading to interpretations on 'where' and 'when' actors lived (material aspects), but not that much on 'how' they lived and 'who' they were (human aspects). It is therefore time to step outside of the comfort zone by focusing on the story of those that acted in the dynamic late medieval landscape of the northeastern Zuyder Zee.

The current study targets the late medieval actors of the northeastern Zuyder Zee region in their natural habitat. From the archaeohistorical perspective, the main research question to be addressed is "Who were the late medieval (AD 1100–1400) inhabitants of the northeastern Zuyder Zee region and how did natural and cultural historic events affect their lives?". Hereto an interdisciplinary approach is undertaken, based on archaeological and historical sources and supported by the results of the recent palaeogeographical study (see Chapter 2). The paper covers four parts, each making use of information on a specific settlement and its inhabitants: Kuinre as an older coastal town along the northeastern shore of the enlarging Zuyder Zee; Kampen as an emerging town situated at the IJssel river mouth into the enlarging Zuyder Zee; Urk as a continuously inhabited island surviving the enlargement of the Zuyder Zee; and Nagele as a coastal settlement that submerged in the 13th century, lost to the enlargement of the Zuyder Zee. These settlements all lay within 25 km of each other (Fig. 6.4), and were affected by the same historic events (coastal landscape physical and societal-economical events). A brief review of late medieval shipwrecks in the Noordoostpolder region is also included, to complement settlement focus with maritime information. Combining and contrasting results per settlement allows to develop answers to the main research question.

Study context, motivation and conceptual framework

The current chapter briefly addresses the topic of the late medieval maritime cultural landscape (MCL) of the northeastern Zuyder Zee region in The Netherlands,

as it already has been introduced and more thoroughly examined in chapters 1 and 3 (see also: Van Popta 2016; Van Popta 2017a); a short exposé on the approach is presented below.

Maritime Cultural Landscape Approach

The concept of the maritime cultural landscape was developed by Westerdahl between the 1970s and 1990s as a way to connect the maritime and terrestrial counterparts of archaeology and to push the traditional focus from shipwrecks and the seabed to a broader understanding of maritime archaeology (Westerdahl 1992; Westerdahl 2014; Chapter 3). Originally, the concept focused on physical remains of maritime culture, *i.e.* all that was left behind by those that used and lived near the water (Westerdahl 1978). In time, the nature of the concept was changed to something more holistic, as the original concept had skipped cognitive maritime cultural remains such as place names, toponyms and sailing routes. Redefined it became: "…the whole network of sailing routes, with ports, havens and harbours along the coast, and its related constructions and other remains of human activity, underwater as well as terrestrial." (Westerdahl 1992: 6).

In the past 25 years, many studies have been conducted within the scope of the MCL concept but more important, several studies have refined the concept (*e.g.* Duncan 2006; Tuddenham 2010; Westerdahl 2011; Westerdahl 2014; Chapter 3). Working with the holistic concept requires clear choices and declarations of methodology/strategy and research questions. For the Zuyder Zee region and the Noordoostpolder in particular the dynamic history of the region, with rapidly changing borders between maritime and terrestrial zones, makes it impossible to only study 'the sea' or 'the land' as they are interconnected. Furthermore, a maritime cultural landscape study should not only study the leftovers of human activity, but rather human activity itself. According to Duncan (2006: 12) this should be done by focusing on cognitive aspects such as folklore and oral histories. Especially for younger periods (say 100–250 years ago) this method has proven to be fruitful. However, when focusing on the late medieval maritime cultural landscape of the Zuyder Zee, a problem occurs: the intensive erosion of the inhabited peatlands resulted not only in the loss of physical evidence, it also caused the disappearance of many oral histories, traditions and folklore. In order to still be able to examine the identity of those that lived in the region of study, the actors need to be placed in the reconstructed landscape ('setting the stage').

Materials and methods

Before one can focus on actors of the late medieval northeastern Zuyder Zee region and their actions, one needs to set up their stage, for which I draw on results from separate palaeogeographical and archaeological studies (as conducted and synthesized by the author in recent previous work; notably in Chapter 2). An overview is presented of the general development of the Zuyder Zee region and more specific, the Noordoostpolder region, starting at the dawn of historical times during the Roman Period and ending at approximately AD 1400. It is based on an interdisciplinary analysis of earlier archaeological, (landscape) historical and palaeogeographical studies (*e.g.* Van Bavel 2010; Vos 2015) to cover not just landscape development, but also consequent land reclamation and cultivation activities by humans and the ongoing battle of man vs. sea in general. For geological, archaeological and palaeogeographical map construction specific methods and underlying source materials, I refer to Chapter 2.

The body of this paper is formed by four case studies of selected settlements and their inhabitants over late medieval time. For each case study, I analyse primary and secondary archaeohistorical information, building on various datasets such as the Dutch National Archaeological Database (ARCHIS), the Medieval Settlement Database (MSD), the Shipwreck Database Flevoland (SDF; see Chapter 5), spatial-geographical datasets (LiDAR, satellite images, aerial photographs), historical documents such as charters and maps and historical studies. For the study area, extracts from these databases contain information on the distribution of late medieval archaeological materials (see also Chapter 2), as well as entry points to historical information. Historical and archaeological studies are used to examine factors such as settlement location (soil type, distance to water, distance to trade routes) and local political and economic development (power, economic focus) that have altered the development of individual settlements and the life of their actors.

It is important to mention that by the above methods, materials and overall research setup, I do not aim to independently reanalyze nor majorly rewrite late medieval histories of individual settlements or their inhabitants. Recent such work is readily available from research by others, *e.g.* De Boer & Geurts (2002; focusing on Kuinre), Geurts (2005; focusing on Urk), and Jager (2015; focusing on Kampen), and for settlements lost to Zuyder Zee expansion research has been performed by the author (Nagele, Fenehuysen; Chapters 2 and 4). Essential information concerning the research question was extracted from these studies and combined, compared and contrasted taking an interdisciplinary position. The main result — and methodological

target — of this paper is to establish a narrative for each of the four settlements and a conceptual chronological model (table) that is based on these narratives.

Setting the stage

Roman Age and Early Medieval developments

At the start of the Common Era, roughly 1000 years before major lowland areas would begin transforming into the Zuyder Zee, the landscape of the study area consisted primarily of unprotected peatland and interconnected large bodies of water, fed by rivers and smaller streams (Vos 2015; Pierik *et al.* 2017; Borger and Kluiving 2017; Chapter 2).[1] The study area proper appears to have been mostly uninhabited, although humans probably have travelled through it, for example considering Roman written sources that mention the region of study, and considering interpretations of trade based on contemporary archaeological finds north and west (Frisia), East (Germania) and South (Roman occupied Germania Inferior) (*e.g.* Gerrets 2010; Nieuwhof *et al.* 2018). The early Roman historians Pomponius Mela, Plinius Maior and Tacitus describe the far stretching peatlands and large water bodies of the region, now interpreted as an assemblage of lakes, then referred to as *Lacus Flevo* and *Flevum* (Flevo lake).[2] During the Roman Era and Early Middle Ages (until the 10th century AD) the North Sea gained minor access to the central part of the Netherlands via the Vlie tidal inlet (Vos 2015; Chapter 2). Storm surges enabled the sea to enter, flood, cover and erode parts of the peatland landscape that surrounded the Flevo lakes (Ente *et al.* 1986; Vos 2015). As a result, the lakes gained size and started to interconnect. By the 8th century AD the name of the open water area in the central Netherlands had changed into *Almaere*, meaning 'all vast waters', underlining the interconnection of lakes and abundance of water in the region (Fig. 6.3: AD 800).[3] The *Almaere* waters were used for transport and travelling (see Buisman 1995: 217; Mostert 1999: 9).

Archaeological evidence from within the Noordoostpolder region that dates to the early medieval period is scarce, especially when compared to the high number of objects from the Late Middle Ages (Wiggers 1955; Van der Heide 1965; Van Popta 2017a). It means that the peatlands remained (largely) uninhabited during the Early Middle Ages (in contrast to the earlier mentioned surroundings). The general trend during the Early Middle Ages (Van Bavel 2010: 27) is that of (re) occupation and (re)cultivation of hardly populated low lands in two phases, the first one under Frankish rule starting in the 6th century and ending in the 9th century mainly affecting the southern Netherlands (with Frisia showing independent development; Pollard 1997; Van Bavel 2010: 32) and the second one under Ottonian-Salian and later Saxonian-German empiric rule, lasting from c. 1000 until approximately 1300 (Van Bavel & Van Zanden 2004: 278-280; Van Bavel 2010, 28; Nieuwhof 2016a: 95). During the second phase, the peatlands then existing in the study area were also cultivated. In other words: unlike neighboring more fertile and populous Frisia, they were not already cultivated during the earlier phase (Van der Heide 1965; 1974; Hogestijn 1992; Van Hezel & Pol 2008; Van Popta & Aalbersberg 2016; Chapter 2). Over most of the study area thick peaty subsoils were present (a metres thick upper peat layer constituted the surface), with very shallow groundwater tables connected to the many lakes and rivers running through it (not major raised bogs, but swamps and fenlands; Gotjé 1993) and lacking a clay cover (the river IJssel only started to deliver abundant clays down-

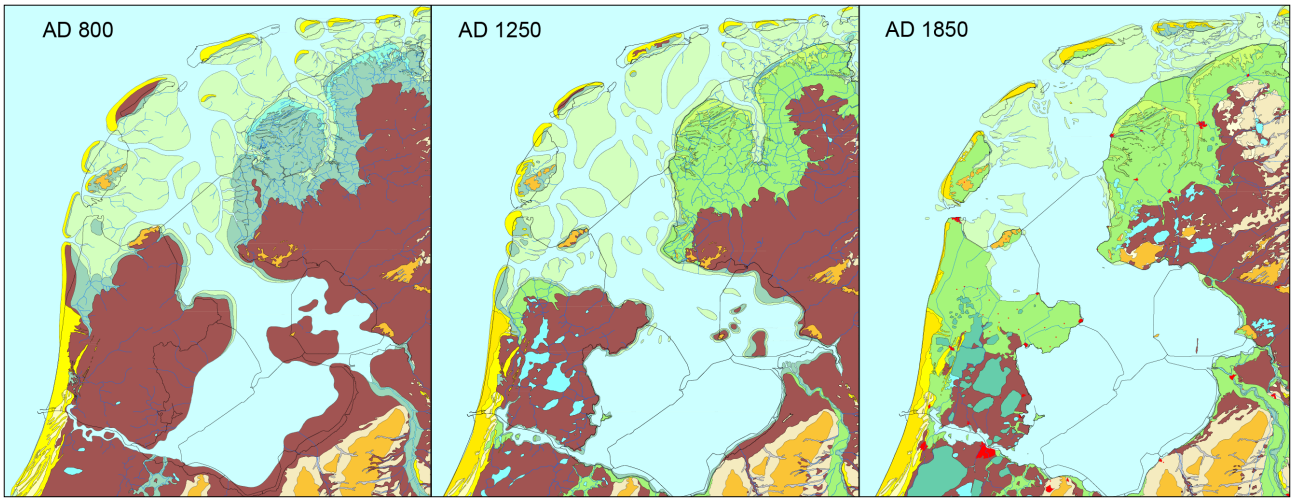


Figure 6.3. Palaeogeographical development of the northern part of the Netherlands between AD 800 and 1850 (after Vos et al. 2020); AD 800: brown = peatland, blue/green = salt marshes, storm surge flood prone; AD 1250 – 1850 green and brown = dike-protected land and peatland. Contours of 20th cy reclamations (Fig. 6.1) for reference.

stream to the area from the 10th century or so; Makaske *et al.* 2008). Such peat land must be considered hard to clear and cultivate (the wet and less fertile nature of the lowlying peatlands were less suitable for agriculture and habitation). Nevertheless, traces of agriculture have been found in the late medieval archaeological record of several settlement locations in the research area. They consist of bone fragments that mainly belong to cattle, sheep/goat and pig (see *e.g.* Wiggers 1955; Van der Heide 1965; Chapter 4; 2019b) and archaeobotanical remains (pollen and seeds) that have been identified as rye, wheat, barley, carrot crops and beets (De Boer & Van Doesburg 2001; Kerkhoven 2003; Geurts 2005; Van Hezel & Pol 2008). In the Noordoostpolder region agriculture appears to have commenced only once population numbers in the immediate surroundings began to rise significantly (the aforementioned second phase: 1000-1300 AD). This gives reason to connecting timelines of peat land cultivation to those of settlements and inhabitants in next sections (see also Chapter 4).

Late Medieval developments

Major storm floods in the 12th century removed the final peat barrier that separated the *Almaere* from the North Sea and scoured and eroded the largely unprotected peatlands of the *Almaere* region. From historical records, Gottschalk (1971) and Buisman (1995) count between 1150 and 1250 at least ten storm floods, half of which likely had a disastrous impact on the peatlands of the Noordoostpolder region[4], with the *Allerheiligenvloed* (All Saints' Flood) of 1170 regarded the key event responsible for the landscape transformation and toponym replacement of *Almaere* to Zuyder Zee (Fig. 6.3: AD 1250; see also Gottschalk 1971; Lenselink & Koopstra 1994; Buisman 1995; Oost 1995; Van den Biggelaar *et al.* 2014; Vos 2015).

The late 12th century floods damaged the peatlands of the Noordoostpolder region and hence impacted the people that had started to cultivate and inhabit them since just 150-200 years before (see above). More reclaimable and cultivatable lands were needed to compensate the population growth in most parts of the Low Countries: the count of Holland was searching for lands in the west whereas the bishop of Utrecht and the count of Gelre considered the previously uninhabited peatlands of the Noordoostpolder region worth cultivating in order to compensate for the need for new land and more products (Hogestijn *et al.* 1994; De Bont 2008; Van Bavel 2010; Van den Biggelaar; Van Popta & Aalbersberg 2016).

Prior to this century of storm floods, peatland reclamation works are likely to have started (in the 10th to 11th century, see above). However, reclamation works as executed in that period were still at a relative small scale (see *e.g.* De Bont 2008) and were organized by those that owned (or claimed to own) the land. For the study area, these were the bishop of Utrecht and the abts of the St. Pantaleon and St. Vitus monasteries (Mol 2011: 85). These territorial lords appointed vassals that were ordered (or they acted on their own initiative) to organize the reclamation and cultivation of the lands. They were furthermore enfeoffed with power and rights over the people and the lands. In turn, the vassals appointed local bailiffs (*schouten*) to organize the power of jurisdiction. Despite the presence of territorial lords, vassals and bailiffs, many of the ordinary people in the region (colonists and their offspring) were no (predial) serfs (Van Bavel 2010: 83). Instead, they could be considered as 'free' men, attracted by the territorial lords and their vassals to reclaim and cultivate the more or less uninhabited peatlands in return for 'freedom' and protection. They had to pay (small) nominal rents (*cijnzen* and *tienden*) in recognition to their territorial lords. Simultaneous and similar developments and settings occurred in the surroundings of the research area (Elburg-Oldebroek-Hasselt-Vollenhove), in the peat areas of the present province of Utrecht and (North-) Holland (see *e.g.* Van Bavel 2010, Mol 2011). The cultivation of the peatlands of the Noordoostpolder region resulted in the origin of several small settlements that can be found in four landscape zones: the northeastern coastal zone (Fig. 6.4 – Lemmer – Kuinre - Vollenhove), the peninsula (Fig. 6.4 – Fenehuysen 1), the islands (Fig. 6.4 – Urk, Nagele, Marcnesse, Emmeloord) and the IJssel river valley and delta (Fig. 6.4 – Kampen) (Van der Heide 1965; Van Popta 2017a).

Living conditions for the peatland cultivating pioneers must have been harsh. The 'freemen' lived in small and isolated settlements, where they would need housing, food, clothes, warmth and other goods to survive. Risks of bad harvest, famine and decease threatened their existence (*e.g.* Van Bavel 2010: 329). Agriculture became the most important aspect of subsistence for the society at large, although little is known and written on its development, dimensions and exact focus (Hoppenbrouwers & Noordegraaf 1986; Hoppenbrouwers 1997). At first, self-supported livelihood must have been important, meaning that agriculture remained predominantly subsistence oriented. It is likely that the inhabitants focused on mixed farming which involved both the breeding of livestock and the growth of crops. Besides agriculture, trade — at first at a local scale and from the 12th and 13th century onwards at a regional scale — must have been of importance to the newly found settlements from the beginning: not only as a necessary development (in case of limited or insufficient primary resources), but also to raise crops and to 'feed the towns'. As a result of the reclamation and cultivation works, positive (economic)

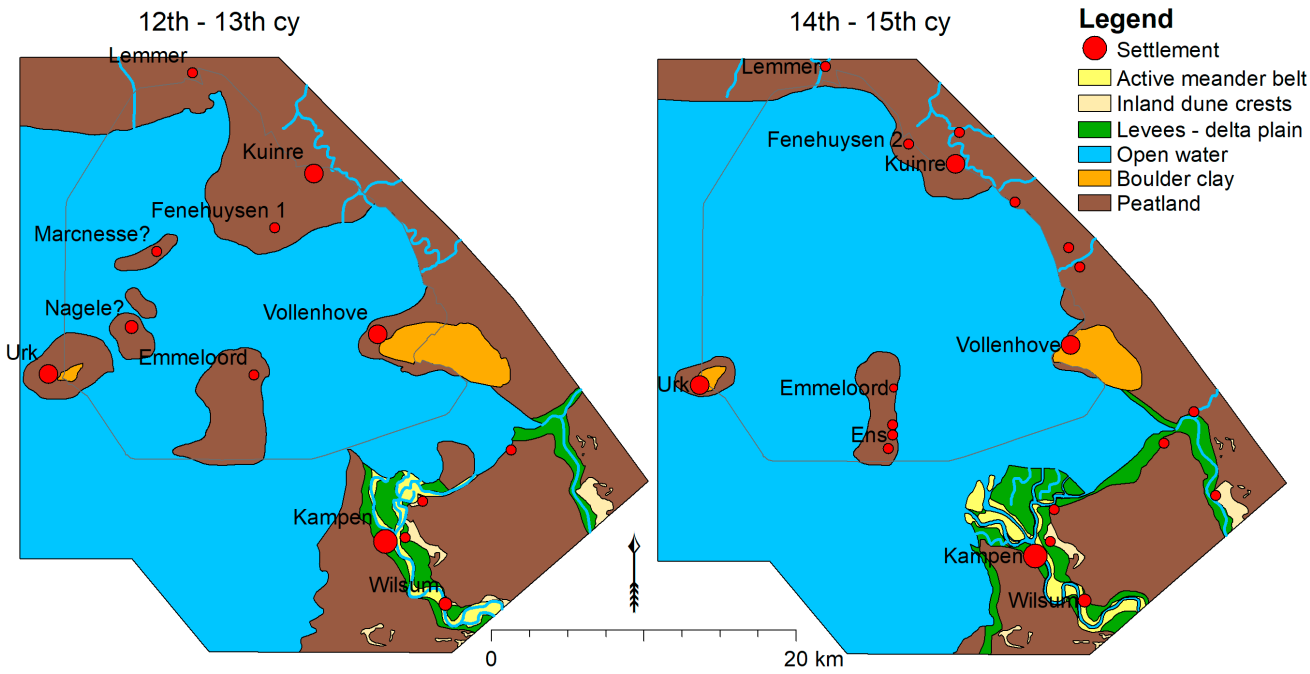


Figure 6.4. Landscape development and habitation in the Noordoostpolder region in the 12th–13th centuries (left) and 14th–15th centuries (right).

effects occurred on the short term (more space, more arable fields, more outcrop).

On the long term there would be a negative outcome for the entire region as the reclamations caused dehydration of the peat (oxidation and compaction) and consequential land subsidence (submergence). Large parts of the cultivated lands became soggy and therefore less suitable for agricultural practice. From at least the 14th century onwards, farmers were forced to practice arable farming on the high grounds only whereas stockbreeding continued to exist on the lower grounds (Geurts 2005; Van Hezel & Pol 2008).

Currently the founding dates of the first settlements in the Noordoostpolder can only be estimated on the basis of the limited number of historical sources and the disturbed archaeological record (Chapter 2). Archaeological objects from the region of study indicate that the oldest settlements must have been founded in the 11th century (see Wiggers 1955; Van der Heide 1965; Hogestijn *et al.* 1994; Van den Biggelaar 2014; Van Popta & Aalbersberg 2016; Van Popta 2017a). Based on the distribution and density of archaeological objects (pottery, bricks, roof tiles, animal bones), several locations of these late medieval settlements are now known (Fig. 6.4; see also Wiggers 1955; Van Popta 2017a; Chapter 2). Charters from the 12th and 13th century provide their names: *Lemmer, Kuinre, Urk, Emmeloord, Marcnesse, Nagele, Fenehuysen* (Veenhuzien), *Kuinrezijl, Vollenhove, Genemuiden, Grafhorst, Wilsum, IJsselmuiden* and *Kampen* (Fig. 6.5; Mol & Van Vliet 1998; Mol 2011; Jager 2015; Chapter 2). Most of these settlements do still exist today but Marcnesse, Nagele and Fenehuysen (see: Van der Heide 1965; Ligtendag 1995; Kuipers & Van Dierendonck 2004) were taken by the Zuyder Zee in the 13th or 14th century (Chapter 2).

Religion also played an important role for the inhabitants of these small and isolated settlements as religious institutions like the St. Pantaleon monastery, the St. Vitus monastery, the St. Odulphus monastery and the Diocese of Utrecht possessed lands, rights and properties in the research area (see also Chapters 2 and 4). The presence of religious property in the Noordoostpolder region is for example proven by several historical charters of the St. Odulphus monastery of Stavoren that contain lists of chapels of the monastery. Seven of them could be found in the small late medieval settlements of the research area: Kuinre, Kuinrezijl, Fenehuysen, Marcnesse, Nagele, Emmeloord and Urk. No physical remains of these first Christian buildings have been preserved due to severe marine erosion. Nevertheless, the chapels – and by that the church as an institution – will have been at the center of each community, both literally and figuratively. In fact, these religious institutions controlled social structures and acted as ecclesiastical authorities.

Palaeogeographical and archaeological studies by Cohen *et al.* (2009: 92), Vos & De Vries (2013), Van den Biggelaar *et al.* (2014), Van Popta (2017a), Pierik *et al.* (2017) and Chapter 2 provide more details on the effects of peat compaction, storm floods and North Sea ingression on the Noordoostpolder landscape in Late Middle Ages (1100-1400). In no more than 200 years, due to

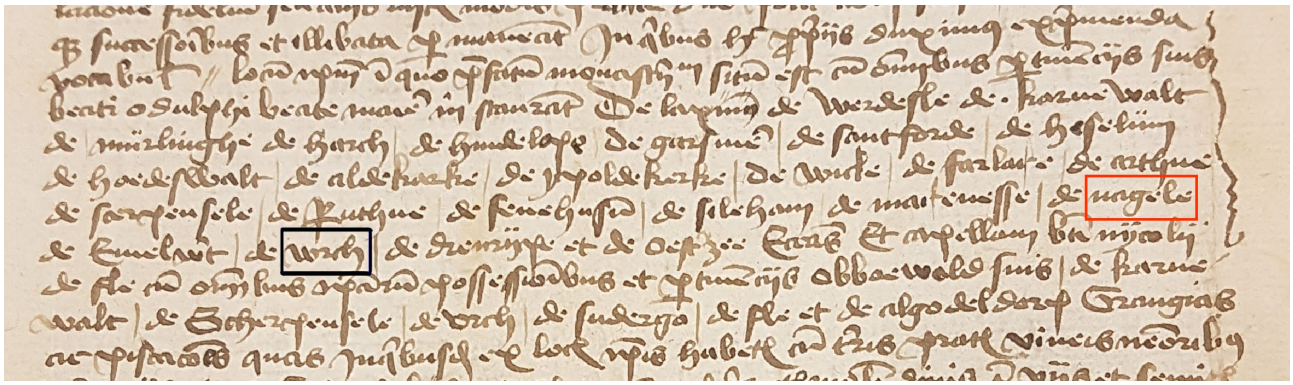


Figure 6.5. 15th-century copy of 13th-century charter of the St. Odulphus monastery that mentions the late medieval settlements in the Noordoostpolder region (highlighted) (after Tresoar).

the earlier mentioned floods and storms, the entire peat peninsula, parts of the coastal zone and most of the islands were washed away. Similar land erosion occurred in other coastal regions of the Low Countries such as Zeeland, Holland, Friesland and Groningen. As a reaction to increased marine threats at the time of increased reliance on peatland agricultural produce — small dikes were constructed along the coast and on the remaining islands, offering only minor protection against the force of the sea (Geurts 2005: 25; Van Bavel 2010: 42; Van den Biggelaar 2014: 178; Chapter 2). A battle of men against the coastal dynamics of the Zuyder Zee started at the turn of the 13th century, and would continue in the following centuries, characterized by more storm floods and further land losses (Fig. 6.3: AD 1850).

Following the actors

Kuinre

By the end of the Early Middle Ages, the landscape of the northeastern part of the study area consisted of vast peatlands through which several small rivers worked their way towards the *Almaere*.[5] One of these rivers, known as the Kuinder, was fed from the Drenthe glacial till-plateau (north east of the study area; Fig. 6.4). The Kuinder made its way westwards, connected close to the *Almaere* with another small river known as the Linde, before bending southwards and discharging into the *Almaere* waters (De Boer & Geurts 2002; Vos & De Vries 2013; Chapter 2). To maintain his authority throughout the region, the bishop of Utrecht (amongst others) ordered the construction of several bishopric strongholds throughout the 12th century (Van Bavel 2010: 72). One of them would develop into the settlement of Kuinre, close to the location where the Kuinder river connected to the Linde river. At first, the settlement of Kuinre was limited to a building with a specific economic/military function (*domus*), several farmsteads and farmland (*swechus*) as is mentioned in a historical charter from AD 1118 (De Boer & Geurts 2002: 16; Mol 2011: 78).[6] The Latin text contains the name *Cunre*, but it is unclear whether it refers to the settlement or to the river. The charter also mentions that the *domus* and *swechus* previously belonged to bishop Conrad (AD 1076-1099), meaning that settlement in Kuinre began before the start of the 12th century (Mol 2011: 79). The so-called Andreas Charter (foundation charter) of the St. Odulphus monastery of Stavoren in Frisia (dating to AD 1132) mentions that at that time a church or chapel had been built in close vicinity of the 'house' and farmsteads of *Kunre* (Mol & Van Vliet 1998: 120; De Boer & Geurts 2002: 16).

In the second half of the 12th century, a fortification was built near the settlement to protect the northeastern border of the bishops' territory against Frisian raids, as is written in the *Annales Egmundenses* (Gumbert-Hepp *et al.* 2007). The fortification was inhabited by a vassal of the bishop named Heinricus Grus, also known and referred to in historical sources as 'Henric of Kunre' or 'Henric de Crane' (Janse 1993: 40; De Boer & Geurts 2002: 33). It is possible that the fortification in which he lived belonged to the *motte* castle type, but there is no physical evidence to prove it. In AD 1197, Grus' fortification was attacked and destroyed by Frisian militia under leadership of William I of Holland, the future count of Holland, and Grus was driven away (Brill 1983: 117-118; Janse 1993: 40; De Boer & Geurts 2002: 29; Burgers 2004: 86; Gumbert-Hepp *et al.* 2007: 297).[7] Without doubt the bishop of Utrecht considered the destruction of his stronghold an attempt to undermine his authority. In following years he made new alliances to strengthen his position, and made a treaty with William I (by then count of Holland) which included the return of Heinricus Grus in Kuinre in 1204. Soon after his return a new castle was constructed, nowadays referred to as Kuinre Castle I (Fig. 6.6; see: De Boer & Van Doesburg 2001; De Boer & Geurts 2002). The remains of this castle were discovered shortly after the

Figure 6.6. Top left: the reconstruction of Kuinre castle I (photo Bayke de Vries, https://commons.wikimedia.org/wiki/File:Terrein_met_resten_van_de_Kuinderburcht_2.jpg, CC BY-SA/4.0). Top right: overview of Kuinre, its castles and a simplified interpretation of the late medieval course of the Kuinder river (Y.T. van Popta). Bottom: impression of present-day Kuinre and canalized Kuinder river (public domain: https://commons.wikimedia.org/wiki/File:Kuinre_Panorama_10.JPG).

reclamation of parts of the Zuyder Zee. Archaeological research was conducted by Modderman (1945), Van der Heide (1954/1955) and De Boer & Van Doesburg (2001) and provided limited evidence on its appearance: a circular castle site, surrounded by six moats, with an elevated courtyard that was surrounded by a ring-wall. Until now it remains unclear whether buildings were constructed within the castle walls. The castle is mentioned in a historical charter dated to 1363, proving that it still stood after one and a half century, but another charter, dated to 1378, describes the construction of a new castle complex at Kuinre (De Boer & Geurts 2002:

31).[8] Archaeological research at the Kuinre Castle I site has proven that occupation of the castle came to an end in the third quarter of the 14th century (De Boer & Van Doesburg 2001: 82). It means that the Kuinre Castle I was given up by the time Kuinre Castle II was constructed, likely because of storms and floods that kept on eroding the peatlands of the region. One particular flood is likely to be held responsible for the abandonment of Kuinre Castle I, described by historical sources as the flood in the night of St. Victor (9 – 10 October 1375): the sea breached through many dikes in the Low Countries, including dikes along the shores of the Zuyder Zee, people had to leave their belongings behind and fled to higher ground (Gottschalk 1971; Buisman 1996; De Boer & Geurts 2002).

Kuinre Castle II was constructed further inland, northeast of Castle I and on the opposite side of the river (Fig. 6.6). The castle site consisted of a circular elevated courtyard surrounded by a wooden stockade, four concentric moats and a bridge (De Boer & Van Doesburg 2001; De Boer & Geurts 2002). The castle became the residence of Herman II of Kuinre (possible offspring of Heinricus Grus), but was handed over to the authority of Frederik van Blankenheim (bishop of Utrecht) in 1407. During the next century the bishops repeatedly spend money to maintain the castle as it was constantly threatened by the Zuyder Zee and damaged during skirmishes. As the Kuinre castles were solely built for territorial and military purposes, they lost their importance after the bishop of Utrecht transferred his territorial power to the Habsburgian German empiric ruler Charles V in 1528 (Janse 1993: 373). Kuinre Castle II was completely deconstructed before AD 1536 as is evident from archaeological research, whereas 'an earthen hill that once contained a castle' is mentioned in 16th century sources (Modderman 1945: 39; De Boer & Geurts 2002: 61).

Late medieval life in Kuinre

The first people to arrive at the location of Kuinre, likely somewhere in the 11th century, were those that wanted to reclaim the peatlands: colonists that acted under the supervision of vassals of the bishop of Utrecht and had to pay taxes (*tienden*) to the bishop and (later on) to the lords of Kuinre (De Boer & Geurts 2002: 16). The ditches they dug have been found during the excavations of the two Kuinre castles and can still be seen on aerial photographs and LIDAR-data. The settlers of Kuinre and their offspring lived the life of farmers: they cultivated the lands and put them to use for arable farming (mainly the production of rye) and animal husbandry (the breeding of cattle, pig and sheep). No intact remains of Kuinder houses have been found, but the charter of AD 1118 mentions the existence of several farmsteads at Kuinre. By contrast great numbers of animal bones have been found at the location of both castles and the settlement, mainly belonging to livestock such as cattle, pig and sheep (see: Modderman 1945; Van der Heide 1954; De Boer & Van Doesburg 2001). Less evidence exists of arable farming as only limited archaeobotanical research has been carried out at Kuinre. Nevertheless, remains of rye, barley and wheat have been found near the castle sites, indicating that these crops were part of the late medieval diet of the castle's occupants (De Boer & Van Doesburg 2001). In time, dehydration of the peatlands caused land subsidence and an increased vulnerability towards seasonal and incidental floodings, resulting in increasingly wet and soggy farmlands (De Boer & Geurts 2002: 16). Practicing agriculture on these fields became increasingly difficult, and many farmers decided, probably during the 14th or 15th century, to abandon arable farming and to solely focus on trade and livestock breeding. The latter must have been (partially) export oriented in order to purchase/import grain from elsewhere.

Historical, palaeogeographical and archaeological sources each indicate that the late medieval inhabitants of Kuinre were dealing with threats of flooding and land loss to Zuyder Zee (De Boer & Van Doesburg 2001; Chapter 2). Remains of late medieval dikes have been found to the east of Kuinre, but their relatively small size could only have offered limited protection against floods (see Wiggers 1955; Van Popta 2017a; Chapter 2). It is likely that the direct surroundings of the settlement and castles were also protected by late medieval dikes, but coastal erosion by the Zuyder Zee continuing to the early 20th century, has washed away all specific evidence; only discolorations of the subsoil reveal the locations of the former dikes. Because of the overall flatness of the landscape along the banks of the Kuinder river, when Kuinre Castle I became threatened, the only option was to move away from the water as is suggested by the abandonment of Kuinre Castle I.

The historically best known inhabitants of late medieval Kuinre were the lords of Kuinre. It is important to realize that these lords were not representatives of the pioneers that started Kuinre: they only arrived when they were able to make a profit (from their position of power) (Van Bavel 2010: 66). Heinricus Grus as the founding father of the Lords of Kuinre dynasty is considered the oldest inhabitant known by name (1197; Janse 1993: 40). His descendants would reside at the castle from the end of the 12th century until 1407, starting as *ministeriales* of the bishop of Utrecht. By the end of the 13th century the status of the lords of Kuinre had changed from *ministeriales* into landlords (*landheren*) as was approved by the bishop (De Boer & Geurts 2002: 34). The strategic location of Kuinre, close to the Frisian

border, the Kuinder river and the important long-distance trade routes across the Zuyder Zee (see also: Kampen), became well exploited by the lords of Kuinre and the inhabitants of the settlement. During the 13th and 14th centuries they made alliances with the counts of Holland (c. 1300) and Gelre (c. 1336), started minting their own coins, collected tolls and fought against the Frisians (Vos van Steenwijk 1976: 83; Janse 1993: 93; De Boer & Geurts 2002: 42). They furthermore acted as privateers on the Zuyder Zee, and in the 14th century allegedly terrorized merchant shipping as is written in several historical documents.[9] This spread their name throughout Hanseatic parts of Europe (*i.e.* Germany, Denmark, Baltic) with Hanseatic towns Hamburg, Lübeck, Stralsund and Danzig demanding the lords of Kuinre to leave their ships alone (De Vos van Steenwijk 1979; De Boer & Geurts 2002: 42).[10] By 1385, Kuinre became a city in legal terms, as is written in a historical document by Herman II, lord of Kuinre, in which he granted the inhabitants of Kuinre privileges (*buurrecht*) and took care of their rights (De Boer & Geurts 2002: 66).[11]

The inhabitants of Kuinre also took advantage of the abundance of water in their surroundings as it provided opportunities to put fish on the menu (remains of fish traps have been found near the castles) and to use the water for transport and trade. The use of water is highlighted by the fact that the largest concentration of shipwrecks in the entire province of Flevoland is found in the immediate surroundings of the harbour of Kuinre (see: Van Popta 2012) whereas the trade is proven by the fact that the lords of Kuinre minted their own coins (De Boer & Geurts 2002: 40). Although clear evidence is lacking, it seems likely that Kuinre functioned as a local market place for goods and products throughout the 13th and 14th century, considering its suitable location and the aspects mentioned above.

By the end of the Late Middle Ages storms calved off the last remaining peatlands between the settlement and the Zuyder Zee. Kuinre's new status as coastal town and market place at the Kuinder river mouth brought economic prosperity to its citizens (Mooijweer 1992). After the Middle Ages and the downfall of the lords of Kuinre the inhabitants of Kuinre continued their trade (*i.e.* butter) and started to focus on fishing. By the 18th century the harbour of Kuinre became silted-up due to the incessant marine deposition of coastal sand, effectively blocking marine trade. The town was, however, still connected to its hinterland via the Kuinder and Linde rivers. The citizens consequently reoriented trade patterns to the hinterland in the 18th and 19th century. Peat fuel (turfs) was extracted from the surroundings and transported inland via the rivers, but this trade never flourished. After the construction of the IJsselmeer closure dam (*Afsluitdijk*) in 1932 and the reclamation of the *Zuyder Zee*, Kuinre lost its maritime character altogether and its population decreased considerably.

Kampen

The city of Kampen can be found in the southeastern part of the study area, located on the western bank of the IJssel river, close to its current mouth (see Fig. 6.4). By the 10th century AD, this part of the *Almaere* region was characterized by uncultivated and desolate peatlands, divided in a western and eastern part by the then still very young IJssel river. In the 7th to 8th century AD, the IJssel had become an active branch of the Rhine river that discharged into open waters in the east of the study area (historically referred to as *Salahon*), connected to the expanding *Almaere* lake (Makaske *et al.* 2008; Cohen *et al.* 2009). In the following centuries, water flow and channel size of the IJssel river would increase and a small delta developed at the river mouth (Ente 1973; Cohen *et al.* 2009; 2012; 2016). Reclamation and cultivation of the lands to the east and west of the IJssel river started in the 11th century (Jager 2015: 69). At first habitation concentrated on higher grounds (river dunes) to the east of the IJssel river (Wilsum, Oosterholt, IJsselmuiden, Grafhorst). Land reclamation to the west of the IJssel river started in the 11th century and first half of the 12th century — which is before the AD 1170 Allerheiligenvloed — and resulted in the origin of the settlement Zalk on a natural levee of the IJssel river (Jager 2015: 129).

During this phase of reclamation and cultivation, the lands close to the IJssel river mouth were not yet cultivated and Kampen did not exist. There has been a lot of debate on the origin of Kampen, whether it was related to a mark (*marke*) organization, whether the settlement was founded by immigrants from Frisia or Wilsum, by merchants from Tiel or Cologne, or by cultivators from West-Frisia and Holland (see *e.g.* Van Engelen van der Veen 1937; Fehrman 1952; Van Mierlo 1984; Speet *et al.* 1986). Lenferink *et al.* (1993) and Kossmann-Putto & Kossmann (2009) provide an extensive and critical overview of this ongoing discussion and prove that the lands of Kampen belonged to the monastery of Essen before AD 1227. The oldest archaeological evidence of Kampen dates to the 12th century AD, whereas historical sources mention the settlement for the first time in AD 1227 (Van Mierlo 1984; Kossmann-Putto & Kossmann 2009: 17; Jager 2015: 129). The first phase of habitation is roughly dated between 1150 and 1200 — likely after the Allerheiligenvloed of AD 1170 — during which Kampen can be characterized as a small agrarian settlement. According to Jager (2015), its inhabitants (settlers) were predominantly focused on

Figure 6.7. Left: the size of the city center of Kampen in c. AD 1335 (orange) and AD 1400 (orange and red). Right: a present-day aerial photograph of Kampen. The houses in between both churches form the oldest part of the city (beeldbank.rws.nl, RWS/Joop van Houdt).

land reclamation and agriculture (on both sides of the dike). The wet environment forced them to be creative: they constructed a dike (*Oudestraat*) along the river and inland artificial mounds on which the first houses were built (Lenferink *et al.* 1993: 22; Jager 2015: 133). Archaeological objects (*i.e.* pottery sherds) found inside the dike date its origin to the late 12th century (Vlierman 1997: 119). Besides some archaeological finds no clear evidence exists of these early farmsteads, although it is assumed that they were wooden structures (Jager 2015: 143). In contrast, Kossmann-Putto & Kossmann (2009: 36) state that Kampen from the start focused on trade as its location near the IJssel river mouth was specifically chosen for that cause by the Essen monastery.

Launching Kampen as a trade centre should thus be seen as a second phase of this settlement, starting at the dawn of the 13th century (Lenferink *et al.* 1993: 16; Jager 2015: 145), following up on the initial peat-land agrarian settlement on the narrow natural levees of the river. The trade centre launch would have happened at a moment that agragrian interests of inhabiting peat lands (not just near Kampen where a fringe of peatland would actually survive, but also near Dronthen and Elburg to the east and southeast where it was lost) suffered the negative effects of the 12th-13th century storm surges (notably in AD 1170 and AD 1196). The storm-surge impacts may be said to have had positive effects on the late medieval development of Kampen. A good part of cultivated peatland in its immediate vicinity survived (Fig. 6.4), while beyond the storm surges cleared the path for old and new trade routes over water using the IJssel river and Zuyder Zee. These routes connected the Rhine-Meuse-Scheldt delta (Holland, Flanders), the Rhine hinterland (Central and Southern Germany), the North Sea (Frisia, England, Denmark, Norway) and the Baltic Sea (Northern Germany, Sweden, Prussia, Poland, Russia). This had lasting impact on the Kampen area: from a relatively insignificant agricultural frontier settlement it became a maritime urban center (Looper 2010: 117; Jager 2015: 135; see also Chapter 3; note that this contradicts the hypothesis of Kossmann-Putto & Kossmann 2009: 36).

The 13th-century urban transformation is characterized by several aspects. Around AD 1220 a church was built from tuff blocks, presumably being the first stone building of Kampen (Van der Heide 1961; Kreek in press). Furthermore, from the second half of the 13th century a city wall was constructed, a feature that only belonged to relatively wealthy and powerful cities (although Kampen never officially gained city rights; see Jager 2015: 153). Kampen reached this stage within one and a half century after its founding, having its Golden Age in the 13th and 14th centuries. The size and population of the city kept on growing, the city's defense was further improved, originally wooden buildings were steadily replaced by stone constructions and wealth among the citizens increased (Fig. 6.7).

The main reason for these developments and the decisive factor that distinguishes Kampen from surrounding settlements (Zalk, Wilsum, Grafhorst) was its suitable location: a 'gateway city' or maritime transit point between traffic on the IJssel and Vecht rivers (towards Germany and the Rhineland) on the one hand and traffic on the Zuyder Zee (towards the North Sea and Baltic Sea) on the other hand (Weststrate 2008: 26; Weststrate 2010: 146; Jager 2015: 430). Large sea-

going ships from various regions in Europe such as Flanders, England, Denmark, Norway, Sweden and the East Frisian Peninsula were unable to sail the shallow waters of the IJssel river whereas river vessels from the Meuse-Rhine region were too small to sail on the dangerous waters of the Zuyder Zee and North Sea. Ships of Kampen also travelled to coastal regions of the Baltic, Atlantic and North Sea: from Riga to Newcastle and from Bergen to Lisbon (Robijn 2005:181; Jager 2015: 427). Of all Dutch cities, Kampen is considered to have been the leading one in the Baltic trade (Weststrate 2008: 30). Halfway through the 14th century Kampen had established strong connections with the powerful Hanseatic League, although it lasted until AD 1441 before the city became an official member of the League (Looper 2010: 114; Jager 2015: 126). From the 15th century onwards, maritime trade slowly turned its way to the western part of Holland. In parallel, the IJssel river outlets started to silten up and freighters became larger, which limited the accessibility of the Kampen cays (Jager 2015: 434; Waldus 2018).

Late medieval life in Kampen

The first people to arrive and settle near the IJssel river mouth (12th century) — the future inhabitants of Kampen — were colonists and farmers, like those who had founded the nearby settlements Zalk, Grafhorst, IJsselmuiden and Wilsum, that cultivated the lands of the bishop of Utrecht. In time, agricultural focus shifted from mixed farming to cattle breeding as arable farming proved to be ineffective due to compaction and oxidation of the peatlands (Kossmann-Putto & Kossmann 2009). This is proven by the large amounts of grain that were imported from the 13th century onwards (Van Haaster *et al.* 2001: 14; Jager 2015: 258; Zeiler 2018: 201). No *in situ* archaeological evidence exists of the homes of these early farmers, but it is likely that they lived in wooden houses on small artificial mounds along primitive dikes (Jager 2015: 445).

Economic growth and prosperity in the second half of the 13th and 14th centuries (due to the successful combination of agriculture and trade) attracted all sorts of people with different backgrounds to Kampen: traders, merchants and craftsmen. At first new inhabitants arrived from the direct surroundings of Kampen but from AD 1350 onwards, parallel to the rise of the Hanseatic League (by then, Kampen was considered an associated member) people came from other regions like Westphalia (Münster), the Rhine region (Duisburg, Cologne) and Holland (Kolman 1990: 146; Jager 2015: 114). It resulted in a mixed population and a diverse economic system with a focus on trade, industry, agriculture and fishing. Many products like steel, wine, cloth, fish, wool, butter, cattle, beer, rye and wood were brought to and sold in Kampen (Jager 2015: 136). Trade might be considered as the most important economic sector of Kampen throughout the Late Middle Ages, but one should not underestimate the lasting importance of agriculture, as wealthy citizens of Kampen owned lands to the west (Broeken and Maten) and north (Kampereiland) of the city (Selles 1996: 158; Jager 2015: 435). This number of people that lived in comfort (*i.e.* landowners and nobles) kept rising during the 14th century and they were happy to spend their money on buying land as it provided a good investment and a lot of prestige.

Population growth, especially from the 14th century onwards, also caused the rise of many crafts and guilds in Kampen (as in other cities of significant size) that can be divided into (amongst others) the food sector (*e.g.* millers, butchers, bakers, brewers), the cloth sector (*e.g.* weavers, tailors, hatters), the leather sector (shoemakers), the metal sector (smiths), the transport sector (shipping) and the construction sector (*e.g.* carpenters, bricklayers, slaters, woodworkers, coopers).[12] Clearly, Kampen became a center (with focus on trade and specific goods) of both regional and international importance.

Remains of several late 12th century wooden houses have been found in the city center of Kampen. They might have belonged to early craftsmen and prove that Kampen, to some extent, functioned as a center of trade by the end of the 12th century (Van Nie & Smit 1997; Bouwmeester 2014). These houses consisted of one large room with a loam floor, wattle walls and/or timbered walls, a roof made of straw or reed and a fireplace in the center of the room (Kolman 1990: 160; Lenferink *et al.* 1993: 22; Kolman 1997: 54). The first stone houses were constructed in the 13th century by order of the town council, although there were few of them (unaffordable as they were for many citizens) until the second quarter of the 14th century (Lenferink *et al.* 1993; Jager 2015: 190). Archaeological and historical research has provided more details on the appearance of these new structures: they are elongated houses that consisted of a wooden framework, stone walls and a wooden roof construction (Kolman 1997: 56). The house was divided in two sections: the main room and the backroom, both with their own hearth. The main room was used as salon, workspace, office, living room and bedroom, while the backroom was inhabited by another family or used as kitchen (Kolman 1990: 162). The scullery, washhouse and toilet were situated in the backyard.

There is no accurate information on population density of Kampen throughout the Late Middle Ages, but 15th century historical sources and historical research indicate that by AD 1420 the total number of registered inhabitants must have been somewhere between 5300

and 8100 (Van der Vlis 1974; Kolman 1990; Benders 1995; Lourens & Lucassen 1997; Jager 2015). The actual number of inhabitants must have been higher since poor immigrants were unable to obtain civil rights and therefore remained unregistered (Kolman 1990: 146).

A selection of the wealthy and influential citizens, especially merchants, was represented in the Council of Kampen and ruled over the city. Before the establishment of the Council, management and jurisdiction were held by a representative of the bishop of Utrecht, the *schout* (Kossmann-Putto 2009: 59). The monasteries were excepted as they possessed their own jurisdiction to a certain degree (Jager 2015: 293). Breaking the rule of law of the Council resulted in penalties like banishment, public humiliation, mutilation and, last but not least, capital punishment (Jager 2015: 432).

Urk

When studying maps of the Zuyder Zee from the 11th century onwards it is not hard to identify Urk as an island in the approximate centre of it. While the Zuyder Zee expanded, Urk would stay an inhabited island with an increasingly remote location. The closest inhabited place nearby was the fellow island of Schokland (at 12,5 km), and the nearest mainland shore of the Zuyder Zee was 18,5 km away (Kampen). In the Early Middle Ages (say AD 500), when the *Almaere* was still to expand and transition into Zuyder Zee, Urk as a the future island was still part of a large peat peninsula (Fig. 6.8), connected to main land in the vicinity of the IJssel river mouth (Cohen *et al.* 2009; Vos & De Vries 2013; Chapter 2). The later island Schokland was also part of this peninsula, as were the peat lands of Kampen. By AD 900 the peninsula was breached (see above, Fig. 6.4). For some time (about two centuries), Urk and Schokland may have been one large island in the expanding *Almaere* waters. By the time of the *Allerheiligenvloed* (1170) and commencement of the Zuyder Zee, however, it had further broken up and Urk was already separated from Schokland (see: Wiggers 1955: 92; Ente *et al.* 1986: 130; Hogestijn 1992; Chapter 2).

A charter from AD 966 mentions the name Urk for the first time when emperor Otto I donates land to the St.-Pantaleon monastery of Cologne (De Vries 1962: 28; Geurts 2005: 32). The donation of land is characterized as 'half of a certain island in the *Almaere*, called Urk, and all lands in between the far side of the *Nakala* river and *Vunningha*.'[13] The donation includes not only land but also meadows, fishing grounds, roads and other properties (De Vries 1962: 28). It is not clear what part of the property lists refers to Urk proper and what to the lands between the *Nakala* river and *Vunningha* (this must have been peatland in between Urk and Kuinre; see also Chapter 2). Another charter from AD 968 also mentions Urk regarding the donation of meadows, fields, forests, water and serfs by Otto I to the St.-Vitus abbey in Hoch-Elten (Geurts 2005: 33). The content of both charters implies that the island of Urk and surrounding peat lands were cultivated and inhabited to a certain extent by the 10th century AD (De Vries 1962: 29; Geurts 2005: 33).[14] In contrast, archaeological sources provide limited evidence for 10th century habitation on what is now known as Urk. This means that (1) the habitation during this period was very limited,

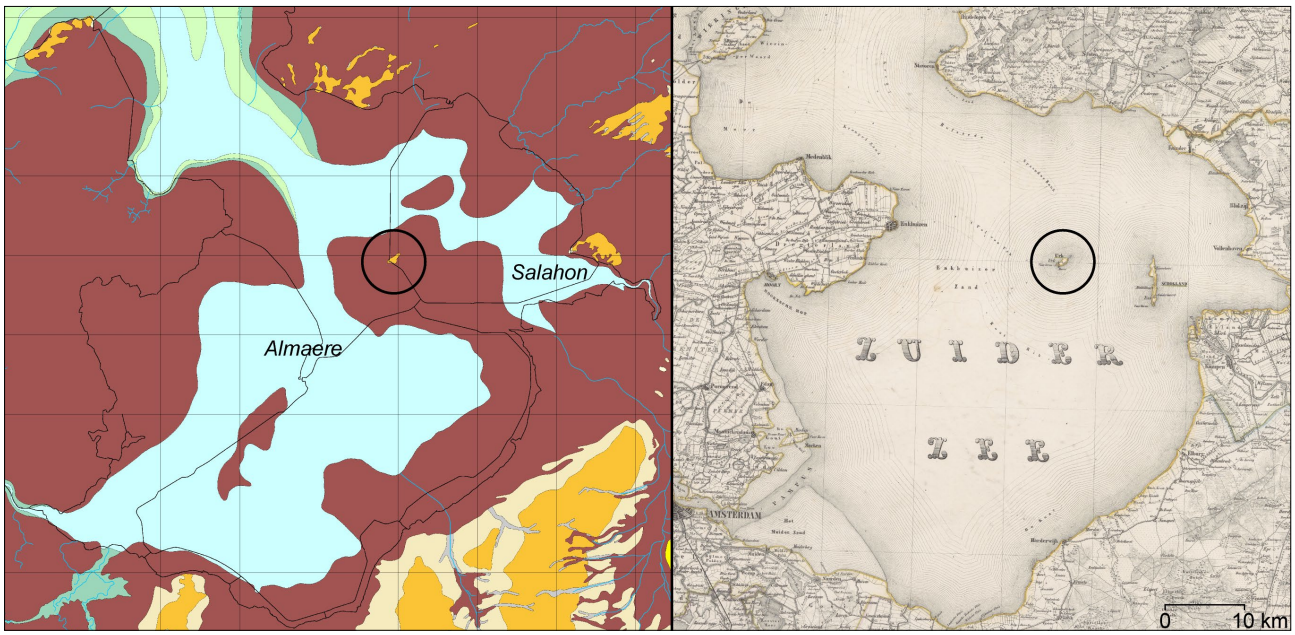


Figure 6.8. Left: Urk (black circle) as part of a large peat peninsula during the Roman Period (palaeogeographical map AD 100: Vos et al. 2020), breached and broken up in early medieval times. Right: as an island in the middle of the Zuyder Zee in the early 20th century (Kadaster, Gemeentekaart).

or (2) its superficial remains have been washed away by late medieval floods (the island Urk was stronger exposed to incoming storm surges than *e.g.* Kuinre and Kampen in their inland coastal positions), or (3) habitation existed primarily on later lost western parts of the island (buried remains of it could reside under water), or a combination of these. The oldest reliable and accurately registered archaeological finds for Urk date back to the 12th century AD (Chapter 2). There might have been several inhabited areas on the originally larger island, but their locations cannot be derived from the (limited) data on distribution and density of archaeological objects (Geurts 2005: 28). By contrast aerial photographs and LiDAR images do clearly depict traces of the medieval peat reclamations, *e.g.* a network of ditches in the northeastern part of the island and dikes on the southeastern edge of the island, comparable to the traces found near Kuinre (see Van Popta 2017a; Van Popta 2019b: area 5/settlement Fenehuysen II).

The storm floods of the 12th and 13th centuries drastically reduced the size of Urk island, a consequence of the reclamations even though dikes were constructed along the borders of the island (see: Van der Heide 1958; Van Popta 2017a; Chapter 2). The inhabitants of Urk were able to retreat to a small patch of higher ground that constituted the center of their island (boulder clay outcrop, a natural leftover of the Saalian Glaciation some 150,000 years ago). This outcrop was much more resistant to the eroding force of the Zuyder Zee than the peatland coasts. Other settled places in and around the Zuyder Zee with outcrops offering such geological retreat opportunity were Wieringen, Gaasterland, Vollenhove, the north Veluwe flank (Elburg, Harderwijk) and Het Gooi (Muiderberg). The settlements Kuinre, Nagele (below) and perhaps also Kampen (above) lacked such opportunity.

By the end of the 13th century AD, the count of Holland started ruling over the lands of Urk (and Emmeloord as well), whereas before the island had belonged to the monasteries of St.-Pantaleon and St.-Vitus since the 10th century (Geurts 2005: 34).[15] The cause of this transition of ownership is not entirely clear, but historical documents suggest that some parts of the land and properties of the monasteries were sold to the count of Holland whereas other parts were given as part of peace treaties (Geurts 2005: 34). Authority was not exercised by the count of Holland himself but enfeoffed to knights from the eastern part of the Low Countries. The oldest recorded and preserved enfeoffment of Urk, dating to the 17th of July 1331, was addressed to vassal Johan (Jan) I, lord of Kuinre (De Vries 1962: 49; De Boer & Geurts 2002: 111; Geurts 2005: 35). The lords of Voorst, powerful knights from the vicinity of Zwolle, were also given rights on the island by AD 1364 (Geurts 2005: 36). The authorities of both vassals were geographically separated: the lord of Voorst ruled the lands to the south of the church of Urk whereas the lord of Kuinre ruled the other part of the island. By 1380 Albrecht of Beieren, count of Holland, had given all rights to the lord of Kuinre, but this new situation would also not last long. In 1381 the entire enfeoffment was made undone by the count and given to an influential nobleman from Holland, Dirk van Zwieten (Janse 1993: 94).[16] As a matter of defense against Frisian privateers and the lords of Kuinre and Voorst, Van Zwieten quickly built a blockhouse in the southern part of the island.[17] It was a wooden stronghold on a stone base that could hold 25 men and several prisoners (De Vries 1962: 61; Geurts 2005: 36). Obviously, the bishop of Utrecht and lord of Kuinre were not amused and the latter tried to attack Van Zwieten several times (De Vries 1962: 63). In 1388 a truce was negotiated between Van Zwieten and the lord of Kuinre that would last for twenty years (Janse 1993: 94). During this period, Urk functioned as a port of refuge for privateers that attacked Frisian ships on the Zuyder Zee (Geurts 2005: 37). After Albrecht of Beieren had passed away in AD 1404, the lord of Voorst seized the opportunity to reclaim his rights on Urk in which he succeeded. Four years later he renounced his rights again whereupon the new count of Holland, Willem VI, transferred them to Herman III, lord of Kuinre (Geurts 2005: 37).

Medieval life on Urk

Late medieval Urk must have been an interesting sight from a distance: a small elevation in the middle of the Zuyder Zee with some habitation on top and bare peatlands surrounding it, subject to many storms and floods. The settlers that reclaimed and cultivated the lands of Urk likely arrived in the 10th century when Urk was still a peninsular cape. Just like those of Kuinre and Kampen, they at first concentrated on agriculture as proven by the charters in which emperor Otto I donates meadows, fields and hayfields (Vreugdenhil 1999: 19). Due to the presence of higher grounds on Urk, arable farming was maintained to some extent, whereas cattle breeding was practiced in the low-lying reclaimed peatlands (Vreugdenhil 1999: 19; Geurts 2005: 40). Although the right of fishing is mentioned in the charter of AD 966, no historical or archaeological sources testify of its importance for Urk throughout the Late Middle Ages (Ypma 1962: 27; Geurts 2005: 42).

It is presumed that the inhabitants of Urk paid nominal rents and delivered goods (*e.g.* grain, butter) to their territorial lords (Geurts 2005: 33). The exact size of the late medieval community on Urk is unknown. Population numbers were first recorded in AD 1637 (Geurts 2005: 31) at which time the community con-

sisted of approximately 300 inhabitants. The wealth and prosperity in Kampen, roughly 20 km to the southeast of Urk, did not remain unnoticed on Urk. Several 14th century sources from the IJssel river town mention the surname *Van Urc(k)* (meaning: from Urk) and indicate that people from Urk moved to Kampen (De Vries 1962: 47). Vice versa some wealthy citizens from Kampen were able to buy and own farmland on Urk (Geurts 2005: 41). Furthermore, the people of Urk focused to some extent on maritime trade thanks to their location in the Zuyder Zee, being familiar with the navigability of surrounding outer and inner waters and the economic prosperity of cities like Kampen and Deventer and perhaps rising cities in the western part of the Zuyder Zee region like Amsterdam, Hoorn and Enkhuizen (De Vries 1962: 44). From the 14th century onwards the inhabitants of Urk withdrew to the highest part of the island while most of the peatland was taken by the sea, leaving only a small strip of land (protected by dikes) to the east of the bolder clay outcrop intact. Life on the small island became tougher and agriculture as the main source of livelihood was replaced by fishing in the 17th century (Geurts 2005: 340).

Nagele

The settlement Nagele has a rather short and tragic history. Historical records prove the past existence of the settlement, but a precise location of it is unknown until today. The toponym Nagele seems to be related to the Nakala river that was mentioned in the charter of AD 966 (see: Urk). The name of the settlement is also mentioned in some 12th century documents (Hogeman 1881; De Vries 1962; Mol & Van Vliet 1998; Geurts 2005; Pol 2015). Several 15th century copies of 12th and 13th century charters from the St. Odulphus monastery of Stavoren mention the chapel of Nagele as one belonging to the monastery (Mol & Van Vliet 1998). Other settlements from the region of study (*i.e.* Kuinre and Urk) are also listed in these charters in a geographically defined order (Mol 2011; Chapter 2). The list starts with the names of settlements in the southwestern part of Friesland and makes its way through the northwestern part of Overijssel into the area lost to later Zuyder Zee expansion. Nagele is mentioned on the list after Sileham (present-day IJsselham), the drowned settlements Fenehuysen and Marcnesse and before Urk. Based on this order, Nagele should be sought somewhere in the southwest of the Noordoostpolder, at that time peatland area. The settlement disappears from historical records after AD 1245. It seems that a major storm (*e.g.* that of AD 1248 or AD 1250) washed away the settlement (Buisman 1995: 4667-472), but damage and land loss started presumably by the aforementioned Allerheiligenvloed (AD 1170) and separation of Urk and Schokland from the main land peat fringe. Klappe (1992: 31-34) believes that Nagele drowned in the early 14th century (perhaps due to a large flood in AD 1307), as the city of Kampen registered several new citizens 'from Nagele' in AD 1308 (see also: Groothoff 2008: 404; Roemeling 2013: 209). Drawing comparisons to repetitive storm damage to the SW of neighboring island Schokland (*e.g.* Van den Biggelaar *et al.* 2014), it is well possible that the Nagele island shrunk in size and was abandoned in step wise fashion.

On neighboring Urk and Schokland, the downfall of Nagele led to a lot of local folklore, passed on by oral tradition. Fishermen told stories of stormy nights on the Zuyder Zee during which they could hear church bells ring, of gravestones caught in nets and/or nets that got snagged on structures on the seafloor (Reinsma 2009; Chapter 3). When in the 1940s the northeastern part of the Zuyder Zee was embanked and drained in the 1940s, no intact remains of Nagele were found. For some time scholars believed that nothing remained of the settlements that drowned during the Late Middle Ages. However, research by Wiggers (1955), Van der Heide (1965), Van Popta (2017a) and Van Popta *et al.* (2020) has revealed clusters of late medieval archaeological objects in the Noordoostpolder region actually represent drowned settlements. Re-emerged remains of drowned Nagele are most likely to be found to the northeast of the island of Urk, based on the information from historical records and the composition of archaeological finds (Fig. 6.9).

Little is known of late medieval Nagele and even less is known of its inhabitants and their way of life. The first ones to arrive, likely in the 10th or 11th century, cultivated the peatlands and lived lives similar to the pioneer farmers like those of *i.e.* Kuinre, Urk and Kampen. Some of them were probably involved in maritime trade, as historical records mention Nagele as maritime transit point between Stavoren and the IJssel river mouth (Pol 2015: 47). The charters of the monastery of Stavoren describe Nagele as a settlement with a church or chapel, probably brick-built considering the late medieval bricks that were found after the reclamations on the assumed settlement location. During the short period of existence of Nagele (no more than 300 years), storms and floods must have seriously limited economic and infrastructural development of the settlement. Small dikes like those constructed near Urk, Schokland and Kuinre did not stand against the eroding force of the Zuyder Zee. Unlike the inhabitants of Urk or Kuinre, those of Nagele were unable to retreat to higher grounds or more inland positions. Last bits of Nagele drowned at the turn of the 14th century but its name lived on: as a surname, as a mythified toponym for the Zuyder Zee waters to the northeast of Urk (Fig.

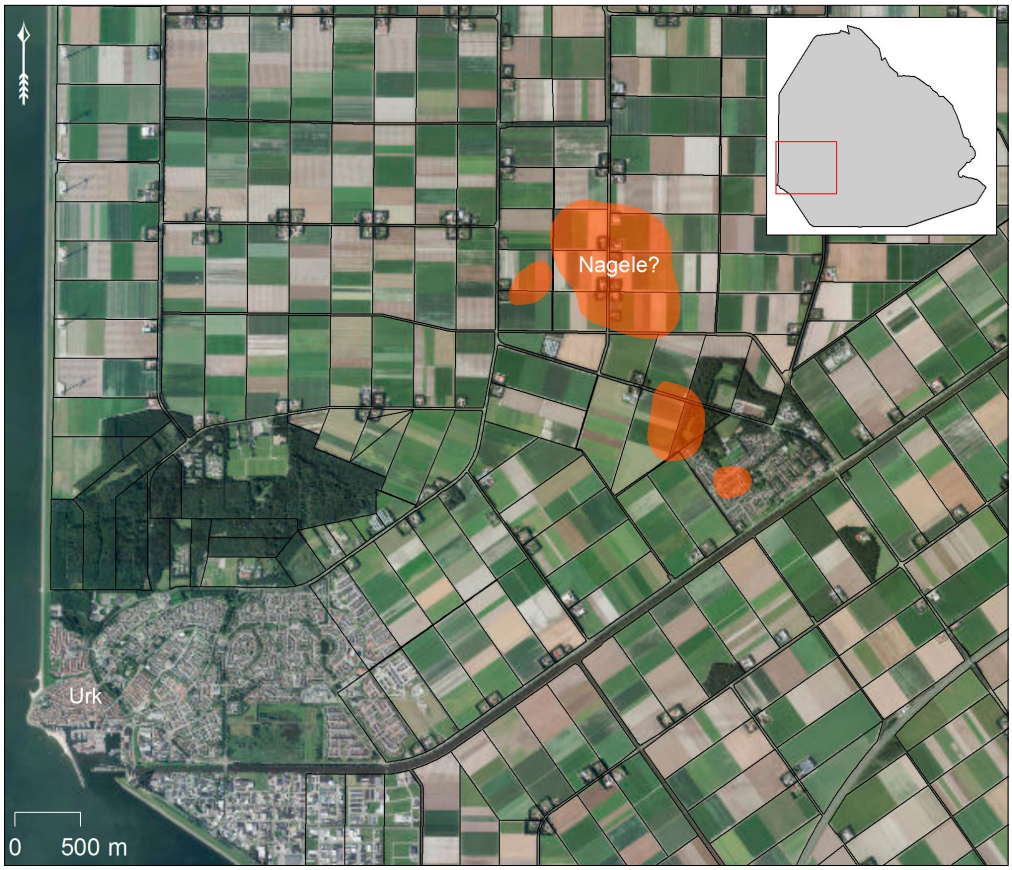


Figure 6.9. Presumed location of the late medieval drowned settlement Nagele, based on the distribution and density of archaeological objects.

6.10), and as a reinstated toponym for a 20th century new settlement in the freshly created dry land of the Noordoostpolder.

Late medieval shipwrecks

Settlements, dikes and ditches marking out fields are not the only remains of material culture of past inhabitants of the study area. The 12th century origin of the Zuyder Zee opened up the study area and improved maritime connections: existing waterways improved (wider, deeper) and new ones were created. As many ships (were able to) set sail on the waters of the Zuyder Zee maritime trade developed rapidly. A number of them wrecked in the shallow waters (owing to dangers of unpredictable weather, floods, floating ice and personal failure; see Van Popta 2014; 2017b). This is testified for by the c. 450 shipwrecks that were discovered in the modern polders of the province of Flevoland, *i.e.* the 20th century reclaimed part of the Zuyder Zee. The spatial distribution and density of these wreck sites in the Noordoostpolder region highlights harbor zones like Kuinre and Schokland and trade routes, especially to Kampen (Van Popta 2012; 2017b; Chapter 5). However, the majority of the shipwrecks dates to the 17th, 18th and 19th centuries.[18] The number of shipwrecks dated to the 12th and 14th century is limited to 10 (Fig. 6.10 and Table 6.1).[19] These are the wrecks most relevant here, and all are freighters of the cog-type (two dating to the late 13th century, eight to the 14th century, 1 to the first half of the 15th century; Van Holk 2010; Chapter 5; Waldus 2018). The Noordoostpolder cogs are the oldest shipwrecks found in the Zuyder Zee. Archaeological traces of older ships have not been discovered yet, despite the historical records that prove the existence of maritime crossings and transport between the 9th and 12th century.

The cog is considered to be the most important freighter of the Late Middle Ages in northwestern Europe. Wrecks of these typical clinker-built ships

Table 6.1. Cog-like vessels from the Noordoostpolder region (based on Van Holk 2010; Blok 2014; Van Popta & Van Holk 2018; Waldus 2018).

Wreck	Date of wreckage (AD)
NA 57	1275–1300
NG 37	1200–1300
NM 107	1380
NM 133–I	1300–1350
NQ 75	1300–1325
NR 1–I	1300–1700
NT 25	1300–1400
OG 77	1300–1400
ON 5	1320–1330
IJssel Cog	1400–1450

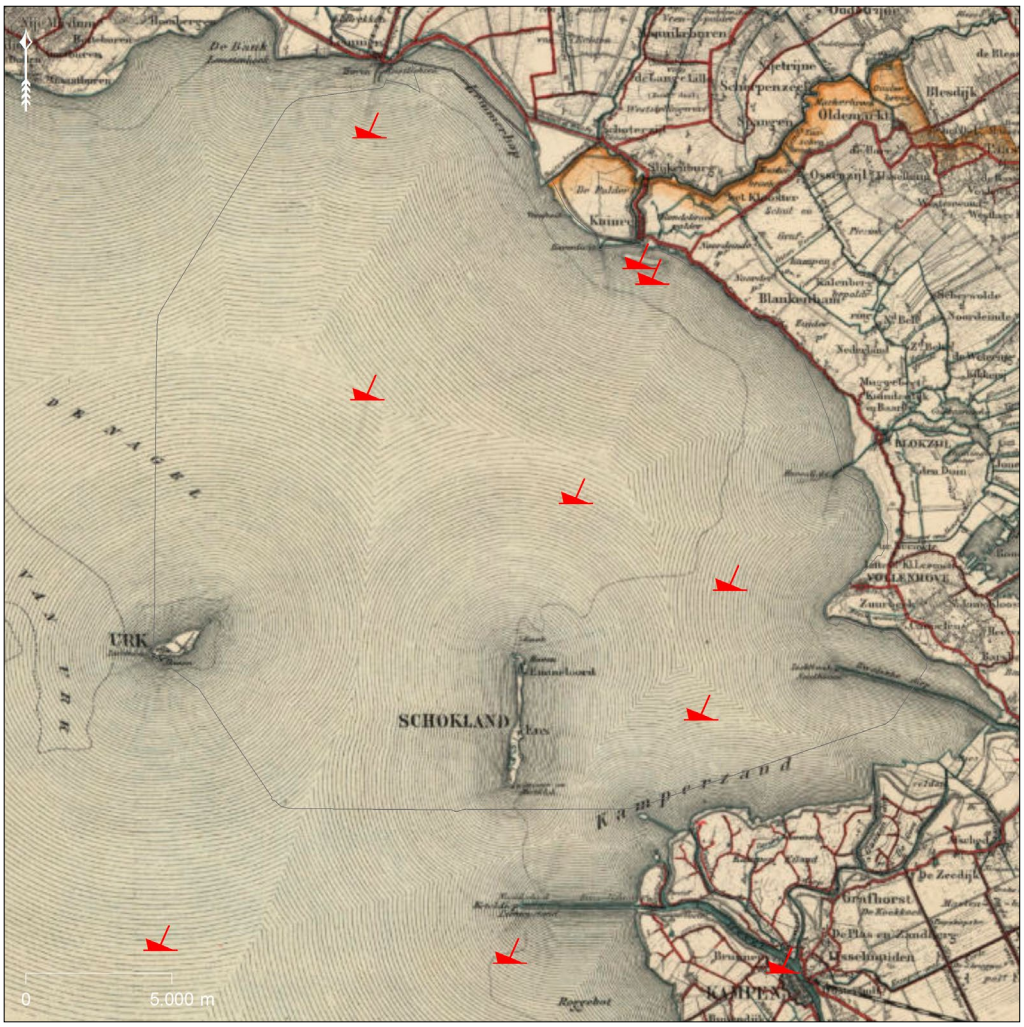


Figure 6.10. Distribution of late medieval cogs (c. AD 1200 – 1500) from the Noordoostpolder region.

have, besides the Netherlands, been found in Belgium, Northern Germany, Denmark and South Sweden (Van Holk 2010: 137). Their appearance is inextricably bound-up with the Hanseatic League, as these ships were able to transport large amounts of bulk cargo across the Baltic Sea and North Sea. Many Hanseatic ports used the cog as a symbol in their seals, whereas nowadays the ship has become part of their coat of arms.

However, as the size and capacity of excavated cogs varies, it is likely that small cogs were used for inland shipping and perhaps privateering whereas large cogs were used for seagoing transport (Van Holk 2010: 35). The smaller cogs probably sailed in between the IJssel river (Kampen, Deventer), the Zuyder Zee (*i.e.* towards Kuinre, Vollenhove, Urk, Stavoren) and possibly the Wadden Sea. Most excavated Noordoostpolder cogs contain only limited amounts of objects, providing little further detail on their ownership or destination. Only one of them (NM 107) carried the remains of a cargo, consisting of c. 5000 red bricks (Blok 2014: 42). The clay used for the construction of the bricks is probably from the Dutch Rhine region, which implies that the bricks were shipped from that region towards the Zuyder Zee. Of the ten cogs only two are to be considered as seagoing (Van Holk 2010: 132). These are NA 57 (c. 1275-1300; the oldest known Zuyder Zee shipwreck) and the so-called IJssel Cog (c. 1400-1450; Waldus 2018) found deliberately sunken in the IJssel river just NE off Kampen.

Discussion

The case studies of the settlements Kuinre, Kampen, Urk and Nagele offer windows to illustrate the effects of late medieval landscape changes and impacts on people inhabiting the region (happening in the study area itself, but also in adjacent areas bordering the Zuyder Zee). It is safe to state that the society at large was affected to a certain extent by the storms, floods and erosion of the peatlands, particularly in the 12th to 13th century. The scale of loss of land is not to be solely regarded as a simple unexpected natural disaster, but rather a consequence of accumulated human interference in the area's lowlands, exacerbated and preyed upon by storm surge impacts. Like elsewhere in the low countries, reclaiming and cultivating the peatlands of the study area started an inevitable process of land subsidence put-

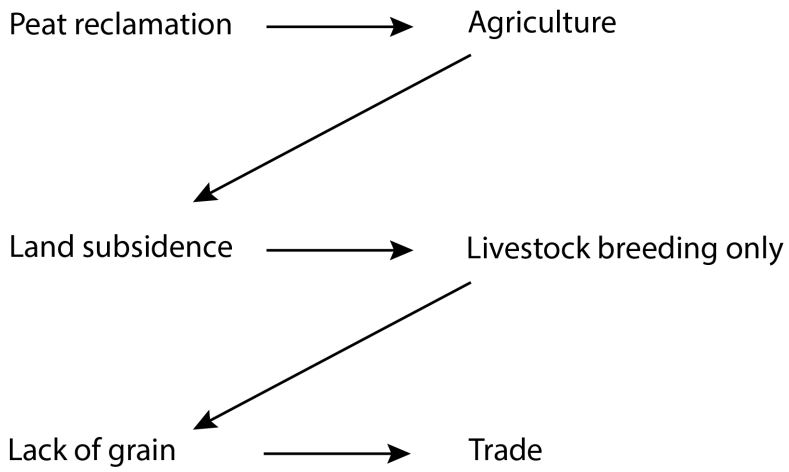


Figure 6.11. Simplified scheme of the late medieval economic development of the Noordoostpolder region.

ting the land at risk for storm impacts (see *e.g.* Borger 1975; Ligtendag 1995; De Bont 2008; Van Bavel 2010; Vos 2015; Pierik *et al.* 2017). In the study area, the land loss that resulted during the Late Middle Ages was considerable, but of similar size as land losses in Zeeland and Zuid-Holland, Frisia and Groningen (with slightly different timings within the Middle Ages). In the study area, it would last some 500-600 years between the 14th century and 20th century before the lost lands would finally be reclaimed. This waiting period is dissimilar to reclamations in SW and NE Netherlands, where reclamations occurred often within two centuries after losing the land, helped by tidal sedimentary circumstances (suppressed in the Zuyder Zee) and economic situation (post-medieval Holland).

It is fair to state that the subsistence of all four settlements originally, *i.e.* in the 11th-12th century, focused on agriculture (Table 6.2). This corresponds to simultaneous developments in neighboring regions Holland and Utrecht (De Bont 2008; Van Bavel 2010: 40). Higher grounds (only available near Kampen and Urk) were used for arable farming, whereas lower (wet) grounds were used for cattle breeding. Originally, arable farming was probably also practiced on the lower grounds but land subsidence — of which the negative effects (soggy fields) were likely to be noticeable from the 13th or 14th century onwards — made the fields unsuitable for crop cultivation (if dikes and dams held against adjacent open waters in the first place). Lack of suitable soils for crop-cultivation drastically limited possibilities of a self-supported livelihood for the inhabitants of Urk and Kampen, and even more so for Kuinre and Nagele. The need for grain-import opened up ways for (maritime) trade (Fig. 6.11). One could even state that trade was a necessary factor for the inhabitants of the Noordoostpolder settlements to survive. From that moment onwards, the development of each of the settlements went its own way.

Where inhabitants of Nagele and Urk suffered, those of Kampen profited from the 12th and 13th century storm floods that opened up the Zuyder Zee. Their rural settlement rapidly urbanized (inhabitants became citizens) and turned into a maritime transit point between the Rhine-IJssel river system and the Zuyder Zee-North Sea-Baltic Sea trading areas (needing different types of ships to navigate). Throughout the Late Middle Ages, Kampen kept focusing on maritime trade, it created strong connections with the Hanseatic League and rapidly became one of the most important towns of the Low Countries. Whereas Kampen profited from the openness created by the storm floods, the settlements of Nagele, Urk and Kuinre suffered land loss. Their inhabitants had to retreat. The small community on Urk focused mainly on agriculture and while the size of their island kept decreasing in the 13th and 14th century, the local boulder clay outcrop brought them relative safety. Kuinre became a powerful stronghold throughout the Late Middle Ages, owing to the actions of its lords that used the strategically positioned settlement and castle for trade and privateering (treacherous waters in front of the town) and also profited from agriculture and rents out of land. Of the inhabitants of short-lived Nagele, likely mostly farmers, we know the least. The lack of nearby high grounds and hinterland sealed their fate. The same can be said on fellow lost settlements Marcnesse and Fenehuysen: storm floods eroded the lands and swallowed these villages.

In hindsight, it may seem that 11th–12th century settlements founded in places without proper natural defensive options were doomed to disappear from their beginning. If so, the case of Schokland (as a longer surviving peatland remnant; Hogestijn 1992; Van Hezel & Pol 2008; Van den Biggelaar *et al.* 2014), is to be considered an exception, and that of Nagele (and Marcnesse and Fenehuysen) the rule. Of the extensive early medieval peatlands in the Noordoostpolder

Table 6.2. General overview of the development of each of the examined late medieval settlements of the research area.

Settlement	Period	Territorial lord(s)	Vassal(s)	Economic focus	Role
Kampen	12th cy	Bishop of Utrecht	Local bailiff (*schout*) and assessors (*keurnoten*)[1]	Agriculture	Agrarian settlement[2]
	14th cy	Assessors become Council of Kampen (1301)	-	Trade Toll[2] International market	Leading city of Low Counties in Baltic Trade[3]
Kuinre	12th cy	Bishop of Utrecht	Lords of Kuinre	Agriculture	Agrarian settlement
	14th cy	Bishop of Utrecht Count of Holland (1331–1362)	Lords of Kuinre	Trade Toll[4] Privateering Regional market	Regional stronghold and market place
Urk	12th cy	St. Pantaleon and St. Vitus monasteries	Lords of Kuinre	Agriculture	Agrarian settlement
	14th cy	Count of Holland (since 1280)	Lords of Kuinre Lords of Voorst	Agriculture Trade	Outport of Kuinre
Emmeloord	12th cy	St. Pantaleon and St. Vitus monasteries	Lords of Kuinre	Agriculture	Agrarian settlement
	14th cy	Count of Holland (since 1280)	Lords of Kuinre Lords of Voorst	Agriculture Trade	Outport of Kuinre
Ens	12th cy	Bishop of Utrecht	Local bailiff (*schout*) and assessors (*keurnoten*)	Agriculture	Agrarian settlement
	14th cy	Assessors become Council of Kampen (1301)	-	Agriculture Trade	Outport of Kampen
Nagele, Marcnesse, Fenehuysen	12th cy	Bishop of Utrecht	Lords of Kuinre	Agriculture Trade?	Agrarian settlement
	14th cy	-	-	-	Drowned

1 Together with other bailiwicks (schoutambten) part of the sheriffdom (drostambt) of IJsselmuiden.
2 Charging of IJssel tolls
3 Focus on maritime infrastructure: shipbuilding, beaconing/buoyage and piloting
4 Charging of Zuyder Zee and Kuinder river tolls

region, Schokland is the only piece that survived the calving of the Zuyder Zee as an island. The inhabitants of this elongated remnant island deployed several strategies to protect themselves and their lands against the water. Since early on, small artificial mounds were erected to provide dry grounds to single farmsteads and barns.[20] By c. AD 1350 over 130 of these mounds were raised and small dikes were constructed in between them to protect the farmlands (Van Hezel & Pol 2008; Van Popta & Aalbersberg 2016). The northern mounds were controlled by the lords of Kuinre (just like Urk and Nagele) whereas the southern ones belonged to the city of Kampen. To some, Schokland may seem like an isolated case as it was an island, but as this paper demonstrates, what happened on this peatland island is not that different (development, economic focus, political power) of that along nearby peatland Zuyder Zee shores, such as around Kuinre and Kampen. By AD 1375, the many small mounds around Schokland were replaced by fewer larger and higher artificial mounds on which entire settlements were founded: Emmeloord in the north and Ens in the south. As coastal erosion opened up waterways and flooded farmlands, the inhabitants of both settlements shifted their economic focus from agriculture towards trade: Emmeloord functioned as an outport of Kuinre whereas Ens functioned as an outport of Kampen (Van Hezel & Pol 2008: 47). Even though the coastal defense and mounds were constantly improved, the coastal defense was breached many times which enabled the sea to flood the island. By the early 19th century no more than 5% was left of Schokland's (original) late medieval size (compare Fig. 6.4 and Fig. 6.8). By that time, the inhabitants of Schokland were supported by the Dutch government: the lands had become too wet for profitable agriculture and fishing had proven to be unprofitable too. By the mid-19th century the Dutch government decided to enforce the evacuation of inhabitants of the island: living there had become too dangerous and expensive to support (Geurts 1991; Van Hezel & Pol 2008). Nevertheless, the case of Schokland proves that it was possible to protect (small) parts of the Noordoostpolder peatlands against the heavy floods.

The findings in this paper stress that a combination of natural and cultural factors (and perhaps a bit of coincidence) determined the development and fate of each of the settlements and their inhabitants. The most important natural factors were the composition of the natural substrate, the division of land- and sea surface and the combined action of wind, climate and water level (as determined by the geographic location; distance and exposition to the Vlie inlet and IJssel river mouth). The most important cultural factor — strongly related to the above — must have been the choice of initial settlement location (as allowed within contemporary political-territorial boundaries). The presence of (nearby) natural heights (levees, river dunes and bolder clay outcrops) provided protection against floods (*i.e.* Urk, Kampen) whereas the distance to nearby (trade) routes (roads, rivers, coasts) brought great economic and strategic advantages (*i.e.* Kuinre, Kampen). Other important cultural factors were safety measures (construction of mounds and dikes), the influence and competence of lord, vassal and/or council and economic focus. The latter is — of course — strongly related to natural factors and settlement location.

Based on the above, it is possible to identify the late medieval inhabitants of the northeastern Zuyder Zee region — who they were and how they lived — and therefore to provide an answer to the main research question. The case studies have clearly illustrated the differences and similarities between settlements, their inhabitants and their development within the research area (Table 6.2). In general the first phase of habitation focused primarily on agriculture. After the origin of the Zuyder Zee and the newly established maritime connections, the actors of the region started living the lives of amongst others lords, merchants and farmers. Their occupation, development and wealth were highly depending on factors such as settlement location, characteristics of the local landscape and subsoil, safety measures, economic focus and competences of their rulers. Some of them gained great wealth and power whereas others lived in poverty or searched for prosperity elsewhere.

Conclusion

The late medieval landscape of the northeastern Zuyder Zee region went through some rapid developments, simultaneous to growing inhabitance of the rims of the region. In no more than a few decades, starting in the second half of the 12th century, most of the peatlands were taken and replaced by the waters of the Zuyder Zee. Several earlier studies have focused on these late medieval landscape changes. The material culture of these pioneers has also been studied in the past, giving some answers on 'when' and 'where' they lived. When combining these aspects, it is possible to take the next step by examining the identity and way of life of the late medieval inhabitants of the region of study, which is the main target of this paper and an important part of the concept of the maritime cultural landscape. Throughout the paper, the settlements and their inhabitants were considered as the actors and their surroundings (the landscape) as the stage on which they acted.

The actors of the study region first settled in the 10th and 11th century AD. Habitation did not start simultaneously: Urk must have been founded early (before AD 966) whereas Kampen started fairly late (in the 12th century). The first people to settle reclaimed and cultivated good parts of the peatlands, founded small settlements and lived the life of farmers. These colonists would have been attracted by policies set by the bishop of Utrecht (the territorial landlord, owning large parts of the Noordoostpolder region), and likely lived the lives of 'free men' that payed taxes and/or nominal rents in recognition to their landlord. In time, the reclamation and cultivation works impacted greatly upon the (economic) development of the settlements of the region. First, the drained peat lands gradually suffered from land subsidence — likely to have started in the 13th and 14th century — which made the lands soggy and no longer suitable for arable farming. Out of necessity, many farmers shifted focus from mixed agriculture towards livestock breeding only. It caused the origin of local trade: in order to meet the primary necessities of life (bread, meat, water) especially grain had to be brought in from elsewhere. Maritime trade on a regional and national scale found great rise as soon as the Zuyder Zee opened in the late 12th century (*i.e.* from AD 1170 onwards). Soon as this happened, we observe a differentiation of the activities of the settlements of the study region. 13th century Kampen and Kuinre profited from the improved connection between the river mouths, Zuyder Zee and North Sea. As older agricultural settlements, they now found themselves in renewed strategic positions on river mouths. For Kampen, agriculture lost importance and maritime trade became the main focus. The latter is partially reflected by the ten known wrecks of late medieval freighters (*koggen*) that were found within the boundaries of the research area. The city of Kampen prospered, its citizens accumulated wealth and many made a living as merchants and shippers. Kuinre owned its continued prosperity solely to its strategic location near the Kuinder river and the Zuyder Zee as a stronghold and local (surrounding countryside) market place. At first, the inhabitants of Kuinre practiced agriculture and (likely) conducted trade to make a living. Things changed after a castle was constructed in which the lords of Kuinre (vassals appointed by the bishop of Utrecht) set up residence: they prof-

ited from (inter)national maritime activities on the Zuyder Zee by charging tolls, privateering and trade, became independent lords and dominated parts of the Noordoostpolder region for centuries. The inhabitants of Urk and Nagele lived on less strategic positions, although water was never far away. Throughout the Late Middle Ages they focused mainly on agriculture and to some extent trade, but heavy floods eroded their lands and limited their agricultural possibilities. The inhabitants of Urk found protection against the Zuyder Zee on their boulder clay outcrop, but Nagele was left at the mercy of the sea as higher grounds and/or hinterland was lacking. The current research concludes that while the Zuyder Zee settlements originally — from the 10th/11th century onwards — focused on agriculture uniformly, saw great differentiated developments in the 13th and 14th century, catalised by physical geographical factors (locational differences, terrain differences, storm surge exposure differences), but steered by communal economic refocusing, and the competences and interests of their rulers.

Endnotes

1 For detailed studies on the pre-roman Holocene landscape development of the Zuyder Zee region see *i.e.* Wiggers 1955; Ente *et al.* 1986; Gotjé 1993; Menke *et al.* 1998; Ten Anscher 2012; Vos 2015.

2 For the Roman documents see: Pomponius Mela, *Chorographia* III, 24; Tacitus, *Annales* I, 60; Plinius Maior, *Naturalis historiae* IV, 101.

3 Willibald van Eichtstätt, *Vita Bonifatii auctore Willibaldi* (AD 753).

4 These major floods occurred in AD 1163, 1170, 1173, 1196, 1214, 1219, 1220, 1221, 1246 and 1248 (Gottschalk 1971; Buisman 1995).

5 The Early and High medieval lakes in the study region are nowadays commonly addressed to as *Almaere* (Almere), but – back then – presumably were known as *Vidrus* (Vecht river) and *Salahon* (IJssel river mouth).

6 Cartulary of the Sticht Utrecht, I, no. 289: "*Ipse autem predictus prepositus, cuius petitioni et fideli servitio super his omnibus, sicut dictum est, obtemperavimus, domum quondam aptam pascuis, que vulgari nomine swechus dicitur, juxta Cunre, nostre potestati tradidit cum quibusdam mansis, qui dicebantur eiusdem ecclesie fuisse, quos predecessor noster Cunradus pie memorie episcopus suo servitio quacunque occasione in partibus illis apposuit*". Published by S. Muller & A.C. Bouman (ed.) 1920-1959.

7 The attack of the Frisians on the fortification of Kuinre is mentioned in the Rhyme Chronicle of Melis Stoke, (1235-1305).

8 De *cameraars-rekeningen* of Deventer, Volume 5, 139.

9 See *e.g.* Cartulary of Overijssel Volume III, 58 and Volume IV, 825; Cartulary of Amsterdam until 1400, 175; *cameraars-rekeningen* of Deventer Volume I, 303 and Volume 2, 90, 107, 177, 183, 208, 209, 209, 735.

10 Hansisches Urkundenbuch, IV, no. 654

11 GA Kampen, Oud-archief inv. 9, ff. 175r-175v.

12 For a complete overview of crafts in late medieval Kampen, see: Haze 1991; Lenferink *et al.* 1993; Jager 2015.

13 "*suppliciter attacti cuiusdam insulae medictatem in Almere, que Urch vocatur, et ultra amnem Nakala quicquid interjacet usque Vunningam*" In: Monumenta Germaniae Historica. Diplomata Regum et imperatorum Germaniae I. Conradi I, Heinrici I et Ottonis I diplomata, no. 324.

14 Donation charters can contain certain standardized pertinence formulas (*e.g.* meadows, fields, forests), thereby implying the presence of cultivated lands although their existence is not necessarily true.

15 It remains unclear how the count of Holland managed to rule over Urk from the late 13th century onwards.

16 Archief Graven van Holland, inv. 195, f. 74.

17 Archief Graven van Holland, inv. 1165; inv. 709, f. 16.

18 New research by Van Popta & Van Holk (2018) has also proven that a lot of primary parameters (ship type, moment of wreckage, wreck site location) are unknown, outdated and/or incorrect.

19 Several detailed archaeological studies have been conducted on the cogs from the Zuyder Zee region, of which the details can be found in Reinders (1979; 1980); Oosting (1987); Van de Moortel (1991; 2001), Hocker & Vlierman (1996), Van Holk (2010) and Blok (2014).

20 Similar artificial mounds were also constructed to the west of Kampen (Jager 2015).

7 Discussion and synthesis

In this study, I have examined the development of the late medieval northeastern Zuyder Zee region in the Netherlands. I reconstructed the physical landscape and studied the most important factor of change and development: man. Focus lay on those that cultivated and inhabited the region and the material culture that they left behind (mainly related to infrastructure and habitation). In doing so, my study built upon and differs from earlier studies on landscape development of the Zuyder Zee in the Late Middle Ages (*e.g.* Wiggers 1955; Buisman 1995; Vos 2015; Pierik *et al.* 2017; see Chapter 2), and earlier maritime archaeological and archaeohistorical studies (*e.g.* Modderman 1945; Van der Heide 1965b, 1974; Geurts 1991, 2005; Hogestijn 1992; Mol 2011; Van den Biggelaar 2017). This discussion chapter will synthesize the gains in knowledge from the PhD-project work in a retrospective way.

The research question encompassing the work was formulated as: *How can interdisciplinary and methodological research, using different research approaches, contribute to improved understanding of the developments shaping and altering the landscape and human usage of the northeastern Zuyder Zee region between 1100 and 1400 AD*? Besides interdisciplinary ambitions, it included a decision to carry out the research in the Noordoostpolder sector of the Zuyder Zee. The earlier work had made clear that this region experienced severe land loss from sea ingression between c. AD 1100 – 1400, although details on how this land loss had evolved progressively were missing and regarded difficult to disentangle from noise and disturbance in the material archaeological record and reworked nature of the depositional record.

This discussion chapter is structured to address two complementary aspects that are combined in the above research question. The first aspect reflects upon the newly developed approach (interdisciplinary and spatial methodologies) to reconstruct eroded medieval maritime landscapes. It also discusses a change of maritime archaeological focus from object- and shipwreck orientated studies to more integrative maritime archaeological research. The second aspect bundles the research outcomes: it synthesizes new insights on the dynamic late medieval development (landscape and man) of the region of study. In addition, I will briefly discuss the differences between the past and present of the region, the uniqueness of the Noordoostpolder as a research area and provide some necessary recommendations for future research.

A shift towards more integrative maritime archaeological studies

The reclaimed part of the Zuyder Zee, now known as the province of Flevoland, was and is considered the largest ship graveyard on land in the world. Over 450 wrecks have been discovered in the former seabed but probably many more have yet not been found. Many of the wreck locations in the Flevoland polders are visualized by marking poles and the results of dozens of excavations have made it to monographs. So, maritime archaeology is clearly represented in the province of Flevoland. However, as Christer Westerdahl and several others advocated and demonstrated since the 1990s, maritime archaeology would be wise to consider not only shipwrecks and the sea, but also the terrestrial counterpart and its remains of maritime culture (Westerdahl 1992; see also Chapter 3). For the Zuyder Zee region, the many shipwrecks that needed to be examined anyways overshadowed taking up a Maritime Cultural Landscape approach. Arguments for this being the case is that documentation of most of the listed late medieval shipwrecks from the study region had remained unpublished, and that in what was documented relative little attention was paid to aspects of formation and cultivation of the Zuyder Zee region. From related disciplines, materials and overviews were available covering land use and land loss history, but for the Zuyder Zee region these also lacked spatial detail and in-depth consideration of what would have been similar to surroundings and what could have been different. Palaeogeographical and historical studies (*e.g.* Vos 2015; Van Bavel 2010) do include relevant and thorough descriptions of the general causes of land loss and narratives for how medieval society responded, but for the study area in late medieval times this offers scenarios and hypotheses more than that it offered the required detail to improve and integrate maritime and terrestrial archaeological understanding (see also Chapter 2). Especially the medieval landscape processes under human usage for the northeastern quarter of the Zuyder Zee (and its other quarters likewise) were considered infeasible to examine due to the large scale (marine) erosion in the region. Evidence and indications that were available (*e.g.* thousands of archaeo-

logical finds, the content of historical maps and charters and geological corings) in cases were neglected or put aside (*i.e.* left to other disciplines to make sense of first), and when used were often incorrectly interpreted.

When the research proposal was written, this research seemed to fit best within the holistic scope of the theoretical concept of the maritime cultural landscape (Westerdahl 1992), intending to bridge the subdisciplinary boundaries between the land and the sea and including both study of the physical remains of maritime cultures and study of the cultural practices. In Chapter 3, facets of the maritime cultural landscape concept were explored and focused on the current research. It turned out that there is no clear single methodology on how to the concept in maritime archaeological study, but that when implementing the crucial part is to cover the 'cultural component'. That part distinguishes maritime cultural landscape studies from maritime archaeological landscape studies and includes and integrates the material cultural aspects deduced from archaeological finds and cognitive aspects such as oral traditions, folklore, toponyms and mental maps.

Now that the PhD-research has progressed and is finishing, Chapter 6 mentions the maritime cultural landscape concept as inspiration to portray settlements and inhabitants as actors in the landscape impacted by the Zuyder Zee. This Discussion chapter reflects once again on the implementation of the concept in this research. Even though the current study has clearly crossed the boundaries of the maritime cultural landscape concept, one might argue that it has not completely embedded all cognitive aspects. There are some narratives (*e.g.* the myth of drowned Nagele; see Chapter 3), historical place names and toponyms that were reused in the modern day landscape (see also Epilogue) and written histories that survived the course of time, but their numbers are limited. This is recognized and felt as an inevitability in working in the medieval part of historic time in the first place. Less is preserved and known of these aspects due the large time gap between the period of research and present day (some 600-900 years). We do, for example, know the sentiment of reclaiming the Zuyder Zee (new arable opportunities, protection against the sea) and experience recent sentimental changes (*e.g.* "we are not the first inhabitants of the region"), but we do not know the late medieval sentiment of the origin of the Zuyder Zee and the reclamation and cultivation of the vast peatlands.

The geographical factors explaining the poor preservation (Zuyder Zee expansion causing erosion) is a secondary matter, negatively affecting archaeological material preservation but positively affecting historical sources. Larger storms are historically recorded events, that one can utilize as cessations when analyzing historical materials — both those referring to materialistic aspects as those referring to cognitive aspects. I would argue that younger research periods (19th and 20th century) can provide much more cognitive data due to the availability of very diverse sources and relatively the small time gap, and therefore are better suited covering the ambiguous nature of the maritime cultural landscape concept. I would also argue that when applying it to earlier periods of time with obviously and inevitably less complete contextual, material and immaterial records, satisfactory implementation of the maritime cultural landscape concept fully should mean 'implementing it fully, as far as source materials allow'.

A lack of availability of datasets or opportunities to cover certain aspects, however, does not mean that a study should be kept away from the concept of the maritime cultural landscape. To my concern, while taking the ambiguous nature of the maritime cultural landscape concept into consideration, the intention of including cultural components (both material and cognitive) in a research is more important than the outcomes that highly depend on reliability, accuracy and availability of datasets. Still, it is best to state that the current study has explored and adopted parts of the holistic concept, but is not solely focused on it. In other words, some nuancing for differences in time-depth is pragmatic when one wishes to apply the maritime cultural landscape concept to cases from earlier historical periods. In this PhD-research, the outcome was that a new integrative methodology was developed and tested to examine and reconstruct the late medieval Noordoostpolder region.

The interdisciplinary and spatial approach taken up in the research provided solutions to analyze and interpret the scattered and multi-facetted nature of available datasets for an interpretation of landscape development, habitation and human behavior (see Chapter 1). It includes the research disciplines of (maritime) archaeology, soil sciences, history, historical geography and landscape history. Many of the datasets involved have been spatially analyzed, as it provides the best opportunity to combine, compare and complement geological, historical, archaeological and remote sensing data. Chapter 2 of the dissertation illustrates the effectiveness of this spatial approach, as the combination of datasets led to two new palaeogeographical reconstructions (AD 1100 and 1400). The drafting of such maps at desired quality was not possible by making use of geological information only, due to the widespread marine erosion that typifies the Zuyder Zee 'from shore to sea' period (which made previous workers overstep the time period in their map series). The solution found was to steer the map drawing with a density analysis of late medieval archaeological objects. That information

pinpointed settlement locations in the study region that before were only vaguely known from historic sources (see Chapter 4 and 6), and could be combined with the geological data to complete the palaeogeographical maps.

The new reconstructions for AD 1100 and 1400 became cultural-palaeogeographical maps: they depict both natural landscape development (including land loss) and habitation impacts (reclamation, cultivation, dikes, settlements). In Chapter 6, I considered the reconstructed landscape as the stage upon which the inhabitants of the study region acted and left traces of their actions. This chapter integrates earlier palaeogeographical and archaeological findings with archaeohistorical factual overviews and cultural reflections as the final element of the new integrative methodology of this thesis. The chapter uses historical and archaeological sources and focuses on the inhabitants of the research area themselves (the actors; Chapter 6), their actions and their lives (or: way of living). Without this component, the dissertation would float somewhere between a palaeogeographical and archaeological landscape study. With this component, the cross-references to the maritime cultural landscapes concept in the thesis are strengthened and the ambitions of the research proposal began to be reached.

The northeastern Zuyder Zee region between AD 1100 and 1400

This study has focused on the dynamic late medieval history of the northeastern Zuyder Zee region. It can be hard to imagine that land reclamation, cultivation, habitation and the loss of land and habitation all occurred in a period of no more than 500 years, the last two in only 300 years. National and regional palaeogeographical maps depict the region before (geological data) and after (historical maps) the formation of the Zuyder Zee, at a safe time interval from the assumed intangible formation itself. The position taken in this thesis is that combining data from several disciplines is a feasible activity that improves our understanding of the developments shaping and altering the landscape and human usage of the northeastern Zuyder Zee between AD 1100 and 1400.

By AD 900, the Zuyder Zee did not yet exist (Chapters 2 and 6). Palaeogeographical and archaeological datasets (and a few historic written sources) inform us on the physical appearance of the region: the later open water area of the Zuyder Zee consisted in early medieval times of vast peatlands and fresh water basins. Historical records begin to mention repeated heavy floods from the second half of the 12th century onwards (Buisman 1995). The impact of these storms breached the peat barrier and caused the Zuyder Zee to open — and with these events the waters of these areas changed name from *Almaere* (large united lakes) and *Salahon* (mouth of river IJssel) and *Nagela* (a local peatland river or creek between Urk and Schokland) to Zuyder Zee. Archaeological data prove that people settled peatlands of the region in the 11th and 12th century (historical sources even indicate the 10th century), just centuries before the heavy erosion would start. A handful of settlements were founded, the locations of which have been rediscovered in this work based on material archaeological finds (Chapter 4). Historical charters contribute to our understanding of these settlements, as they mention their names (*i.e.* Kuinre, Fenehuysen, Marcnesse, Nagele, Urk, Emmeloord) at specific moments in time (AD 1132, AD 1243, AD 1245; see Chapter 2). A combination of archaeological and historical analyses in Chapters 2 and 4 indicates the settlements to have been abandoned (and/or relocated) in the 13th and 14th century in response to peatland loss and increased exposure to Zuyder Zee storms and floods. The physical remains of these settlements today are high density archaeological object scatters, mainly consisting of pottery sherds, bricks and animal bones (Chapter 4). The archaeological and palaeogeographical findings based in the object scatters provide clear proof of habitation in the study area, but the results are somewhat static: it proves 'where' and 'when' people lived, not 'why' and 'how'.

Historical records and studies interpreting and synthesizing them (at national, regional and local levels), provide the necessary evidence to better understand the way of life in the region — especially when combined with geological and archaeological datasets. Reaching that archaeohistorical level was the aim of Chapter 6. The chapter synthesizes the proof that people settled in the region to reclaim the largely uninhabited peatlands of the Zuyder Zee region. In the 10th–11th century, the peatlands of the study area were a last remaining uncultivated and mainly uninhabited area amidst already more densely populated regions in the Netherlands. That they had not been cultivated thus far obviously was not without a reason: the wet and less fertile nature of the low-lying peatlands made them less suitable for agriculture and habitation, and hence not of interest to early medieval farmers and their patrons. When late medieval times began, the lands were nevertheless cleared and cultivated for food production (Van Bavel 2010; Chapter 6). Traces of the phases of reclamation that followed can still be seen on aerial photographs and LiDAR data, especially near the island of Urk and the former northeastern shore of the Zuyder Zee (Chapter 4).

The scale at which the cultivated peatlands were lost in subsequent centuries, may well have been exacer-

bated by the human reclamation and cultivation activities. The ditch networks laid over the lands to drain the peat topsoils caused large-scale oxidation and land subsidence, which made the lands vulnerable to the earlier mentioned floods. It means that the expansion of the Zuyder Zee was not simply natural disaster, but caused by a combination of natural and cultural factors: the storms can be regarded natural factors, but the consequential floods are mainly a cultural factor as the peatlands stood no change against the water due to human caused oxidation and compaction. I reckon, however, that the expansion of the Zuyder Zee in the Middle Ages would also have occurred without humans interfering with the peat lands in the study area, at a slower pace. The process of land erosion and accumulation of water / sea ingression had already started way before the 12th century (*Lacus Flevo*, *Almaere*; see Chapter 2 and Wiggers 1955; Ente *et al.* 1986; Ten Anscher 2012; Vos & De Vries 2013; Vos 2015). Despite the increased influence of the Zuyder Zee, only part of the inhabitants of the northeastern quarter fled. Others started living on small artificial mounds or natural heights (boulder clay outcrops, river dunes, levees) and /or constructed dikes to provide extra protection. The remains of these dikes and mounds have to some extent been excavated and documented, although little is preserved of them (Wiggers 1955; Van der Heide 1965; Hogestijn 1992; Van Popta & Aalbersberg 2016). By contrast, their locations are still clearly visible on aerial photographs and satellite images, as is proven in Chapter 4.

Chapter 6 also suggests that during the first phase of late medieval habitation (11th and 12th century), agriculture was the main focus of those that inhabited the region. After the establishment of new maritime transport routes (Rhine river – IJssel river – Zuyder Zee – Wadden Sea – North Sea – Skagerak – Sont – Baltic Sea) due to the opening up of the Zuyder Zee, settlements like Kuinre and Kampen (and Urk to some extent) profited from the increased possibilities to conduct trade over water, which brought them great power and prosperity. This change of focus was not just based on personal interests and opinions of the inhabitants, but depended greatly on the location characteristics of settlements — a suitable location (near river mouths, along trade routes, reachable hinterland) and subsoil (sand, boulder clay, clay) — economic focus and the competence of landlords. By the end of the 14th century the settlements of Kampen and Kuinre flourished whereas Urk and Schokland struggled and Nagele, Marcnesse and Fenehuysen had drowned (Chapter 6). By AD 1600, the Zuyder Zee (by then completely surrounded by dikes) had reached a more or less stable form, although loss of land would continue on *i.e.* the islands of Urk and Schokland for the following centuries (Chapter 2).

Conclusions

The most important findings of this PhD-research for late medieval (maritime) archaeology are:

- A density analysis of eroded archaeological remains (mainly pottery sherds, bricks and animal bones) provided the right information to pinpoint previously unknown settlement locations in the research area.
- The highly disturbed archaeological settlement remains are now rightfully characterized as settlement remains and their locations are marked and protected on relevant cultural heritage maps.
- Tentatively connecting historical settlement names (derived from maps and charters) to archaeological sites has become possible.
- The thesis made the step from studying (part of) the Zuyder Zee region from a mainly nautical point-of-view (*e.g.* studying the hundreds of wreck sites individually or together) towards a more integrative maritime archaeological theme, which also includes (terrestrial) settlement remains (being clusters, despite taphonomical processes).
- No single methodology exists on how to adopt the maritime cultural landscape concept, but when adopting it, it is crucial to study the 'cultural component'. For that, material and immaterial datasets (and approaches) are available, but it is important to understand that younger research periods (19th and 20th century) can provide much more cognitive (immaterial) data and therefore better suit the ambiguous nature of the concept.
- Spatial data resources and methodologies provide opportunities to improve the quality of archaeological datasets (*e.g.* the accuracy of wreck sites in the Zuyder Zee region) and to generate new data (*e.g.* identify settlement locations, identify parceling networks).
- It is highly recommended to further examine the late medieval archaeological left overs of the submerged settlements, both the material left in the fields of the Noordoostpolder and the material stored in the archaeological depot of the Province of Flevoland. Focus should be on providing more accurate dates for the moment of submergence of each settlement.
- Clear parallels can be drawn — and should be examined — between the (cultural) development of northeastern Zuyder Zee region and several other regions of study, both national (*e.g.* other quadrants of the Zuyder Zee, the North-Frisian terp region and the Drowned Lands of Saefthinge) and international (*e.g.* Nordstrand in Germany and De Polders in Belgium).

For that, similar methodologies/approaches as those in this research might prove to be of value.

The most important findings for the palaeogeographical and historical understanding of the Noordoostpolder region are:

- The information derived from analyzing the archaeological data from the research area (see above) fills gaps that previously could not be filled with sec geological and sec historical sources (including charters and maps) alone.
- Reclamation and cultivation of the peatlands in the research area started several centuries before marine erosion increased and the consequential name change from Almaere into Zuyder Zee.
- Coastal erosion occurred as a gradual and pulsated process, fed by the energy of major storms.
- Due to coastal erosion, several former (inland) settlements were left at the mercy of the waves (Nagele, Marcnesse, Fenehuysen) and/or were relocated further inland.
- The first phase of medieval habitation in the research area focused primarily on agriculture. After the Zuyder Zee commenced and established new maritime connections, the actors of the region changed scenes. While farming continued on remaining coastal land, new protagonists started living the lives of lords and merchants.
- The concept of the maritime cultural landscape is multidisciplinary and for that the combination of material and immaterial information also applies to less archaeological themes such as the 'human influence on the landscape', 'community spirit' and 'the emergence of water boards'.
- Clear parallels exist between the landscape (and perhaps also cultural) development of the region of study and that of the southeastern part of the Zuyder Zee region (*e.g. Arkemheen* polder, lakes near Elburg), whereas contrasting developments (both natural and cultural) with the western part of the Zuyder Zee region (Amsterdam, Hoorn, Enkhuizen) should be further explored.

Closing remarks and recommendations

The above overview of the formation of the Zuyder Zee and the late medieval development of the northeastern Zuyder Zee region proves the effectiveness of an interdisciplinary approach within the boundaries of the maritime cultural landscape concept. I can highly recommend (maritime) archaeological colleagues to access the datasets in a spatial environment (if possible) as it creates great overviews of the study region and enables direct comparisons between (very different) datasets. For that, I decided to construct Open Access datasets that contain as accurate and detailed as possible information on shipwrecks (SDF) and settlements (MSD). The above outcomes demonstrate that the combination of datasets from different disciplines contributes greatly to our understanding of the developments that shaped and altered the landscape and the human usage of the Zuyder Zee region between AD 1100 and 1400.

Completing this dissertation closes my PhD-research on the late medieval Zuyder Zee region, but I consider it only a first step in accessing and assessing the maritime cultural landscape of the Zuyder Zee in general. I have focused on the research period of AD 1100–1400 during which the Zuyder Zee was formed and the first historic inhabitants of the region arrived. Needless to say, there are many more periods that should carefully be studied. Especially the youngest period of the region (c. AD 1800–1932), for which detailed archaeological and historical datasets can lead to interesting results (*e.g.* Van Popta 2019c), is highly undervalued (particularly from an archaeological point-of-view), now and in the past, as it is often considered too young and of less importance. This is illustrated by the fact that many relatively young shipwrecks (19th century) were removed from the former seabed of the Zuyder Zee without proper documentation in the early years of maritime archaeological research in the Netherlands.

I would furthermore recommend to critically assess each dataset one opts to use, when further exploring the maritime cultural landscape(s) of the Zuyder Zee. The nature of these datasets can be very diverse and of different accuracies, as is proven by the study of shipwrecks from the entire Zuyder Zee region in Chapter 5. The results of Chapter 5 improved the accuracy of the shipwreck locations, but other primary information on these same wrecks (i.e. ship type, construction date, date of wreckage) is still incomplete and unverified. The same goes for the level of registration of archaeological objects that represent late medieval settlement locations (see Chapter 4). Especially pottery sherds stored in depots could and should be dated more accurately in order to provide more detailed dates for individual settlement locations. For this study, a general date of the pottery (accuracy on century-level) proved to be sufficient to determine the average age of submerged settlement locations. Upgrading the dating accuracy potentially could constrain their submergence dates.

Finally, the archaeological object clusters that represent late medieval settlement locations have been wrongfully interpreted in the past as 'waste' or 'noise', thereby neglecting their true value and importance for maritime research. As a secondary product of this study, these sites are now recorded, valued and added to new archaeological heritage maps of the Province of Flevoland and the Noordoostpolder municipality (Ten

Anscher *et al.* 2018; Velthuis *et al.* 2018). These steps were taken too late to prevent the complete destruction of Fenehuysen I. Even though no intact remains of the late medieval settlement are expected to be present on such locations, an archaeological field survey (a relatively simple, cheap and fast method) would have resulted in an accurate documentation of the object types, dates and distribution. I would therefore highly recommend to systematically examine the leftovers of the limited number of late medieval drowned settlements in the Noordoostpolder region, as they are all highly endangered by modern disturbances.

8 Epilogue

Past and present in a unique landscape

The Noordoostpolder with its planned infrastructure and modern appearance belongs to the youngest regions of the Netherlands. To some, it might be considered boring, flat and monotonous with a history that is hard to experience. Others might actually appreciate the openness of the landscape, the long strait roads, large farms and tall windmills. Nevertheless, past and present are undeniably intertwined in this region. The clayish and sandy soils of the arable fields are for example still filled with characteristic Zuyder Zee shells.[1] The excavation of shipwrecks in the middle of fields covered with onions, tulips or potatoes further illustrates the interface between past and present.

The oldest settlements of the region and both former islands (Schokland and Urk) still contain traces of the late medieval phase of the region. Schokland should be considered the only peat island that survived the origin of the Zuyder Zee and many centuries of marine influence. The main artificial living mounds on the island (14th century AD) are still present and the 19th-century outline of the island has been highlighted with trees (Chapter 3, Fig. 3.3). After the 20th century reclamation of the Zuyder Zee, settlements like Kuinre, Blankenham, Blokzijl and Vollenhove transformed from coastal towns into inland settlements and lost their maritime identity to a large extent, although certain characteristics like former harbours, reconstructed castles and the dikes can still be seen. The situation for Urk is rather different. Urk has been an island for a little more than a millennium, starting at the dawn of the Late Middle Ages and ending in AD 1939. The change of

Figure 8.1. Excavation of the 18th-century English merchantman 'Queen Anne' (NK 47-II) in the middle of arable crops in the Noordoostpolder (2018), c. 2 km west of settlement area 5 (see Fig. 6.4).

status from mainland to island (Late Middle Ages) and from island to mainland (20th century) was not part of a natural cycle but a process, from beginning to end caused by human interference. During the final centuries of the Zuyder Zee, Urk changed focus from agriculture to fishing, as the first proved unprofitable due to the lack of (fertile) land. Present-day Urk partially tries to hold on to this maritime identity: wandering around on Urk (indeed: **on** Urk, not **in** Urk) is, for those with a little imagination, the same as being on an island. The settlement still has some coastline on its western and southern edges, a harbor and an active fishing fleet. However, Urk as part of the mainland and surrounded by arable fields is way closer to its late medieval ancestry than many might expect.

The above given examples illustrate the uniqueness of the Noordoostpolder as a research area. Not because of single aspects: there are many more locations in the Netherlands (and across the world) that contain remains of drowned settlements (*e.g.* the famous Drowned Lands of Saefthinge in the Dutch province of Zeeland, other parts of Flevoland like the *Arkemheen* polder and the Wadden-Sea coastal region that stretches from the Netherlands to Denmark). There are also many more examples of (much older) reclaimed lands in the Netherlands (*e.g.* Beemster, Scheemer, Purmer, Haarlemmermeerpolder) and abroad (*e.g.* Blockland and Nordstrand in Germany and De Polders in Belgium). However, the combination of the dynamic history of the region (from land into sea into land), together with a high amount of cultural heritage and modern artificial appearance, makes the Noordoostpolder truly unique.

Endnote

1 Two typical Zuyder Zee shells are Mya arenaria (Soft shell-clam or Sand Gaper) and Cerastoderma glaucum (lagoon cockle).

References

Adams, J., 2002. Maritime archaeology. In: C. Orser (ed.). *Encyclopedia of historical archaeology*. London: Routledge, 228-230

Anschuetz, K.F., R.F. Wilshusen & C.L. Scheick, 2001. An Archaeology of Landscapes: Perspectives and Directions. *Journal of Archaeological Research* 9.2, 157-211.

Bannerman, N. & C. Jones, 1999. Fish-trap types: a component of the maritime cultural landscape. *The International Journal of Nautical Archaeology* 28.1, 70-84.

Baron, A.T.O., 2008. *Constructing the notion of the maritime cultural heritage in the Colombian territory: tools for the protection and conservation of fresh and salt aquatic surroundings.* New York: United Nations.

Bartels, M., 2011. *Steden in scherven. Vondsten uit beerputten in Deventer, Dordrecht, Nijmegen en Tiel (1250-1900).* Zwolle: Spa Uitgevers B.V.

Bartels, M.H. (ed.), 2016a. *Dwars door de Dijk. Archeologie en geschiedenis van de Westfriese Omringdijk tussen Hoorn en Enkhuizen*. Hoorn: Stichting Archeologie West-Friesland.

Bartels, M.H., 2016b. Hoofdstuk 9. Archeologisch onderzoek naar zeedijken. In: M.H. Bartels (ed.). *Dwars door de dijk. Archeologie en geschiedenis van de Westfriese Omringdijk tussen Hoorn en Enkhuizen*. Hoorn: Stichting Archeologie West-Friesland, 195-221.

Bass, G.F., 1966. *Archaeology under water.* London: Praeger.

Bass, G.F., 2013. The development of maritime archaeology. In: A. Catsambis, B. Ford & D.L. Hamilton (eds). *The Oxford Handbook of Maritime Archaeology*. Oxford: Oxford University Press, 3-22.

Bass, G.F., P. Throckmorton, J. Du Plat Taylor, J.B. Hennessy, A.R. Shulman & H. Buchholz, 1961. Cape Gelidonya: A Bronze Age Shipwreck. *Transactions of the American Philosophical Society* 57.8, 1-177.

Bass, G.F. & F.H. van Doornick, 1982. *Yassi Ada: a Seventh-Century Byzantine Shipwreck*. College Station: Texas A & M University Press.

Baxter, M.J., C.C. Beardah & R.V.S. Wright, 1997. Some Archaeological Applications of Kernel Density Estimates. *Journal of Archaeological Science* 24.4, 347-354.

Behre, K-E., 1992. The history of rye cultivation in Europe. *Vegetation History and Archaeobotany*, 1.3, 141-156.

Benders, J.F., 1995. De demografische ontwikkeling van Overijssel 1369-ca. 1600: een kritische reactie. *Overijsselse Historische Bijdragen* 110, 31-43.

Berendsen, H.J.A., 1997. *De vorming van het land. Inleiding in de geologie en geomorfologie. Fysische geografie van Nederland* (second edition). Assen: Koninklijke Van Gorcum.

Berendsen, H.J.A., K.M. Cohen & E. Stouthamer, 2007. The use of GIS in reconstructing the Holocene palaeogeography of the Rhine–Meuse delta, The Netherlands. *International Journal of Geographical Information Science* 21.5, 589-602.

Blok, K., 2014. De verdwenen Kogge van Modderman. Een kogge-achtig scheepswrak in de bodem van Flevoland (= Grondsporen 32). Groningen: Groninger Instituut voor Archeologie.

Bohncke, S.J.P., 1993. Lateglacial environmental changes in the Netherlands: spatial and temporal patterns. *Quaternary Science Reviews* 12, 707-718.

Borger, G.J., 1975. *De Veenhoop. Een historisch-geografisch onderzoek naar het verdwijnen van het veendek in een deel van West-Friesland.* Thesis (PhD): University of Amsterdam.

Borger, G.J. & S.J. Kluiving, 2017. The Wet Heart of the Netherlands. In: S.J. Kluiving, L. Kootker & R. Hermans (eds). *Interdisciplinarity between humanities and science. A festschrift in honour of prof. dr. Henk Kars.* Leiden: Side Stone Press, 37-54.

Bos, J.M., 1988. *Landinrichting en archeologie: het bodemarchief van Waterland* (= NAR 6). Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek.

Bos, I.J., 2010. *Distal delta-plain successions, Architecture and lithofacies of organics and lake fills in the Holocene Rhine-Meuse delta plain, The Netherlands.* Thesis (PhD): University of Utrecht.

Bosch, J.H.A., P. Cleveringa & T. Meijer, 2000. The Eemian stage in the Netherlands: history, character and new research. *Netherlands Journal of Geosciences* 79, 135-145.

Bosscher, Ph.M., G.D. van der Heide, D. van der Vlis & U.E.E. Vroom, 1973. Bussum: De Boer.

Bouwmeester, H.M.P., 2014. Bouwen in de stad: Het ontstaan en de vroegste ontwikkeling van het Nederlandse stadhuis. In: A.G. Lange, E.M. Theunissen, J.H.C. Deeben, J. van Doesburg, J. Bouwmeester & T. de Groot (eds). *Huisplattegronden in Nederland. Archeologische sporen van het huis.* Eelde/Amersfoort: Barkhuis/Rijksdienst voor het Cultureel Erfgoed, 421-464.

Brand, H. & E. Knol (eds), 2010. *Koggen, Kooplieden en Kantoren. De Hanze, een praktisch netwerk.* Hilversum: Verloren.

Brill, W.G. (ed.), 1983. *Rijmkroniek van Melis Stoke.* Utrecht: HES Uitgevers.

Buhlman, M., 2012. *Hildrigim, Bruder des Heiligen Liudger. Beiträge zur Geschichte Werdens* [http://www.michael-buhlmann.de/Geschichte], accessed on 20 January 2017.

Buisman, J., 1995. *Duizend jaar weer, wind en water in de Lage Landen. Deel 1: tot 1300.* Franeker: Van Wijnen.

Buisman, J., 1996. *Duizend jaar weer, wind en water in de Lage Landen. Deel 2: 1300 tot 1450.* Franeker: Van Wijnen.

Buitelaar, A.L.P. & G.J. Borger, 2015. Landscape development and settlement history of the Vecht area (722–1122). *Netherlands Journal of Geoscience* 94, 375-385.

Burgers, J.W.J., 2004. *Rijmkroniek van Holland (366-1305) door een anonieme auteur en Melis Stoke.* Den Haag: Instituut voor Nederlandse Geschiedenis.

Busschers, F.S., C. Kasse, R.T. van Balen, J. Vandenberghe, K.M. Cohen, H.J.T. Weerts, J. Wallinga, C. Johns, P. Cleveringa & F.P.M. Bunnik, 2007. Late Pleistocene evolution of the Rhine-Meuse system in the southern North Sea basin: imprints of climate change, sea-level oscillation and glacio-isostacy. *Quaternary Science Reviews* 26, 3216-3248.

Busschers, F.S., C. Kasse, R.T. van Balen, J. Vandenberghe, K.M. Cohen, H.J.T. Weerts, J. Wallinga, C. Johns: Cleveringa & F.P.M. Bunnik, 2008. Response of the Rhine-Meuse fluvial system to Saalian ice-sheet dynamics. *Boreas* 37, 377-398.

Caporaso, A., 2017. A Dynamic Processual Maritime Archaeological Landscape Formation Model. In: A. Caporaso (ed.). *Formation Processes of Maritime Archaeological Landscapes.* New York: Springer International Publishing, 7-30.

Ceraudo, G., 2013. Aerial Photography in Archaeology. In: C. Corsi, B. Slapšak & F. Vermeulen (eds). *Good Practice in Archaeological Diagnostics*. New York City: Springer International Publishing, 11-30.

Cleveringa, T. Meijer, R.J.W. van Leeuwen, H. de Wolf, R. Pouwer, T. Lissenberg & A.W. Burger, 2000. The Eemian stratotype locality at Amersfoort in the central Netherlands: a re-evaluation of old and new data. *Netherlands Journal of Geosciences* 79.2/3, 197-216.

Cohen, K.M., E. Stouthamer, W.Z. Hoek, H.J.A. Berendsen & H.F.J. Kempen, 2009. *Zand in Banen – Zanddieptekaarten van het Rivierengebied en het IJsseldal in de provincies Gelderland en Overijssel.* Arnhem: Provincie Gelderland.

Cohen, K.M., E. Stouthamer, H.J. Pierik & A.H. Geurts, 2012. *Rhine-Meuse Delta Studies' Digital Basemap for Delta Evolution and Palaeogeography.* Utrecht: Utrecht University.

Cohen, K.M., L. Gibbard & H.J.T. Weerts, 2014. North Sea palaeogeographical reconstructions for the last 1 Ma. *Netherlands Journal of Geosciences* 93, 7-29.

Cohen, K.M., 2017. *Beschrijving gebiedsindeling en legenda kaartlaag T0123: Begraven Hoofdlandschappen en Landschapszones* (Deltares report 1210450-0014). Utrecht: Deltares.

Cowley, D. & L. Ferguson, 2010. Historic aerial photographs for archaeology and heritage management. In: M. Forte, S. Campana & C. Liuzza (eds). *Space, Time, Place: Third International Conference on Remote Sensing in Archaeology, 17th-21st August 2009, Tiruchirappalli, Tamil Nadu, India* (=British Archaeological Reports International Series 2118). Oxford: Archaeopress, 97-104.

Crumlin-Pedersen, P.O., 1978. *Søvejen til Roskilde, Historisk Årbok fra Roskilde Amt.* Roskilde: Vikingeskibshallen.

Crumlin-Pedersen, P.O., 2000. To be or not to be a cog: the Bremen Cog in perspective. *International Journal of Nautical Archaeology* 29.2, 230-246.

Davis, O., 2008. *Processing and Working with LiDAR Data in ArcGIS: A Practical Guide for Archaeologists. Aberystwyth:* The Royal Commission on the Ancient and Historical Monuments of Wales.

De Boer, C. & J. van Doesburg, 2001. *Burchten op de bodem van de zee: Aanvullend Archeologisch Onderzoek (AAO) naar de burchten van Kuinre* (= ROB Rapportage Archeologische Monumentenzorg 91). Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek.

De Boer, C. & A.J. Geurts, 2002. *Oude burchten in het nieuwe land. De middeleeuwse kastelen van Kuinre in de Noordoostpolder.* Lelystad: Stichting Uitgeverij de Twaalfde Provincie.

De Bont, C., 2008. *Vergeten land. Ontginning, bewoning en waterbeheer in de westnederlandse veengebieden (800-1350).* Thesis (PhD): Wageningen University.

De Gans, W. & F.P.M. Bunnik, 2005. Resten van stormvloeden rond de voormalige Zuiderzee. *Grondboor and Hamer* 5/6, 124-127.

De Haas, T., H.J. Pierik, A. van der Spek, K.M. Cohen, B. van Maanen & M. Kleinhans, 2017. Holocene evolution of tidal systems in The Netherlands: Effects of rivers, coastal boundary conditions, eco-engineering species, inherited relief and human interference. *Earth-Science Reviews* 177, 139-163.

De Lange, G., J. Gunnink, Y. Houthuessen & R. Muntjewerff, 2012. *Bodemdalingskaart Flevoland.* Houten: Grontmij Nederland B.V.

De Langen, G.J., 1992. *Middeleeuws Friesland. De economische ontwikkeling van het gewest Oostergo in de vroege en volle middeleeuwen.* Thesis (PhD): University of Amsterdam.

Delgado, J.P. & M. Staniforth, 2009. Underwater archaeology. In: D.L. Hardesty (ed.). *Archaeology. Encyclopedia of Life Support Systems. Volume 1*. Oxford: EOLSS Publications, 227-248.

De Mulder, E.F.J., & J.H.A. Bosch, 1982. Holocene stratigraphy, radiocarbon datings and paleogeography of central and northern North-Holland (The Netherlands). *Mededelingen Rijks Geologische Dienst* 36.3, 111-160.

De Mulder, E.F.J., M.C. Geluk, I. Ritsema, W.E. Westerhoff & T.E. Wong, 2003. *De ondergrond van Nederland.* Groningen/ Houten: Wolters-Noordhoff bv.

De Vos van Steenwijk, A.N., 1979. De muntschat van Kirial. *Overijsselse Historische Bijdragen. Verslagen en mededelingen VORG* 94, 5-10.

De Vries, C., 1962. *Geschiedenis van het eiland Urk*. Kampen: Zalsman.

De Vries, J., 1976. *Economy of Europe in an Age of Crisis.* Cambridge: Cambridge University Press.

Dirkx, G.H.P., P.W.F.M. Hommel & J.A.J. Vervloet, 1996. *Kampereiland: een wereld op de grens van zout en zoet.* Utrecht: Matrijs.

Ducke, J., 2015. Spatial Cluster Detection in Archaeology: Current Theory and Practice. In: J.A. Barcelo and I. Bogdanovic (eds).

Mathematics and Archaeology. Boca Raton: CRC Press, 352-368.

Duncan, B.G., 2006. *The maritime Archaeology and Maritime Cultural Landscapes of Queenscliffe: A Nineteenth Century Australian Coastal Community.* Thesis (PhD): James Cook University.

Duncan, B.G. & M. Gibbs, 2015. *Please God Send Me a Wreck. Responses to Shipwreck in a 19th Century Australian Community.* New York: Springer.

Edelman, T., 1974. *Bijdrage tot de historische geografie van de Nederlandse kuststreek.* 's Gravenhage: Directie waterhuishouding en waterbeweging.

Ente, P.J., 1973. De IJsseldelta. *Kamper Almanak* 1973-1974, 137-164.

Ente, P.J., J.C.F.M. Haans & M. Knibbe, 1971. *De Bodem van Overijssel, de Noordoostpolder en Oostelijk Flevoland. Toelichting bij blad 3 van de bodemkaart van Nederland schaal 1: 200,000.* Wageningen: Stiboka.

Ente, P.J., J. Koning & R. Koopstra, 1986. Flevobericht nr. 258. *De bodem van Oostelijk Flevoland.* Lelystad: Rijksdienst voor de IJsselmeerpolders.

Erlandson, J.M., 2001. The Archaeology of Aquatic Adaptions: Paradigms for a New Millennium. *Journal of Archaeological Research* 9.4, 287-350.

Ettema, W. 2005. Boeren op het Veen. Een ecologisch-historische benadering (1000-1500). *Holland* 1, 239-258.

Fehrmann, C.N., 1952. Over de opkomst van Kampen. *Kamper Almanak* 1952, 194-243.

Firth, A., 1995. *Three Facets of Maritime Archaeology: society, landscape and critique* [http://splash.wessexarch.co.uk/2010/04/14/three-facets-ofmaritimearchaeology], accessed on 20 January 2018.

Flatman, J., 2003. Cultural biographies, cognitive landscapes and dirty old bits of boat: 'theory' in maritime archaeology. *The International Journal of Nautical Archaeology* 32, 143-157.

Ford, B., 2011. Introduction. In: B. Ford (ed.). *The Archaeology of Maritime Landscapes.* New York: Springer, 1-10.

Franke, S., 1932. *Sagen en legenden rond de Zuiderzee met illustraties van A.J. van 't Hoff.* Zutphen: Uitgeverij Thieme.

Frankot, E., 2012. *'Of Laws of Ships and Shipmen'. Medieval Maritime Law and its Practice in Urban Northern Europe.* Edinburgh: Edinburgh University Press.

Gaastra, F.M., 2009. *Geschiedenis van de VOC. Opkomst, bloei en ondergang.* Zutphen: Walburg Pers.

Gawronski, J., A.F.L. van Holk & J. Schokkenbroek (eds), 2017. *Ships and Maritime Landscapes. Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology, Amsterdam 2012.* Eelde: Barkhuis.

Gerrets, D.A., 2010. *Op de grens van land en water. Dynamiek van landschap en samenleving in Frisia gedurende de Romeinse Tijd en de Volksverhuizingstijd* (=Groningen Archaeological Studies 13). Thesis (PhD): University of Groningen.

Geurts, A.J., 1991. *Schokland: de historie van een weerbarstig eiland.* Zutphen: Walburg Pers.

Geurts, A.J., 2005. Urk. *De geschiedenis van een eiland.* Lelystad: Nieuw Land Erfgoedcentrum.

Gibbins, D., 1990. Analytical approaches in maritime archaeology: a Mediterranean perspective. *Antiquity* 64 (243), 376-389.

Gibbins, D. & J. Adams, 2001. Shipwrecks and maritime archaeology. *World Archaeology* 32.3, 279-291.

Gildemacher, K., 2001. West Frisian Place-Names. In: H.H. Munske (ed.). *Handbook of Frisian Studies.* Tübingen: Max Niemeyer Verlag, 155-169.

Gosden, C. & L. Head, 1994. Landscape – A Usefully Ambiguous Concept. *Archaeology in Oceania* 29.3, 113-116.

Gotjé, W., 1993. *De Holocene laagveenontwikkeling in de randzone van de Nederlandse kustvlakte (Noordoostpolder).* Thesis (PhD): University of Amsterdam.

Gottschalk, M.K.E., 1971. *Stormvloeden en rivieroverstromingen in Nederland. Deel 1: De periode vóór 1400.* Assen: Koninklijke Van Gorcum bv.

Greverus, I., 1999. Island as Borderland: Such as Rügen and Usedom. In: M. Rösler & T. Wendl (eds). *Frontiers and Borderlands: Anthropological Perspectives.* Frankfurt am Main: Peter Lang Publishing, 59-74.

Groothedde, M., 2010. De 'nieuwe' IJssel. Wat vertellen de historische bronnen en archeologische vondsten. *Bijdragen en Mededelingen Gelre* 101, 7-26.

Groothoff, C.C., 2008. Onderzoek naar het verdwenen kerkdorp Nagele. *Westerheem* 57.6, 403-408.

Gumbert-Hepp, M., J.P. Gumbert & J.W.J. Burgers, 2007. *De Annalen van Egmond. De Annales Egmundenses, Annales Xantenses, het Egmondse leven van Thomas Becket en het Chronicon.* Hilversum: Verloren.

Haalmeijer, H. & D. Vuik, 2006. *Aken, tjalken en kraken. Zeilschepen van de Lage Landen – de binnenvaart.* Alkmaar: De Alk.

Hagoort, W.J., 2006. *De Gelderse zeepolder Arkemheen. Namen van bouw-, hooi- en weilanden, boerderijen, beken en wegen. Gemeenten Nijkerk en Putten (806-2002).* Utrecht: Walburg Pers.

Havard, H., 1874. *La Hollande pittoresque: voyages aux villes mortes du Zuiderzée.* Paris: E. Plon et Cie.

Haze, D., 1991. *Nijverheid, gilden en kleinhandel in het middeleeuwse Kampen.* Thesis (MA): University of Utrecht.

Henstra, D.J., 2010a. Het veengebied aan de overzijde van de Nagele. *It Beaken* 72.1/2, 7-18.

Henstra, D.J., 2010b. *Fon Jelde: opstellen van D.J. Henstra over middeleeuws Frisia.* Groningen: Barkhuis.

Hocker, F.M., 2011. *Vasa. A Swedish Warship.* Stockholm: Medstroms Bokforlag.

Hoek, W.Z., 2000. Abiotic landscape and vegetation patterns in the Netherlands during the Weichselian Late Glacial. *Netherlands Journal of Geosciences* 79.4, 497-509.

Hogeman, J., 1881. Een oud Overijselsch kerkdorp, geheel kerspel en stichtsleen Nagele genoemd, weggespoeld en verzwolgen door de Zuiderzee, met eenige historische en geografische

opmerkingen. *Overijsselse Historische Bijdragen. Verslagen en mededelingen VORG* 12, 1-29.

Hogestijn, J.W.H., 1992. Schokland in de late middeleeuwen. Schokland Revisited. *Cultuur Historisch Jaarboek voor Flevoland* 2, 95-112.

Hogestijn, J.W.H., M.H. Bartels & F.J. Laarman, 1994. Archeologisch onderzoek van twee terpschaduwen op kavel J77 (gemeente Noordoostpolder). Ruimte voor verandering. *Cultuurhistorisch Jaarboek voor Flevoland* 4, 77-96.

Hoppenbrouwers, P. & L. Noordegraaf, 1986. *Agrarische geschiedenis van Nederland: van prehistorie tot heden.* 's Gravenhage: Staatsuitgeverij.

Hoppenbrouwers, P., 1997. Agricultural production and technology in the Netherlands, c. 1000-1500. In: G. Astill & J. Langdon (eds). *Medieval farming and technology. The impact of Agricultural Change in Northwest Europe.* Leiden: Koninklijke Brill, 89-114.

Ingold, T. 1993. The Temporality of Landscape. *World Archaeology* 25.2, 152-74.

Israel, J.I., 1989. *Dutch Primacy in World Trade, 1585–1740.* Oxford: Oxford University Press.

Jansma, E., R.J. van Lanen & H.J. Pierik, 2017. Travelling through a river delta: a landscape-archaeological reconstruction of river development and long-distance connections in the Netherlands during the first millennium. *Medieval Settlement Research* 32, 35-39.

Jager, A., 2015. *Middeleeuws Kampen. De ruimtelijke en economische structuur van de stad aan de hand van archeologische, bouwhistorische, numismatische en historische bronnen.* Zwolle: Spa Uitgevers.

Janse, A., 1993. *Grenzen aan de macht. De Friese oorlog van de graven van Holland omstreeks 1400. 's* Gravenhage: Stichting Hollandse Historische reeks.

Jasinski, M.E., 1999. *Which way now? Maritime archaeology and underwater heritage into the 21st century.* Unpublished paper presented at the world archaeological congress 4, maritime archaeology: challenges for the new millennium. Cape Town, South Africa.

Jongmans, A.G., M.W. van den Berg, M.W.P. Sonneveld, G.J.W.C. Peek & R.M. van den Berg van Saparoea, 2013. *Landschappen van Nederland. Geologie, bodem en landgebruik.* Wageningen: Wageningen Academic Publishers.

Kamman, R. 1985. *Geschiedenis van Kuinre en omgeving.* Hoogersmilde: Grafiplan.

Kasse, C., 2002. Sandy aeolian deposits and environments and their relation to climate during the Last Glacial Maximum and Lateglacial in northwest and central Europe. *Progress in Physical Geography* 26.4, 507-532.

Kerkhoven, A.A., 2003. *Rogge, zout en bodemschatten. De archeologie en het cultuurlandschap van Urk in de Late- en Post-Middeleeuwen.* Thesis (MA): University of Amsterdam.

Klappe, B., 1992. Verging Nagele in 1308? *Het Schokker Erf* 21, 31-35.

Kluiving, S.J., M. Rappol & D. van der Wateren, 1991. Till stratigraphy and ice movements in eastern Overijssel, The Netherlands. *Boreas* 20.3, 193-205.

Kok, M.S.M., 2008. *The homecoming of religious practice: an analysis of offering sites in the wet lowlying parts of the landscape in the Oer-IJ area (2500 BC – AD 450).* Thesis (PhD): University of Amsterdam.

Kolen, J. 2005. *De biografie van het landschap. Drie essays over landschap, geschiedenis en erfgoed.* Thesis (PhD). Vrije Universiteit Amsterdam.

Kolman, C.J., 1990. De verstedelijking van Kampen in de Late Middeleeuwen. *Kamper Almanak* 1990, 145-177.

Kolman, C.J., 1997. De houtconstructies van het laat-middeleeuwse Kamper woonhuis, een verkenning van de bouwterminologie in de archivalia. In: M. Barwasser & M. Smit (eds). *Acht eeuwen tussen twee stegen. Archeologisch, historisch en bouwhistorisch onderzoek in Kampen.* Kampen: Stichting Archeologie IJssel/Vechtstreek, 53-66.

Kooistra, M.J., L.I. Kooistra, P. van Rijn & U. Sass-Klaassen, 2006. Woodlands of the past. The excavation of wetland woods at Zwolle-Stadshagen (the Netherlands): Reconstruction of the wetland wood in its environmental context. *Netherlands Journal of Geosciences* 85.1, 37-60.

Koomen, A.J.M. & G.J. Maas, 2004. *Geomorfologische Kaart Nederland (GKN); Achtergronddocument bij het landsdekkende digitale bestand* (= Alterra-rapport 1039). Wageningen: Alterra.

Kosian, M.C., R.J. van Lanen & H.J.T. Weerts, 2016. *Een nieuwe kaart van Nederland in 1575.* Amersfoort: Rijksdienst voor het Cultureel Erfgoed.

Kossmann-Putto, J.A., 2009. Stadsbestuur van Kampen in de Middeleeuwen. In: J.A. Kossmann-Putto (ed.). *Over middeleeuwse geschiedenis. Elf opstellen.* Utrecht: Matrijs, 57-73

Kossmann-Putto, J.A. & F.J. Kossmann, 2009. Kampen en Essen. In: J.A. Kossmann-Putto (ed.). *Over middeleeuwse geschiedenis. Elf opstellen.* Utrecht: Matrijs, 15-56.

Koster, K., J. Stafleu & K.M. Cohen, 2017. Generic 3D interpolation of Holocene base-level rise and provision of accommodation space, developed for the Netherlands coastal plain and infilled palaeovalleys. *Basin research* 29.6, 775-797.

Kreek, J.C.G., in press. *Het ontstaan en vroege ontwikkeling van Kampen: De topografie van de binnenstad opnieuw bekeken.* Tijdschrift Historische Geografie.

Kuhn, T.S., 1970. *The structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Kuipers, J.J.B. & R.M. van Dierendonck, 2004. *Sluimerend in slik. Verdronken dorpen en verdronken land in zuidwest Nederland.* Middelburg: Uitgeverij Den Boer/De Ruiter.

Lahn, W., 1992. *Die Kogge von Bremen.* Bremerhaven: Deutsches Schiffahrtsmuseum.

Lemmens, M.J.P.M., 2011. *Geo-information. Technologies, Applications and the Environment.* Dordrecht: Springer.

Lenferink, H.J.J., Th. M. van Mierlo, E.F.L.M. van de Werdt, J. Grooten, F. van der Pol & J. van Gelderen, 1993. *Geschiedenis*

van Kampen. Deel 1. "maer het is hier te Campen". Kampen: IJsselacademie.

Lenselink, G. & R. Koopstra, 1994. Ontwikkeling in het Zuiderzeegebied; van Meer Flevo, via de Almere-lagune, tot Zuiderzee. In: M. Rappol & C.M. Soonius (eds). *In de Bodem van Noord-Holland.* Amsterdam: Lingua Terrae, 129-140.

Ligtendag, W.A., 1995. *De Wolden en het water. De landschaps-en waterstaatsontwikkeling in het lage land ten oosten van de stad Groningen vanaf de volle middeleeuwen tot ca. 1870.* Thesis (PhD): University of Amsterdam.

Lim, K., P. Treitz, M. Wulder, B. St-Onge & M. Flood, 2003. LiDAR remote sensing of forest structure. *Progress in Physical Geography* 27.1, 88-106.

Löfgren, O., 1981. Människan i landskapet - landskapet i människan. In: L. Honko & O. Löfgren (eds). *Tradition och miljö: et kulturekologiskt perspektiv.* Lund: LiberLäromedel, 235-261.

Looper, B., 2010. De Nederlandse Hanzesteden: scharnieren in de Europese economie 1250-1550. In: H. Brand & E. Knol (eds). *Koggen, Kooplieden en Kantoren. De Hanze, een praktisch netwerk.* Hilversum: Verloren, 108-123.

Lourens, P. & J. Lucassen, 1997. *Inwonersaantallen van Nederlandse steden ca. 1300 – 1800.* Amsterdam: Amsterdam University Press.

Maarleveld, T.J., 1998. Archaeological heritage management in Dutch waters: exploratory studies. *Scheepsarcheologie* V. Lelystad: ROB/NISA.

Makaske, B., G.J. Maas & D.G. van Smeerdijk, 2008. The age and origin of the Gelderse IJssel. *Netherlands Journal of Geosciences* 87.4, 323-337.

McGrail, S., 1984. Maritime archaeology. Present and future. In: S. McGrail (ed.). *Aspects of maritime archaeology and ethnography.* London: National Maritime Museum, 11-40.

Meide, C.T., 2013. *The Development of Maritime Archaeology as a Discipline and the Evolving Use of Theory by Maritime Archaeologists.* Unpublished position Paper 2.

Menke, U., E. van de Laar & G. Lenselink, 1998. *Flevobericht nr. 415. De geologie en bodem van Zuidelijk Flevoland.* Lelystad: Rijkswaterstaat Directie IJsselmeergebied.

Meyer, H., 2016. *De staat van de delta. Waterwerken, stadsontwikkeling en natievorming in Nederland.* Nijmegen: Van Tilt.

Miller, H.M.L., 2002. Comparing Landscapes of Transportation: Riverine-Oriented and Land-Oriented Systems in the Indus Civilization and the Mughal Empire. In: E.C. Robertson, J.D. Seibert, D.C. Fernandez & M.U. Zender (eds). *Space and Spatial Analysis in Archaeology*. Calgary: University of Calgary Press, 281–292.

Modderman, P.J.R., 1945. *Over de wording en beteekenis van het Zuiderzeegebied.* Thesis (PhD): University of Groningen.

Moerman, H.J., 1956. *Nederlandse plaatsnamen. Een overzicht.* Leiden: E.J. Brill.

Mol., J.A. & K. van Vliet, 1998. *De oudste oorkonden van het Sint-Odulfusklooster van Staveren. Jaarboek voor Middeleeuwse Geschiedenis 1*, 73-134.

Mol, J.A., 2011. De middeleeuwse veenontginningen in Noordwest-Overijssel en Zuid-Friesland: datering en fasering. *Jaarboek voor Middeleeuwse Geschiedenis* 14, 46-90.

Mooijweer, J., 1992. De "status" van Kuinre, Blokzijl en Zwartsluis gedurende het Ancien Régime. *Overijsselse historische bijdragen: verslagen en mededelingen van de Vereeniging tot Beoefening van Overijsselsch Regt en Geschiedenis* 107, 115-144.

Mostert, M., 1999. *Bonifatius bij Dokkum vermoord*. Hilversum: Uitgeverij Verloren.

Muckelroy, K., 1978. *Maritime Archaeology.* Cambridge: Cambridge University Press.

Muis, L.A. & S. van den Brenk, 2015. *Onderzoek naar scheepswrakken in Flevoland door middel van remote sensing* (= Periplus Archeomare rapport 14A032-01). Lelystad: Nieuw Land Erfgoedcentrum.

Murrieta-Flores P., 2014. Developing computational approaches for the study of movement: assessing the role of visibility and landscape markers in terrestrial navigation during Iberian Late Prehistory. In: S. Polla & P. Verhagen (eds). *Computational Approaches to the Study of Movement in Archaeology. Theory, Practice and Interpretation of Factors and Effects of Long Term Landscape Formation and Transformation.* Berlin/Boston: De Gruyter, 99-132.

Nicolay, J.A.W. (ed.), 2010. *Terpbewoning in oostelijk Friesland. Twee opgravingen in het voormalige kweldergebied van Oostergo.* Eelde: Barkhuis.

Nieuwhof, A. (ed.), 2016a. *Van Wierhuizen tot Achlum. Honderd jaar archeologisch onderzoek in terpen en wierden.* Groningen: Vereniging voor Terpenonderzoek.

Nieuwhof, A., 2016b. De lege vierde eeuw. In: A. Nieuwhof (ed.). *Van Wierhuizen tot Achlum. Honderd jaar archeologisch onderzoek in terpen en wierden.* Groningen: Vereniging voor Terpenonderzoek, 129-140.

Nieuwhof, A., J.A.W. Nicolay & J. Wiersma, 2018 (ed.). *De geschiedenis van terpen- en wierdenland. Een verhaal in ontwikkeling.* Groningen: Vereniging voor Terpenonderzoek.

Oost, A.P., 1995. *Dynamics and sedimentary development of the Dutch Wadden Sea with emphasis on the Frisian Inlet; a study of the barrier islands, ebb-tidal deltas and drainage basins* (= Geologica Ultraiectina 126). Thesis (PhD): University of Utrecht.

Parker, A.J., 1999. A maritime cultural landscape: the port of Bristol in the Middle Ages. *International Journal of Nautical Archaeology* 28.4, 323-342.

Peeters, J.H.M., 2007. *Hoge Vaart-A27 in context: towards a model of Mesolithic-Neolithic land use dynamics as a framework for archaeological heritage management.* Thesis (PhD): University of Amsterdam.

Peeters, J., F.S. Busschers & E. Stouthamer, 2015. Fluvial evolution of the Rhine during the last interglacial-glacial cycle in the southern North Sea basin: A review and look forward. *Quaternary International* 357, 176-188.

Peeters, J., F.S. Busschers, E. Stouthamer, J.H.A. Bosch, M.W. van den Berg, J. Wallinga, A.J. Versendaal, F.P.M. Bunnik & H. Middelkoop, 2016. Sedimentary architecture and chronostratigraphy of a late Quaternary incised-valley fill: A case study of the late Middle and Late Pleistocene Rhine system in the Netherlands. *Quaternary Science Reviews* 131, 211-236.

Petrejus, E.W., 1971, *Oude zeilschepen en hun modellen. Binnenschepen, jachten en vissersschepen.* Bussum: Unieboek.

Pierik, H.J., K.M. Cohen, P.C. Vos, A.J.F. van der Spek & E. Stouthamer, 2017. Late Holocene coastal-plain evolution of the Netherlands: the role of natural preconditions in human-induced sea ingressions. *Proceedings of the Geologists' Association* 128.2, 180-197.

Pierik, H.J., 2017. *Past human-landscape interactions in the Netherlands: Reconstructions from sand belt to coastal-delta plain for the first millennium AD.* Thesis (PhD): University of Utrecht.

Pol, A., 2015. Het 'eerste leven' van Nagele. *Cultuurhistorisch Tijdschrift Rondom Schokland* 55.4, 37-56.

Pollard, S., 1997. Marginal Europe: the contribution of marginal lands since the Middle Ages. Oxford: Oxford University Press.

Pollard, A.J., 2008. The maritime landscape of Kilwa Kisiwani and its region, Tanzania, 11th to 15th century AD. *Journal of Anthropological Archaeology* 27.3, 265–280.

Pons, L.J. & A.J. Wiggers, 1959/1960. *De holocene wordingsgeschiedenis van Noord-Holland en het Zuiderzeegebied.* Wageningen: De Stichting voor Bodemkartering.

Pons, L.J., S. Jelgersma, A.J. Wiggers & J.D. de Jong, 1963. Evolution of The Netherlands coastal area during the Holocene. In: J. de Jong (ed.). *Verhandelingen van Het KNGMG Transactions of the Jubilee Convention – Part Two.* 's Gravenhage: Koninklijk Nederlands Geologisch Mijnbouwkundig Genootschap, 197-207.

Raemaekers, D.C.M., 2010. *Schokkerhaven-E170 (gemeente Noordoostpolder). Vondsten AWN-veldverkenningen 2002-2009 en ROB-opgraving 1988* (= Grondsporen 9). Groningen: Groninger Instituut voor Archeologie.

Reeves, D.M., 1936. Aerial Photography and Archaeology. *American Antiquity* 2.2, 102-107.

Reinders, H.R., 1981. *Modderwerk: het uitdiepen van de haven van Amsterdam in de tweede helft van de zeventiende eeuw.* Lelystad: RWS/RIJP.

Reinsma, R., 2009. *Namen op de kaart. Oorsprong van geografische namen in Nederland en Vlaanderen.* Amsterdam/ Antwerp: Atlas.

Reh, W., C. Steenbergen & D. Aten, 2005. Zee van land. De droogmakerij als atlas van de Hollandse landschapsarchitectuur. Wormer: Noord-Holland.

Rensink, E., H.J.T. Weerts, M. Kosian, H. Feiken & B.I. Smit, 2016. *Archeologische Landschappenkaart van Nederland, Versie 2.6. A*mersfoort: Rijksdienst voor het Cultureel Erfgoed.

Rienks, K.A. & G.L. Walther, 1954. *Binnendiken en slieperdiken in Fryslân.* Bolsward: Osinga.

Robijn, V., 2005. Brothers in life and death. Religious and social aspects of the Kampen 'Schepenmemorie' (1311–c.1580). In: A.J. Brand (ed.). *Trade, diplomacy and cultural exchange. Continuity and change in the North Sea area and the Baltic c.1350–1750.* Utrecht: Verloren, 169-183.

Roemeling, O.D.J., 2013. *Heiligen en Heren. Studies over het parochiewezen in het Noorden van Nederland vóór 1600.* Thesis (PhD): University of Leiden.

Roep, T.B. & J.F. van Regteren Altena, 1988. Paleotidal levels in tidal sediments (2800-3635 BP): compaction, sea level rise and human occupation (3275-2620 BP) at Bovenkarspel, NW Netherlands. In: P.L. de Boer, A. van Gelderen and S.D. Nio (eds). *Tide-influenced sedimentary environments and facies.* Dordrecht: Kluwer, 215-231.

Rutte, R., 2003. Stadsaanleg in de late middeleeuwen. Over bouwpercelen, straten en standaardmaten in Elburg en enige andere steden. *Bulletin KNOB* 2003.4/5, 122-137.

Sass-Klaassen, U. & E. Hanraets, 2006. Woodlands of the past. The excavation of wetland woods at Zwolle-Stadshaven (the Netherlands): Growth pattern and population dynamics of oak and ash. *Netherlands Journal of Geosciences* 85.1, 61-71.

Selles, A., 1996. Het leven van de Kamper stadsboeren I. Middeleeuwse burgers boerden. *Kamper Almanak* 1996, 157-166.

Sintobin, T. (ed.), 2008. *Getemd maar rusteloos. De Zuiderzee verbeeld – een multidisciplinair onderzoek.* Hilversum: Verloren.

Schokker, J., H.J.T. Weerts, W.E. Westerhoff, H.J.A. Berendsen & C. den Otter, 2007. Introduction of the Boxtel Formation and implications for the Quaternary lithostratigraphy of the Netherlands. *Netherlands Journal of Geosciences* 86.3, 197-210.

Speet, B.J.M., G. van Herwijnen, C. van de Kieft, J.C. Visser & J.G. Wegner, 1986. *Historische stedenatlas van Nederland. Aflevering 4. Kampen.* Delft: Delftse Universitaire Pers.

Spek, M., F.D. Zeiler & E. Raap, 1996. *Van de Hunnepe tot de zee; de geschiedenis van het Waterschap Salland.* Kampen: IJsselacademie.

Stevin, H., 1667. W*isconstich Filosofisch Bedryf. Begrepen in veertien Boeken.* Leiden: Philips de Croy.

Tamse, C.A., 1963. Bijdrage tot de economische geschiedenis van Kampen in de Middeleeuwen en de XVIe eeuw. *Kamper Almanak* 8, 204-279.

Teekens, P. & A. Spoelstra, 2009. A*rcheologische Rapporten Oranjewoud 2009/66. Bureauonderzoek en inventariserend veldonderzoek in het herinrichtingsgebied Wellerwaard nabij Emmeloord, gemeente Noordoostpolder*. Heerenveen: Oranjewoud b.v.

Ten Anscher, T.J., 2012. *Leven met de Vecht: Schokland-P14 en de Noordoostpolder in het neolithicum en de bronstijd.* Thesis (PhD): University of Amsterdam.

Ten Anscher, T.J., G.H. de Boer, Y.T. van Popta & S. van der Veen, 2017. *Erfgoed in de Polder! Actualisatie van de ar-*

cheologische waarden- en verwachtingskaart van de gemeente Noordoostpolder (= Raap-rapport 3155). Weesp: Raap Archeologisch Adviesbureau B.V.

Ter Wee, M.W., 1962. The Saalien Glaciation in the Netherlands. *Mededelingen Rijks Geologische Stichting* 15, 57-76.

Törnqvist, O., 2013. The skeleton in the Dune. Unlocking the Explanatory Potential of Shipwrecks through Physical Landscape Studies. In: J. Adams & J. Rönnby (eds). *Interpreting Shipwrecks. Maritime Archaeological Approaches* (= Södertörn Academic Studies 56). Southampton: The Highfield Press, 25–35.

Tuddenham, D.B., 2010. Maritime Cultural Landscapes, Maritimity and Quasi Objects. *Journal of Maritime Archaeology* 2010, 5-16.

Van Asselen, S., E. Stouthamer & T.W.J. van Asch, 2009. Effects of peat compaction on delta evolution: a review on processes, responses, measuring and modeling. *Earth-Science Reviews 92*, 35-51.

Van Bavel, B.J.P., & J.L. van Zanden, 2004. The jump-start of the Holland economy during the late-medieval crisis, c. 1350-c. 1500. *The economic history review* 57, 503-532.

Van Bavel, B.J.P., 2010. *Manors and Markets: Economy and Society in the Low Countries, 500-1600.* Oxford: Oxford University Press.

Van Beek, R., 2009. *Reliëf in Tijd en Ruimte. Interdisciplinair onderzoek naar bewoning en landschap van Oost-Nederland tussen vroege prehistorie en middeleeuwen.* Thesis (PhD): Wageningen University.

Van Buijtenen, M.P. & H.T. Obreen, 1956. *Westergo's IJsselmeerdijken.* Bolsward: Osinga.

Van den Biggelaar, D.F.A.M., S.J. Kluiving, R.T. van Balen, C. Kasse, S.R. Troelstra & M.A. Prins, 2014. Storms in a lagoon: flooding history during the last 1200 years derived from geological and historical archives of Schokland (Noordoostpolder, The Netherlands). *Netherlands Journal of Geosciences* 93, 175-196.

Van den Biggelaar, D.F.A.M., 2017. *New land, old history: past landscapes and hominin activity covering the last 220,000 years in Flevoland, The Netherlands.* Thesis (PhD): University of Amsterdam.

Van Geel, B., D.P. Hallewas & J.P. Pals, 1983. A Late Holocene deposit under the Westfriese Zeedijk near Enkhuizen (prov. of Noord-Holland, the Netherlands): palaeoecological and archaeological aspects. *Review of Palaeobotany and Palynology* 39, 269-335.

Van der Hammen, T., 1951. *Late-Glacial flora and periglacial phenomena in the Netherlands.* Thesis (PhD): Leiden University.

Van der Heide, G.D., 1951. Archaeologisch-geologisch onderzoek in de voormalige Zuiderzee. *Grondboor & Hamer* 11.2, 187-192.

Van der Heide, G.D., 1954. Twee ronde burchten bij Kuinre. *Kamper Almanak*, 173-194.

Van der Heide, G.D., 1958. Terp- en dijkresten in het Zuiderzeegebied. *Kamper Almanak* 57/58, 163-175.

Van der Heide, G.D., 1961. Voorlopige gegevens over de opgraving in de Boven- of st. Nicolaaskerk te Kampen. *Kamper Almanak*, 241-265

Van der Heide, G.D., 1965a. *Archeologie van de Zuiderzeebodem.* Ketelhaven: RIJP.

Van der Heide, G.D., 1965b. *Van landijs tot polderland. Tweeduizend eeuwen Zuiderzeegebied.* Amsterdam: Strengholt N.V.

Van der Heide, G.D., 1974. *De Zuiderzee. Van land tot water, van water tot land.* Haren: Knoop & Niemeijer.

Van der Heide, G.D. & A.J. Wiggers, 1954. Enkele resultaten van het geologische en archaeologische onderzoek betreffende het eiland Schokland en zijn naaste omgeving. *Langs gewonnen velden*, 96-113.

Van der Schrier, D.M., 2004, Wanneer de IJssel een Rijntak werd en hoe het meer Flevo afwaterde. *Westerheem* 53, 182-189.

Van der Vlis, D., 1974. Vlag, wapens en zegels van Kampen. *Kamper Almanak* 1974, 241-248.

Van der Zon, N., 2013. *Kwaliteitsdocument AHN2* [http://www.ahn.nl], accessed on 05 April 2017.

Van Duivenvoorde, W., 2015. *Dutch East India Company Shipbuilding. The Archaeological Study of Batavia and Other Seventeenth-Century VOC Ships.* Austin: Texax A&M University Press.

Van Engelen van der Veen, G.A.J., 1937. Het ontstaan van Kampen en de vorming van het stadsgebied. *Verslagen en Mededelingen van de vereeniging tot beoefening van Overijssels Regt en Geschiedenis* 53, 64-92.

Van Haaster, H., D.C. Brinkhuizen & J.T. Zeiler, 2001. *Archeobotanisch en –zoölogisch onderzoek van twee beerputten aan de Voorstraat in Kampen* (= BIAXaal 125). Zaandam: BIAX Consult.

Van Hezel, G. & A. Pol, 2005. *De Flevolandse geschiedenis in meer dan 100 verhalen.* Amsterdam: Van Gennep.

Van Hezel, G. & A. Pol, 2008. *Leven met water. Schokland en omgeving*. Utrecht: Uitgeverij Matrijs.

Van Holk, A.F.L., 1991. Scheepsarcheologie en maritieme cultuur. In: R. Reinders & R. Oosting (eds). *Scheepsarcheologie: prioriteiten en lopend onderzoek. Inleidingen gehouden tijdens de glavimans symposia in 1986 en 1988* (= Flevobericht 322). Lelystad: Rijkswaterstaat, directie Flevoland, 9-18.

Van Holk, A.F.L., 1996. *Archeologie van de binnenvaart: wonen en werken aan boord van binnenvaartschepen (1600-1900)* (= Flevobericht 410). Lelystad: ROB/NISA.

Van Holk, A.F.L., 2005. *De Zuiderzee als verkeersplein; een beurtvaarder als voorbeeld. Ooit Zuiderzee…* Cultuur Historisch Jaarboek voor Flevoland 2015, 9-28.

Van Holk, A.F.L., 2010. Maritieme archeologie van de kogge. In: H. Brand & E. Knol (eds). *Koggen, Kooplieden en Kantoren. De Hanze, een praktisch netwerk.* Hilversum: Verloren, 124-143.

Van Holk, A.F.L., 2017a. The Zuiderzee (the Netherlands). Highway, fishing ground and power landscape. In: J. Gawronski, A.F.L. van Holk & J. Schokkenbroek (eds). *Ships and Maritime Landscapes. Proceedings of the Thirteenth*

International Symposium on Boat and Ship Archaeology, Amsterdam 2012, 73–78. Eelde: Barkuis.

Van Holk, A.F.L. (ed.), 2017b. *Een Wijdschip, Watergeuzen en Wolfsklingen. Opgraving van een scheepswrak aan de Vogelweg (gem. Lelystad), vergaan in 1572* (= Grondsporen 26). Groningen: Groninger Instituut voor Archeologie.

Van Huissteden, J., J. Vandenberghe & B. van Geel, 1986. Late Pleistocene stratigraphy and fluvial history of the Dinkel Basin (Twente Eastern Netherlands). *Eiszeitalter und Gegenwart* 36, 43-59.

Van Mierlo, Th. M., 1984. De topografische ontwikkeling van Kampen in de eerste helft der 14e eeuw. *Kamper Almanak* 1984, 217-266.

Van Nie, M. & M. Smit, 1997. Houten huizen aan de Oudestraat. In: M. Barwasser & M. Smit (eds). *Acht eeuwen tussen twee stegen. Archeologisch, historisch en bouwhistorisch onderzoek in Kampen*. Ede: Stichting Archeologie Overijssel/ Vechtstreek, 67-77.

Van Popta, Y.T., 2012a. Knooppunt Zuiderzee. Een ruimtelijke analyse van scheepsvindplaatsen in Flevoland. *Paleo-aktueel* 23, 97-104.

Van Popta, Y.T., 2012b. *Wie zeilen kan, zeilt bij elke wind. Een inventarisatie, kwantificatie en ruimtelijke analyse van de gevonden scheepswrakken in Flevoland.* Unpublished report, University of Groningen, Groningen Institute of Archaeology.

Van Popta, Y.T., 2013. Flevoland ondersteboven. Een interdisciplinair onderzoek naar de bodemprofielen van scheepswrakken in Flevoland. *Paleo-aktueel* 24, 91-97.

Van Popta, Y.T., 2014. Storm op komst. Een archeo-historisch onderzoek naar de oorzaken van scheepsrampen op de Zuiderzee. *Cultuurhistorisch Jaarboek voor Flevoland* 2014, 70-83.

Van Popta, Y.T., 2016. Taken by the sea. New analyses on the dynamic past of the maritime cultural landscape known as the former Zuiderzee (the Netherlands). *Cambridge Archaeological Review* 31.2, 75-90.

Van Popta, Y.T., 2017a. Opgespoorde sporen van bewoning. Een archeologische, historische en geografische interpretatie van het laatmiddeleeuwse landschap van de Noordoostpolder. *Tijdschrift voor Historische Geografie* 2.3, 130-143.

Van Popta, Y.T., 2017b. Shipwreck distribution: a spatial analysis of shipwrecks in the province of Flevoland (the Netherlands). In: J. Gawronski, A.F.L. van Holk & J. Schokkenbroek. *Ships and Maritime Landscapes. Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology, Amsterdam 2012*. Eelde: Barkhuis Publishing, 126-131.

Van Popta, Y.T., 2018. Lost islands, drowned settlements and forgotten shipwrecks: interaction between aspects of the maritime cultural landscape of the former Zuiderzee (AD 1100-1400). *Proceedings of the Fourteenth International Symposium on Boat and Ship Archaeology, Gdánsk 2015*, 85-90.

Van Popta, Y.T., 2019a. No country for men. Searching for late medieval submerged settlements in the northeastern Zuiderzee area, the Netherlands. *European Journal of Archaeology* 22.4, 567-587.

Van Popta, Y.T., 2019b. *Op zoek naar verdronken Veenhuizen. Verkennend archeologisch onderzoek naar laatmiddeleeuwse bewoningsresten in het Kuinderbos, Flevoland* (= Grondsporen 54). Groningen: Groninger Instituut voor Archeologie.

Van Popta, Y.T., 2019c. Dat mag in de krant! Archeohistorisch onderzoek naar de ondergang van een 19de-eeuwse tjalk op de Zuiderzee. *Paleo-aktueel* 30, 127-136.

Van Popta, Y.T. & G. Aalbersberg, 2016. Onbekend, maar niet onbemind: terpen en terponderzoek in de Noordoostpolder. In: A. Nieuwhof (ed.). *Van Wierhuizen tot Achlum. Honderd jaar archeologisch onderzoek in terpen en wierden.* Groningen: Vereniging voor Terpenonderzoek, 129-140.

Van Popta, Y.T. & A.F.L. van Holk, 2018. Where are the shipwrecks of the Zuiderzee? A new version of the Shipwreck Database Flevoland (3.0), based on spatial and archaeohistorical research concerning wreck sites in the province of Flevoland. *Palaeohistoria* 59/60, 191-227.

Van Popta, Y.T., C.L. Westerdahl & B.G. Duncan, 2019. Maritime Culture in the Netherlands: Accessing the Late Medieval Maritime Cultural Landscapes of the North-Eastern Zuiderzee. *International Journal of Nautical Archaeology* 48.1, 172-188.

Van Popta, Y.T., K.M. Cohen, P.C. Vos & M. Spek, 2020. *Reconstructing medieval eroded landscapes in the Northeastern Zuyder Zee (The Netherlands): towards a refined palaeogeographical time series of the Noordoostpolder between AD 1100 and 1400.* Landscape History.

Van Tuinen, E. & D. van den Bersselaar, 2005. Flevoland en Noordoostpolder zakken nog maximaal een halve meter: tot 2050 grootste daling in het zuidwesten. H2O: *Tijdschrift voor watervoorziening en afvalwaterbehandeling* 17, 14-15.

Van Vliet, E.G., 1992. Schokland en Kampen. *Het Schokker Erf* 19, 1-7.

Van Zijverden, W.K., 2017. *After the Deluge. A Palaeogeographical Reconstruction of Bronze Age West-Frisia (2000-800 BC).* Thesis (PhD): Leiden University.

Velthuis, I., A. Botman, J. Huizer, Y.T. van Popta & J. Verweij, 2018. *Archeologie en Aardkunde in Flevoland. Een inventarisatie van archeologische en aardkundige waarden in de provincie Flevoland.* Amersfoort: ADC ArcheoProjecten.

Vlierman, K., 1997. IJzeren voorwerpjes met een eigen verhaal. In: M. Barwasser & M. Smit (eds). *Acht eeuwen tussen twee stegen. Archeologisch, historisch en bouwhistorisch onderzoek in Kampen.* Ede: Stichting Archeologie IJssel/Vechtstreek, 113-123.

Vos, P.C., 2008. *The geological development of the Oer-IJ area. In: M.S.M. Kok (ed.). The homecoming of religious practice: an analysis of offering sites in the wet lowlying parts of the landscape in the OerIJ area.* Amsterdam: University of Amsterdam, 81-95.

Vos, P.C. & S. de Vries, S., 2013. *2e generatie palaeogeografische kaarten van Nederland* (second edition). Utrecht: Deltares.

Vos, P.C., 2015. *Origin of the Dutch Coastal Landscape. Long-term landscape evolution of the Netherlands during the Holocene, described and visualized in national, regional and local palaeogeographical map series.* Thesis (PhD): Utrecht University.

Vos, P.C., J. de Koning & R. van Eerden, 2015. Landscape history of the Oer-IJ tidal system, Noord-Holland (The Netherlands). *Netherlands Journal of Geosciences* 94.4, 295-332.

Vos, P.C., M. van der Meulen, H. Weerts & J. Bazelmans, 2020. *Atlas of the Holocene Netherlands, landscape and habitation since the last ice age.* Amsterdam: Amsterdam University Press.

Vreugdenhil, V., 1999. Het verdronken land van Urk. *Historisch-Geografisch Tijdschrift* 17.1, 15-24.

Waldus, W.B. (ed.), 2018. *De opgraving en lichting van de 15de-eeuwse IJsselkogge.* Utrecht: Matrijs.

Walsmit, E.H., H. Kloosterboer, N. Persson & R. Ostermann, 2009. *Spiegel van de Zuiderzee: geschiedenis en cartobibliografie van de Zuiderzee en het Hollandse Waddengebied.* Houten: Hes & De Graaf.

Washburn, S.L. & C.S. Lancaster, 1968. *The evolution of hunting. In: R.B. Lee & I. DeVore (eds). Man the Hunter.* New York: De Gruyter, 293-303.

Waterhout, B., W. Zonneveld & E. Louw, 2013. *Case Study Markermeer-IJmeer, the Netherlands: Emerging Contextualisation and Governance Complexity.* Amsterdam: AISSR programme group Urban Planning.

Westerdahl, C.L., 1978. *Marinarkeologisk inventering med utgångspunkt från ett norrlåndskt exempel. C-uppsats i arkeologi, VT 1978.* Unpublished seminar paper. Stockholm University.

Westerdahl, C.L., 1986. Die Maritime Kulturlandschaft. Schiffe, Schiffahrtswege, Häfen-Überlegungen zu einem Forschungansatz. Zeitschrift des Deutchen Schiffahrtsmuseums. *Deutsches Schiffartsarchiv* 9, 7-58.

Westerdahl, C.L., 1992. The Maritime Cultural Landscape. *International Journal of Nautical Archaeology* 21, 5-14.

Westerdahl, C.L., 1994. Maritime cultures and ship types: Brief comments on the significance of maritime archaeology. *International Journal of Nautical Archaeology* 23.4, 265-270.

Westerdahl, C.L., 1998. *The Maritime Cultural Landscape. On the concept of the traditional zones of transport geography* [https://www.abc.se/~pa/publ/cult-land.htm], accessed on 18 January 2018.

Westerdahl, C.L., 2000. From land to sea, from sea to land. On transport zones, borders and human space. In: J. Litwin (ed.). Down the river to the sea. *Eighth International Symposium on Boat and Ship Archaeology, Gdańsk 1997*. Gdańsk: Polish Maritime Museum, 11-20.

Westerdahl, C.L., 2003. Holy, Profane and Political. Territoriality-extra territoriality: A Problem with Borders. Some Notes and Reflections. *Acta Bibliothecæ Regiæ, Papers in Cartography, Numismatics, Oriental Studies and Librarianship Presented to Ulla Ehrensvärd, Acta Bibliothecæ Regiæ, Stockholmiensis* LXIX, 467-95.

Westerdahl, C.L., 2004. Maritime Cultures and Ships Types: Brief Comments on the Significance of Maritime Archaeology. *International Journal of Nautical Archaeology* 23.4, 265-270.

Westerdahl, C.L., 2005. Maritime Cosmology and Archaeology. *Deutsches Schiffahrtsarchiv* 28, 7-54.

Westerdahl, C.L., 2008. Fish and Ships. Towards a theory of maritime culture. *Deutches Schiffahrtsarchiv Wissenschaftliches Jahrbuch des Deutchen Schiffahrtsmuseums* 30, 191-236.

Westerdahl, C.L., 2011. The Maritime Cultural Landscape Revisited. In B. Ford (ed.). *The Archaeology of Maritime Landscapes.* New York: Springer, 331-344.

Westerdahl, C.L., 2013. The Maritime Cultural Landscape. In: B. Ford, D.L. Hamilton & A. Catsambis (eds). *The Oxford Handbook of Maritime Archaeology.* Oxford: Oxford University Press, 733-762.

Westerdahl, C.L., 2014. The Maritime Middle Ages. Past, Present, and Future. Some Ideas from a Scandinavian Horizon. *European Journal of Archaeology* 17.1, 120-138.

Westerdahl, C.L., 2017. Ships for ships' sake? Flipping the label. From ships and landscapes to landscapes and ships (1997-2012). In: J. Gawronski, A.F.L. van Holk & J. Schokkenbroek (eds). *Ships and Maritime Landscapes. Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology, Amsterdam 2012.* Eelde: Barkhuis, 3-10.

Westerhoff, W.E., M.C. Geluk & E.F.J. de Mulder, 2003a. Deel 2. Geschiedenis van de ondergrond. In: E.F.J. de Mulder, E.F.J., M.C. Geluk, I. Ritsema, W.E. Westerhoff & T.E. Wong (eds), 2003. *De ondergrond van Nederland.* Groningen/Houten: Wolters-Noordhoff bv., 119-246.

Westerhoff, W.E., T.E. Wong & E.F.J. de Mulder. 2003b. Deel 3. Opbouw van de ondergrond. In: E.F.J. de Mulder, E.F.J., M.C. Geluk, I. Ritsema, W.E. Westerhoff & T.E. Wong (eds), 2003. *De ondergrond van Nederland.* Groningen/Houten: Wolters-Noordhoff bv., 247-373.

Weststrate, J., 2008. *In het kielzog van moderne markten. Handel en scheepvaart op de Rijn, Waal en IJssel, ca. 1360-1560.* Hilversum: Verloren.

Weststrate, J., 2010. Handel en transport over land en rivieren. In: H. Brand & E. Knol (eds). *Koggen, Kooplieden en Kantoren. De Hanze, een praktisch netwerk,* 144–159. Hilversum: Verloren.

Wiemer, R., 2002. Standardisation: the key to archaeological data quality. In: J. Garciá Sanjuán & D.W. Wheatley (eds). *Mapping the future of the past. Managing the spatial dimension of the European archaeological resource.* Sevilla: Universidad de Sevilla, 103-108.

Wiggers, A.J., 1955. *De wording van het Noordoostpoldergebied. Een onderzoek naar de physisch-geografische ontwikkeling van een sedimentair gebied.* Zwolle: Tjeenk Willink.

Wubs-Mrozewicz, J.J., 2008. *Traders, Ties and Tensions. The Interaction of Lübeckers, Overijsslers and Hollanders in Late Medieval Bergen.* Hilversum: Verloren.

Ypma, Y.N., 1962. *Geschiedenis van de Zuiderzeevisserij.* Thesis (PhD): University of Amsterdam.

Zagwijn, W.H., 1983. Sea-level changes in The Netherlands during the Eemian. *Geologie en Mijnbouw* 62.3, 437-450.

Zagwijn, W.H., 1986. *Geologie van Nederland, Deel 1. Nederland in het Holoceen.* Haarlem: Rijks Geologische Dienst.

Zagwijn, W.H., 1989. Vegetation and climate during warmer intervals in the Late Pleistocene of western and central Europe. *Quaternary International* 3.4, 57-67.

Zeiler, F.D., 2018. Het Digestum Vetus: een blik in het stedelijk leven in de late middeleeuwen. *Kamper Almanak* 2018, 173-214.

List of publications

Main articles

Van Popta, Y.T., 2019a. No country for men. Searching for late medieval submerged settlements in the northeastern Zuiderzee area, the Netherlands. *European Journal of Archaeology* 22.4, 567-587.

Van Popta, Y.T. & A.F.L. van Holk, 2018. Where are the shipwrecks of the Zuiderzee? A new version of the Shipwreck Database Flevoland (3.0), based on spatial and archaeohistorical research concerning wreck sites in the province of Flevoland. *Palaeohistoria* 59/60, 191-227.

Van Popta, Y.T., C.L. Westerdahl & B.G. Duncan, 2019. Maritime Culture in the Netherlands: Accessing the Late Medieval Maritime Cultural Landscapes of the North-Eastern Zuiderzee. *International Journal of Nautical Archaeology* 48.1, 172-188.

Van Popta, Y.T., K.M. Cohen, P.C. Vos & M. Spek, 2020. Reconstructing medieval eroded landscapes in the Northeastern Zuyder Zee (The Netherlands): towards a refined palaeogeographical time series of the Noordoostpolder between AD 1100 and 1400. *Landscape History*.

Van Popta, Y.T., in prep. Lords, Merchants and Farmers. An archaeohistorical point-of-view on consequences of the expansion of the Zuyder Zee (AD 1100-1400; Noordoostpolder, The Netherlands). *International Journal of Maritime Archaeology*.

Secondary articles

Ten Anscher, T.J., G.H. de Boer, Y.T. van Popta & S. van der Veen, 2017. *Erfgoed in de polder! Actualisatie van de archeologische waarden- en verwachtingskaart van de gemeente Noordoostpolder* (= RAAP-rapport 3155). RAAP Archeologisch Adviesbureau B.V., Weesp.

Van Popta, Y.T., 2015. Het maritieme cultuurlandschap van Schokland. In: *Paleo-aktueel 26*, 133-140.

Van Popta, Y.T., 2016. Taken by the sea. New analyses on the dynamic past of the maritime cultural landscape known as the former Zuiderzee (the Netherlands). *Cambridge Archaeological Review* 31.2, 75-90.

Van Popta, Y.T., 2017a. Opgespoorde sporen van bewoning. Een archeologische, historische en geografische interpretatie van het laatmiddeleeuwse landschap van de Noordoostpolder. *Tijdschrift voor Historische Geografie* 2.3, 130-143.

Van Popta, Y.T., 2017b. Shipwreck distribution: a spatial analysis of shipwrecks in the province of Flevoland (the Netherlands). In: J. Gawronski, A.F.L. van Holk & J. Schokkenbroek. *Ships and Maritime Landscapes. Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology, Amsterdam 2012.* Eelde: Barkhuis Publishing, 126-131.

Van Popta, Y.T., 2018a. Lost islands, drowned settlements and forgotten shipwrecks: interaction between aspects of the maritime cultural landscape of the former Zuiderzee (AD 1100-1400). *Proceedings of the Fourteenth International Symposium on Boat and Ship Archaeology, Gdánsk 2015*, 85-90.

Van Popta, Y.T., 2018b. Sloop de dijken, laat de zee terugkeren. *Cultuurhistorisch Tijdschrift Rondom Schokland* 58, 19-25.

Van Popta, Y.T., 2019b. *Op zoek naar verdronken Veenhuizen. Verkennend archeologisch onderzoek naar laatmiddeleeuwse bewoningsresten in het Kuinderbos, Flevoland* (= Grondsporen 54). Groningen: Groninger Instituut voor Archeologie.

Van Popta, Y.T., 2020. An interdisciplinary and layered approach towards the reconstruction of the late medieval maritime cultural landscape of the Noordoostpolder region, the Netherlands. *Proceedings of the Sixth International Congress on Underwater Archaeology, Fremantle, Australia.*

Van Popta, Y.T. & G. Aalbersberg, 2016. Onbekend, maar niet onbemind: terpen en terponderzoek in de Noordoostpolder. In: A. Nieuwhof (ed.). *Van Wierhuizen tot Achlum. Honderd jaar archeologisch onderzoek in terpen en wierden.* Groningen: Vereniging voor Terpenonderzoek, 129-140.

Velthuis, I., A. Botman, J. Huizer, Y.T. van Popta & J. Verweij, 2018. *Archeologie en Aardkunde in Flevoland. Een inventarisatie van archeologische en aardkundige waarden in de provincie Flevoland.* Amersfoort: ADC ArcheoProjecten.

Nederlandse samenvatting

Introductie (H1) en Algehele conclusie (H7)

Dit promotieonderzoek richt zich op het noordoostelijke deel van één van de meest belangrijke Nederlandse maritieme landschappen: de Zuiderzee en de middeleeuws ontgonnen landschappen die haar voorgingen. De fasering van de laatmiddeleeuwse transformatie van het gebied tot de Zuiderzee en de consequenties daarvan voor de bewoners was een onderbelicht onderzoeksthema. Eerdere paleogeografische en archeologische studies beschouwden de dynamische ontwikkeling van het gebied in deze specifieke periode alleen grof stoffelijk. Men ging er lang van uit dat mariene erosie er zo omvangrijk en verstorend was geweest dat de reconstructie van het verloop van ontginningsfasen en kustafslag vrijwel onmogelijk was.

Het promotieonderzoek heeft als doel om toch tot gefaseerde reconstructies te komen, door nieuw onderzoek te doen naar de rijke archeologische inventaris van het gebied (terrestrisch en maritiem) en door dit op nieuwe manieren in fysisch-geografische en landschapshistorische contexten te plaatsen. Zo konden voor het maritieme landschap van het noordoostelijke Zuiderzeegebied tussen ca. 1100 en 1400 n. Chr. de relatie onderzocht worden tussen landschapsontwikkeling en gebruik van land (ontginning, cultivatie) en water (maritiem)van het laatmiddeleeuwse maritieme (cultuur)landschap tegen haar geologische en historische achtergrond. Een ander doel in het onderzoek behelst de focus van het maritiem archeologisch onderzoek in Nederland. De focus lag voorheen vooral op de scheepswrakken. In dit proefschrift is de maritiem archeologische informatie verwerkt in een meer integrale maritieme landschapsreconstructie, hetgeen voortbouwt op aanzetten van andere onderzoekers om bijvoorbeeld scheepswrakken in een bredere context te plaatsen. Al met al is het onderzoek sterk gericht op het ontwikkelen van een interdisciplinaire methodologie waarmee de geërodeerde middeleeuwse landschappen in het Zuiderzeegebied kunnen worden gereconstrueerd, gebruikmakend van verschillende onderzoeksbenaderingen. In haar opzet heeft het proefschrift daarmee een methodologisch karakter. De centrale onderzoeksvraag luidt daarom: hoe kan interdisciplinair methodologisch onderzoek bijdragen aan het beter begrijpen van de ontwikkelingen tussen ca. 1100 en 1400 AD die het landschap en menselijk gebruik van het noordoostelijke Zuiderzeegebied hebben gevormd en gewijzigd?

Uit het onderzoek is gebleken dat het onderzoeksgebied in minder dan 500 jaar transformeerde van onontgonnen veenvlaktes en meren naar open water waarbij nagenoeg alle resten van tussentijdse ontginning, cultivatie en bewoning werden opgeruimd. Aan de veranderingen in het landschap stonden zowel natuurlijke als culturele factoren ten grondslag: de stormen kunnen worden gezien als een natuurlijke factor, terwijl de daaruit voortgekomen vloeden het gevolg waren van menselijk ingrijpen in het landschap (ontginning en cultivatie van land zorgde voor uitdroging en krimp van de veenbodems). De laatmiddeleeuwse archeologische resten, die nu terecht aan bewoning van het gebied zijn gekoppeld, zijn feitelijk de laatste overblijfselen van een sterk dynamische regio waarin boeren, handelaren, heren en uiteindelijk ook vissers leerden omgaan met het water.

In totaal zijn vijf onderling verbonden hoofdstukken geschreven die gezamenlijk tot bovenstaande conclusie hebben geleid. Hoofdstuk 2 onderzoekt de laatmiddeleeuwse paleogeografische ontwikkeling van het studiegebied waarbij paleogeografische reconstructies van het onderzoeksgebied worden gepresenteerd voor de tijdsneden van 900, 1100, 1400 en 1600 n. Chr. De kaarten voor 1100 en 1400 n. Chr. zijn nieuwe kaartbeelden van momenten die eerdere tijdseries oversloegen. In hoofdstuk 3 wordt ingegaan op de theorievorming en toepassing daarvan in de maritieme archeologie, waarbij met name wordt stilgestaan bij het concept van het maritieme cultuurlandschap en hoe dit geprojecteerd kan worden op het Zuiderzeegebied. Hoofdstuk 4 behandelt de ruimtelijke spreiding van laatmiddeleeuwse archeologische objecten uit de Noordoostpolder, waarbij vondstconcentraties worden geprojecteerd op de landschapsreconstructies uit hoofdstuk 2. In hoofdstuk 5 wordt een detailstudie naar nauwkeurigheid van wraklocaties in Flevoland gepresenteerd. Het onderzoek sluit daarmee in mindere mate aan op het interpreteren van het laatmiddeleeuwse landschap, maar toont juist aan dat, ondanks dat maritiem archeologisch onderzoek zich hoofdzakelijk op scheepswrakken richt, de primaire gegevens van deze wrakken nog steeds niet volledig betrouwbaar zijn. Hoofdstuk 6 presenteert ten slotte een archeohistorisch overzicht van het laatmid-

deleeuwse leven in het onderzoeksgebied en richt zich daarbij voornamelijk op de bewoners van het gebied en hun gedrag.

Het reconstrueren van middeleeuwse geërodeerde landschappen van de noordoostelijke Zuiderzee (H2)

Dit hoofdstuk richt zich op de grootschalige erosie van de laatmiddeleeuwse veenlandschappen langs de laguneranden van het noordoostelijke Zuiderzeegebied, oftewel de huidige Noordoostpolder. Daarvoor zijn paleogeografische reconstructies geïntegreerd met archeologisch en ruimtelijk-archeohistorisch onderzoek. Het gelijktijdig verlies van de venige kustvlakten en de opkomst van maritieme activiteiten binnen het onderzoeksgebied is bestudeerd vanuit archeologische, geologische en historische perspectieven. In de eerste helft van de middeleeuwen (ca. 500 tot 1000 n. Chr.) bestond het centrale deel van Nederland grotendeels uit uitgestrekte veengebieden en onderling verbonden meren. Dit gold ook voor de Noordoostpolder, waar de rivieren Vecht en IJssel gezamenlijk verbinding hadden met het Vlie en er enige getij-indringing was vanuit de westelijke Waddenzee. Tijdens de volle en late middeleeuwen (ca. 1000 tot 1500 n. Chr.) zorgden stormvloeden wijdverbreid voor progressieve afslag van de toen al bewoonde veengebieden, waardoor het centrale deel van Nederland transformeerde in de Zuiderzee. In de alsmaar uitbreidende watermassa werden middeleeuwse akkers, grasland en dorpen gestaag opgeruimd. Veen werd geërodeerd en omgewerkt tot sloef-achtige lagen detritus op de waterbodem, en deze jonge zeebodemafzettingen bevatten plaatselijk een concentraat van middeleeuwse archeologische resten. Dit gecombineerde archief werd al intensief onderzocht vanaf het moment dat de Noordoostpolder droogviel en gereed werd gemaakt voor de landbouw (vanaf de jaren '40 van de vorige eeuw). Uit het onderzoek bleek dat in de bodem nog laatmiddeleeuwse archeologische resten aanwezig zijn die een opvallende ruimtelijke spreiding blijken te hebben. Daar waar de bodem van de voormalige lagune dusdanig is omgewerkt dat op basis van geologische gegevens geen gedetailleerde paleogeografische reconstructie kon worden gemaakt, zijn archeologische data gebruikt om de uitbreiding en ontwikkeling van de lagune in kaart te brengen. De oplossing voor het interpreteren van de paleogeografie van de verdwenen veengebieden voor de kaartbeelden van 1100 en 1400 n. Chr. bleek dus te zitten in het omkeren van de volgorde waarin de data werden verwerkt: de ruimtelijke patronen in de verspreiding en dichtheid van archeologische objecten kwamen op de eerste plaats, en de geologische beschrijving van de afzettingen op de bodem van de lagune op de tweede plaats. Voor eerdere perioden en andere gebieden is het wel vanzelfsprekend om geologische data op de eerste plaats te zetten en archeologische gegevens ter aanvulling te gebruiken.

Als eindresultaat worden in hoofdstuk 2 vier nieuwe paleogeografische kaarten van het onderzoeksgebied gepresenteerd, met daarop zowel culturele als natuurlijke landschappelijke elementen. De kaartbeelden voor 1100 en 1400 n. Chr. zijn de eerste gedetailleerde reconstructies van het onderzoeksgebied waarop relevante terrestrische en maritieme archeologische resten staan afgebeeld. Deze nieuwe kaartbeelden maken het gefaseerde verloop van de kustafslag in de late middeleeuwen duidelijk, waarvan de maritiem culturele implicaties in verdere hoofdstukken worden verkend. Het kaartbeeld voor 900 n. Chr. is een update van een eerdere reconstructie gebaseerd op geologische gegevens (aansluitend op de landelijke serie paleogeografische kaarten), en het kaartbeeld voor 1600 n. Chr. toont de landschapsreconstructie van het onderzoeksgebied overeenkomstig de oudste historische kaarten van de Zuiderzee. Deze kaartbeelden dienen de aansluiting en inbedding van de laatmiddeleeuwse reconstructies op de voorgaande en volgende tijdsperioden.

De combinatie van de vier kaartbeelden onthult de vervlochten landschapshistorie van land en zee in het onderzoeksgebied als achtergrond van verschuivingen in het menselijk gebruik van beide. Daar waar rond 900 n. Chr. nog relatief grote (onbewoonde) veengebieden in het onderzoeksgebied aanwezig zijn, toont het kaartbeeld van 1100 n. Chr. aan dat door erosie verschillende (schier)eilanden en kapen zijn ontstaan. Op deze eilanden en langs de kustzone komen verschillende nederzettingen voor waarvan de namen bekend zijn uit historische bronnen. Het kaartbeeld van 1400 n. Chr. toont de verdere uitbreiding van de Zuiderzee aan, waarbij slechts kleine fragmenten van de veengebieden resteren en verschillende nederzettingen zijn verdronken. Het kaartbeeld van 1600 n. Chr. toont het uiteindelijke formaat van de Zuiderzee met de aangelegde bedijking langs de overgebleven veengebieden.

Het laatmiddeleeuwse maritieme cultuurlandschap van de noordoostelijke Zuiderzee (H3)

In dit hoofdstuk zijn de theorie en praktijk van het onderzoeksdiscipline 'maritieme archeologie' en het concept van het maritieme cultuurlandschap onderzocht. Het doel van het onderzoek was om te zoeken naar mogelijkheden en beperkingen om het concept toe te passen op het noordoostelijke Zuiderzeegebied tussen ca. 1100 en 1400 n. Chr. Het maritieme cultuurlandschap als theoretisch concept is in de jaren '90 van de vorige eeuw opgesteld door maritiem archeoloog Christer Westerdahl om binnen maritiem archeologische theorievorming een brug te slaan tussen het land en het

water. Onder het theoretisch concept van Westerdahl wordt verstaan: het gehele netwerk van vaarroutes, met aanlegplaatsen, havens en havenplaatsen langs de kust, en alle daaraan gerelateerde constructies en andere resten van menselijke activiteit, zowel onder water als op het land (Westerdahl 1992; 2013).

Uit het onderzoek is gebleken dat er verschillende theoretische begrippen zijn die geassocieerd en verbonden zijn aan het maritieme cultuurlandschap, zoals maritieme cultuur, maritiem culturele centra, maritiem culturele gebieden, transportzones, transportenclaves en overslagplaatsen. Al deze begrippen kennen hun eigen reflectie op het onderzoeksgebied: zo kunnen plaatsen als Kampen, Vollenhove en Lemmer gekenmerkt worden als maritieme centra in de regio, en geldt Kampen verder ook als een overslagplaats (Zuiderzee – IJssel). Daarnaast kan het maritieme cultuurlandschap ook worden opgesplitst in verschillende aspecten (landschappen) die helpen bij het begrijpen en systematiseren van de te bestuderen datasets. Het gaat daarbij in hoofdzaak om landschappen verwant aan economie (levensonderhoud), transport, grondstoffen en macht/politiek. Daarnaast zijn er ook meer immateriële aspecten denkbaar zoals het cognitieve- en rituele landschap en het hedendaagse landschap dat bijvoorbeeld is gericht op vrije tijd en toerisme.

Op basis van de verschillende hiervoor genoemde facetten en aspecten kan worden gesteld dat het concept van het maritieme cultuurlandschap het beste kan worden bestudeerd door datasets te combineren en de resultaten daarvan te koppelen aan de aspecten van het landschap waartoe ze behoren. Ook kan worden geconcludeerd dat er geen eenduidige methode bestaat om het concept toe te passen in archeologisch onderzoek: niet alleen is het concept nog steeds in ontwikkeling, de veelzijdige aard ervan maakt dat de kracht van het concept enigszins verwatert. In andere woorden, het ontbreken van duidelijke grenzen met betrekking tot de interpretatie en toepassing van het concept van het maritieme cultuurlandschap zorgt ervoor dat het té holistisch is voor het ontwikkelen van een methodiek die nieuwe inzichten over Zuiderzeegroei in de late middeleeuwen kan blootleggen. Om die reden is voor het huidige promotieonderzoek besloten om twee duidelijke grenzen toe te kennen: een ruimtelijke (Noordoostpolder) en een chronologische (late middeleeuwen). Ook is gebleken dat het concept beter toepasbaar is op de jongere onderzoeksperioden (19e en 20e eeuw): hiervoor zijn veel meer gegevens beschikbaar als gevolg van de zeer diverse soorten bronnen en het relatief kleine tijdverschil (100 tot 150 jaar), wat beter bij de veelzijdige aard van het concept past. Dit wil echter niet zeggen dat het maritieme cultuurlandschap enkel toepasbaar is op deze perioden. Het is voor oudere perioden namelijk onvermijdelijk dat minder (volledige) contextuele, materiële en immateriële gegevens beschikbaar zijn; voor het toepassen maritieme cultuurlandschap zou daarom moeten gelden 'het volledig implementeren van het concept, voor zover het bronmateriaal dit toelaat'.

Laatmiddeleeuwse verdronken nederzettingen in het noordoostelijk Zuiderzeegebied (H4)

Dit hoofdstuk heeft als doel om verdronken en geërodeerde culturele (archeologische) resten in het noordoostelijke Zuiderzeegebied te herkennen en te karakteriseren, waarbij de focus specifiek op verdronken laatmiddeleeuwse nederzettingen ligt. Voor het identificeren van dergelijke verdronken plaatsen is een grote hoeveelheid middeleeuws archeologisch vondstmateriaal uit het onderzoeksgebied ruimtelijk in kaart gebracht en geanalyseerd. Uit de ruimtelijke spreiding bleek al snel dat er sprake is van verschillende hoge vondstconcentraties in het onderzoeksgebied. Om vast te kunnen stellen of deze concentraties verdronken nederzettingen vertegenwoordigen, moet voldaan worden aan verschillende eisen (hoeveelheid, dichtheid ten opzichte van omgeving, samenstelling van het materiaal). Na toepassing van deze eisen bleken in totaal zeven nederzettingslocaties over te blijven, waarvan drie reeds bekend zijn (Urk, Schokland en Kuinre). De vier overige locaties representeren de vermoedelijke resten van de dorpen *Marcnesse*, *Nagele* en *Fenehuysen I* en *Fenehuysen II*, die op basis van op deze locatie aangetroffen aardewerkvondsten grotendeels uit de late middeleeuwen (ca. 12e tot 14e eeuw) dateren. Nabij de meest oostelijke nederzettingslocatie werden op luchtfoto's, satellietbeelden en hoogtekaarten ook rechtlijnige antropogene sporen ontdekt die grotendeels in het Kuinderbos bleken te liggen. Archeologisch onderzoek dat naar aanleiding van deze ontdekking in 2017 op deze locatie is uitgevoerd, toont aan dat er sprake is van een laatmiddeleeuws stelsel van sloten dat diende voor het ontginnen en afwateren van het land en het begrenzen van (landbouw)percelen. In de slootvullingen is relatief veel archeologisch nederzettingsmateriaal aangetroffen dat vermoedelijk heeft toebehoord aan het verdronken dorp *Fenehuysen* dat daar tussen ca. 1300 en 1700 zal hebben gelegen (dit blijkt ook ten dele uit historische kaarten). Het gaat daarbij mogelijk om de tweede locatie van het dorp, aangezien enkele kilometers verder naar het zuiden een andere vondstconcentratie is aangetroffen die, op basis van historisch kaartmateriaal, ook *Fenehuysen* wordt genoemd. Verder onderzoek naar de archeologische sporen in het Kuinderbos zou kunnen uitwijzen of er nog meer fysieke resten/sporen van het verdronken dorp in de venige bodem bewaard zijn gebleven.

Waar zijn de Zuiderzeewrakken gebleven? (H5)
Al enkele decennia lang hebben maritiem archeologen, overheden en archeologische bedrijven gewerkt met een gedateerde en onnauwkeurige dataset (met name doelend op locatie en aan- of afwezigheid) van scheepswrakken uit het Zuiderzeegebied (hoofdzakelijk Flevoland). De informatie van deze wrakken is verspreid over enkele databases (zowel analoog als digitaal) die ieder verschillende aantallen wrakken en daaraan gekoppelde primaire gegevens presenteren. Om toch tot een helder en nauwkeurig overzicht te komen van alle scheepswrakken die zijn ontdekt in de voormalige Zuiderzee, is in 2012 besloten om alle primaire gegevens te verzamelen en te verwerken in een nieuwe database: de Scheepswrakken Database Flevoland (SDF). In dit hoofdstuk wordt de derde versie van de SDF gepresenteerd die in hoofdzaak is gemaakt om de kennis over de huidige situatie van de wrakken (*in situ*, verwijderd, onbekend) en de nauwkeurigheid van de coördinaten die de wraklocaties aanduiden (exact, geschat, onbekend) te toetsen. Daarvoor is gebruik gemaakt van de originele opgravingsdocumentatie van de scheepswrakken waarin relatief nauwkeurige beschrijvingen van de wraklocaties staan vermeld. De manier van beschrijven bleek echter enigszins problematisch te zijn aangezien de toenmalige lokale topografie (met name de aanwezige drainagegreppels en de afstanden tot kavelsloten) werd gebruikt, die vandaag de dag sterk is veranderd. Met behulp van historische luchtfoto's, LIDAR-data en satellietbeelden konden locaties van voormalige drainagegreppels en kavelsloten alsnog worden herleid waarna in een GIS de originele wraklocaties van veel scheepswrakken kon worden achterhaald. Tijdens het raadplegen van de historische luchtfoto's bleken tientallen wraklocaties ook daadwerkelijk daarop zichtbaar te zijn, zij het als een verkleuring, een verstoring of zelfs als opgravingsput. De zichtbare wraklocaties bleken in alle gevallen exact overeen te komen met de beschrijvingen van de wraklocaties in de opgravingsdocumentatie, hetgeen de nauwkeurigheid en transparantie van de toegepaste onderzoeksmethode kon onderstrepen. De nieuwe versie van de SDF bevat daarom gegevens die een veel nauwkeurigere verspreiding en dichtheid van wraklocaties in de provincie Flevoland zichtbaar kunnen maken in het kader van ruimtelijk maritiem archeologisch onderzoek. Daarnaast kan de database ook worden gebruikt voor maritiem archeologisch erfgoedbeleid. Alleen op die manier kunnen de nog in de voormalige zeebodem aanwezige wrakken effectief worden beschermd.

Heren, handelaren en boeren (H6)
Dit hoofdstuk behandelt de ontwikkeling van de nederzettingen en de bewoners daarvan in het noordoostelijke Zuiderzeegebied tussen circa 1100 en 1400 n. Chr. Vooralsnog is weinig aandacht besteed aan degenen die zich in de middeleeuwen in het onderzoeksgebied vestigden. Ze worden gezien als acteurs in een landschap (het toneel), waarbij de focus ligt op hun gedrag en handelingen: wie waren ze, hoe leefden ze, welke keuzes maakten ze en wat waren de consequenties daarvan in een relatief dynamische omgeving? Deze menselijke aspecten zijn bestudeerd vanuit een archeohistorisch perspectief, wat inhoudt dat inzichten uit archeologische en historische studies zijn gecombineerd en geanalyseerd. Het eerste deel van het hoofdstuk biedt een overzicht van de algemene ontwikkeling van het landschap in het onderzoeksgebied, waarvoor hoofdzakelijk gebruik is gemaakt van paleogeografische en archeologische studies: het neerzetten van het toneel was nodig om vervolgens de acteurs te kunnen belichten.

Het tweede deel van het hoofdstuk zet de nederzettingen en de bewoners van het studiegebied centraal. Daarvoor zijn vier verschillende nederzettingen en hun bewoners in detail bestudeerd, waarbij iedere nederzetting een bepaald aspect van het onderzoeksgebied vertegenwoordigt: Kuinre (een nog bestaande nederzetting langs de voormalige oostkust), Kampen (een opbloeiende handelsplaats nabij de monding van de IJssel), Urk (een continu bewoonde plaats dat wist te overleven als eilandrest midden in de Zuiderzee) en Nagele (een kustnederzetting die in de 13e eeuw verdronk in de Zuiderzee). Aan de hand van de vier casestudies wordt duidelijk dat het onderzoeksgebied al in de 10e en 11e eeuw werd bevolkt. De eerste bewoners die neerstreken richtten zich op het ontginnen en cultiveren van het land, stichtten kleine nederzettingen en leefden als boeren. In de 13e en 14e ontstond meer differentiatie in werkzaamheden, welvaart en ontwikkeling wat leidde tot verschillende sociale-economische gradaties: heren, handelaren en boeren. Dat bijvoorbeeld juist Kampen opbloeide en Nagele verdronk was enerzijds het gevolg van verschillende fysisch-geografische factoren zoals de ondergrond en locatie van de verschillende nederzettingen (en daarmee kwetsbaarheid voor stormvloeden, bereikbaarheid), en anderzijds afhankelijk van de economische focus van een gemeenschap in combinatie met de competenties en interesses van de plaatselijke heersers.

Dankwoord

Daar waar voor velen het schrijven van een proefschrift wordt gezien als een 'lastige opgave', durf ik hier wel te opperen dat het een koud kunstje was vergeleken met het schrijven van een dankwoord: probeer maar eens niemand te vergeten. Maar hier zit ik dan toch, de laptop op schoot, een zak snoep en chips binnen handbereik en een verhaal van dank in gedachten. De namen die daarin voorbij komen zijn ongetwijfeld niet die van alle personen die hier een plekje hadden verdiend; daarvoor alvast mijn excuses.

Dit proefschrift kan worden gezien als het eindproduct van vele jaren onderwijs, studeren en schrijven, maar de weg ernaartoe was alle behalve recht: van Havo, naar Vwo, naar Landmacht, naar Rechten met als tweede studierichting Archeologie 'omdat het mij wel grappig leek'. Hoe impulsief de keuze voor een studie Archeologie ook mocht zijn, de interesse voor het vakgebied is altijd wel aanwezig geweest. Van het tekenen van landschappen op de basisschool (mijn eerste paleogeografische kaarten) tot het zoeken naar kleipijpen, aardewerk en dierlijk botmateriaal op 'de Bulten' in Nijland. Dit dankwoord leidt daarom ook terug naar de basis van alles: de basisschool De Earste Trimen in Nijland. Met name de schitterende historische verhaalvertellingen van meester Roel Faber en de wijze lessen van meester Ruurd Smink zal ik nooit vergeten. Ook op de Bogerman in Sneek (middelbare school) ging mijn interesse (sport even niet meegeteld) met name uit naar het vak Geschiedenis. De levendige en humoristische lessen van mevrouw Sytske Veltman (die ik ook tijdens mijn studie in Groningen nog regelmatig heb gesproken) hebben absoluut hun bijdrage geleverd richting dit promotieonderzoek.

Toen ik na afronding van de middelbare school en na enkele omzwervingen voor de eerste keer het Groninger Instituut voor Archeologie aan de Poststraat 6 in Groningen binnenstapte, wist ik al snel: hier blijf ik wel (lees: wél) even hangen. Ik heb in al die jaren ontzettend veel mensen leren kennen die op allerlei manieren een rol hebben gespeeld in de weg naar dit proefschrift. Vanuit mijn studiejaar noem ik met name graag mijn Fryske freonen Marco en Theun en mijn kameraad Folkert. Ik zal ook Gudo, van wie we veel te vroeg afscheid hebben moeten nemen, nooit vergeten. Samen studeren creëert absoluut een band, maar deze wordt pas echt sterk 'in het veld'. Ik denk ook even terug aan de mooie studententijd in Groningen met mijn huisgenoten Jacob Bandstra, Jakob Bosma en Henry Ong. Ik kan er verder absoluut niet omheen om al die legendarische opgravings- en survey-campagnes in Crustumerium tussen 2009 en 2014 te noemen. Onder de bezielende leiding van Peter, Bert en Barbara hebben we in al die jaren heel wat meegemaakt. Ik denk aan de grote meloenwedstrijd, zwempartijen (in het vlak), spooktochten, cheeseburgers, Maximus, Bassie, George Baker, de ***-shower, etc. De namen die hier sowieso moeten worden genoemd zijn Jord, Tom, Evelien, Paula, Nikolaas, Gert, Siebe, Tim en Jorn. In 2011 begon ook mijn maritieme specialisatie met de zomeropgravingen van de International Fieldschool for Maritime Archaeology in Flevoland (IFMAF) waaraan ik ieder jaar deel heb genomen. Ook daarbij horen mooie verhalen waarin met name de namen van mijn maritieme collega's Gerrit en Koen regelmatig 'opduiken'. Verdere dank gaat uit naar de twee landmeetbreinen van het GIA: Erwin Bolhuis en Sander Tiebackx. Het ruimtelijk onderzoek in dit proefschrift vindt namelijk zijn grondslag in het leren werken (en daardoor ruimtelijk denken) met meetlint, waterpas, Total Station en uiteindelijk GPS. Ik vergeet daarbij uiteraard ook niet alle mooie gesprekken over de FC in de kantine of op de tekenkamer. Ik bedank Sander ook nog in het bijzonder voor al zijn inzet bij de veldwerkprojecten die tijdens mijn promotietraject zijn uitgevoerd. Van de scheepsverkenning in Rutten in de herfst van 2016, naar de proefputten in het Kuinderbos in de zomer van 2017 (teken, teken en nog eens teken) tot de ruim drie maanden durende scheepsopgraving van de 'Queen Anne' in de zomer van 2018, met elke ochtend een verse bak koffie in de bus: ACTION SQUATR! Ik hoop dat we nog vaak samen in het veld mogen staan. Er zijn ook verschillende collega's waarmee ik door de jaren heen goed heb kunnen praten over proefschrift-gerelateerde zaken. Ik noem daarbij in het bijzonder Mans Schepers, René Cappers, Jørgen van Beek en Theo ten Anscher. Eén persoon verdient hierbij nog een eigen aankondiging: hij staat bekend als de 'Kim Cohen van de archeologie' en als mijn eeuwige rivaal: Stijn Arnoldussen. Stijn, ooit zal je inzien waarom scheepswrakken mooier zijn dan grafheuvels, Celtic Fields en kloosterterreinen. Ik dank je voor alle projecten die we samen hebben uitgevoerd, voor al je advies en de barbecues in Haren. Treur niet, je bent nooit te oud om de overstap naar maritieme archeologie te maken. Er zijn ook tientallen (ex-)studenten die door hun deelname aan verschillende deelprojecten van dit onderzoek een bijdrage aan het eindresultaat

hebben geleverd, al was het alleen al door het graven van kuilen in het Kuinderbos zodat ik de plaatselijke bodemopbouw kon documenteren; ja, het leven van een promovendus is zwaar. Han Vastenhoud, Rik Hijlkema, Tayla van Ingen, Remco Keegstra, Thom Brongers en Jelke Take hebben in dat opzicht onuitwisbare herinneringen achtergelaten (ja, ook tijdens de excursie naar Schotland).

Ik maak dan nu een sprong richting het promotieonderzoek zelf; ook daar valt nog het één en ander over te zeggen. In de eerste plaats wil ik de Nederlandse Organisatie voor Wetenschappelijk Onderzoek danken voor het toekennen van de subsidie waarmee dit project uitvoerbaar is gemaakt. Ook dank ik de Vereniging voor Terpenonderzoek en de Stichting H-en-M voor hun subsidie waarmee de resultaten van dit onderzoek zijn gepubliceerd als boekwerk. In het bijzonder ben ik Annet Nieuwhof zeer erkentelijk voor haar hulp en advies met betrekking tot het aanvragen van verschillende subsidies. Verdere dank gaat uit naar uitgever Roelf Barkhuis en Hannie Steegstra voor de prachtige opmaak van dit werk.

In de tweede plaats wil ik in alle vanzelfsprekendheid en willekeurige volgorde mijn promotoren bedanken voor hun begeleiding en geloof in dit project. Daan, onze overlegmomenten, jouw bestuurlijke- en organisatorische blik tezamen met je kennis over Flevoland als onderzoeksgebied heeft ervoor gezorgd dat dit onderzoek altijd kon worden bijgestuurd indien dat nodig was. André, als eerste promotor heb je niet alleen een grote bijdrage geleverd aan dit onderzoek, je hebt er ook voor gezorgd dat ik mij kon specialiseren in de maritieme archeologie. Je gaf me daarbij de ruimte om ideeën uit te werken tot onderzoeken, waaronder deze. Het is een eer om de eerste persoon te zijn die onder jouw hoede mag promoveren. Theo, jouw enthousiasme, verfrissende invalshoek vanuit de historie van het landschap, ideeën, brainstormmomenten en nakijkrondes hebben dit onderzoek naar een hoger niveau getild. Kim, ook wel bekend als de 'Stijn Arnoldussen van de fysische geografie', jouw invloed is overal merkbaar in dit proefschrift, niet alleen met betrekking tot bodem en landschap, maar ook in de archeologische en historische interpretaties. Ik heb veel geleerd van je inzicht en opbouwende (en uitgebreide – soms heerlijk sarcastisch) commentaar, en wil de lezer een mooi voorbeeld dan ook niet onthouden: '*Natural defense is een vreselijk menselijk perspectief; alsof de natuur daar mee bezig was*'. Ik hoop dat we in de toekomst nieuwe projecten samen mogen uitvoeren! Uiteraard dank ik ook de drie leden van de beoordelingscommissie (Jerzy Gawronski, Gilles de Langen en Hans Renes) voor hun bereidheid om dit proefschrift te beoordelen en natuurlijk voor hun positieve oordeel. Verder noem ik graag mijn maritieme collega's Christer Westerdahl, Brad Duncan, Wouter Waldus, Hans van Westing, Alice Overmeer, Johan Opdebeeck en Harold Broekmans; evenals het 'historische-clubje' van de Noordoostpolder bestaande uit Gerrit van Hezel, Aaldert Pol, Anne Post, Kees Groothoff en Klaas die Vries; en de AWN-leden van Flevoland (in het bijzonder Jan Boes en Archie Ermans) die ook allemaal hun bijdrage leveren aan de maritieme archeologie. In het bijzonder noem ik vanuit dit rijtje ook nog Dick Velthuizen: in het veld bij uitstek een vaderfiguur, sfeermaker en liefhebber van de polders.

Dan kom ik nu uit bij de personen die de afgelopen jaren het dichtst bij mij hebben gestaan. In de eerste plaats dank ik Bob, Maarten, Michiel en Angela voor alle vakanties, concerten, potjes ezelen, bandoefeningen en Buitenlandse-Bieravonden; ze zorgden steeds voor de juiste afleiding. Ik noem in het bijzonder ook mijn beste vrienden – en tevens paranimfen – Sebastiaan Berswerda en Remco Bronkhorst. Sabbes, de looptijd van dit promotieonderzoek is slechts een fractie van de looptijd van onze vriendschap. Ik dank je voor alle tijd die we met elkaar doorbrengen, of het nou tijdens het sorteren van post, op bezoek in Rome, op de bank met een potje Fifa of bij het Arsenaal in Naarden is; het is altijd goed. Remco, ik noem je voor de verandering een keer niet als laatste. Ik ben ontzettendt blij dat er op het GIA nog iemand rondliep met hetzelfde verziekte gevoel voor humor als mij. Het zegt eigenlijk al genoeg dat we van Sarah niet samen in één tombe mochten werken. Had je trouwens al gezien dat er in de vorige zinnen enkele fouten staan? Ik wens je veel succes met het afronden van je eigen promotieonderzoek en kijk uit naar je terugkomst in Nederland.

Ten slotte wil ik graag mijn familie in dit dankwoord noemen, ook al hebben ze naar vermoeden geen flauw idee wat ik de afgelopen jaren heb uitgevoerd (en dat is prima). Ze zijn er in die jaren namelijk wel altijd geweest, en daarvoor ben ik ze dankbaar: Maaike, Wietske, Tjeerd, Corneliske (Billy) en Ysbrandus, bedankt. Ik dank ook graag mijn schoonfamilie voor hun belangstelling en steun tijdens het promotietraject en noem daarbij in het bijzonder de naam van Sigurd. Ik zou mijn ouders in dit dankwoord bij wijze van spreken kunnen overslaan: mijn dank aan hun adres laat zich moeilijk in woorden uitdrukken. Hun onvoorwaardelijke steun, geloof en belangstelling heeft mij altijd gesterkt: heit en mem, tige, tige tank!

Dan blijft er nog één persoon over om te noemen, en dat is mijn lieve vriendin Morvenna. Soms voelt het voor mij alsof we dit promotieonderzoek samen hebben doorlopen, en in zekere zin is dat ook zo. Wat hebben we veel meegemaakt in de afgelopen jaren. Ik ben je ontzettend dankbaar voor alles: zonder jou had ik nooit een punt achter deze allerlaatste zin kunnen zetten.

Yftinus