

# 1 General introduction

## 1.1 Framework of the project ‘Biography of the New Land’

One of the largest enterprises undertaken by the Dutch government in the 20<sup>th</sup> century was the reclamation of the Zuiderzee, an inlet of the North Sea that reached to the central part of the Netherlands. The Zuiderzee region was drained to protect its inhabitants against the influence of the sea and to serve agricultural and economic purposes. Furthermore, reclaiming the area was also of major importance to restore the international reputation of the Netherlands as a modern nation (De Pater 2011). Although the first plan to drain the Zuiderzee area originated from the 17<sup>th</sup> century (see Stevin 1667), the idea to reclaim the area did not take shape until halfway the 19<sup>th</sup> century. Around AD 1850, experience gained with the reclamation of Lake Haarlem (western Netherlands) (Jeurgens 1991) sparked renewed interest in the drainage of the Zuiderzee. Although several plans were made to reclaim the Zuiderzee region since that time, it was the design by Cornelis Lely from 1891 that was accepted in slightly modified form by parliament in 1918 (Wortman 1926) after a long political struggle (see De Pater 2011 for an overview). This struggle ended when the storm surge of 1916 flooded large parts of the Zuiderzee region, hereby shifting the attention for reclamation of the region to the forefront. The influence of the North Sea plays a major role in the history of the area. Not only as the impetus for draining the area, but also because life at sea and the accompanying struggle against water were inherent in the cultural identity of the population. For example, at Schokland (located in the northern part of the polder that is called the province of Flevoland since 1986, central Netherlands; Fig. 1), storm surges eroded parts of the former island, causing its inhabitants to live and struggle with water (see Chapter 6 for an overview).

With the construction of the ‘Zuiderzee Works’ (embankments and Flevoland polder) to reclaim the area, the physical environment of the region changed considerably. Traditions of living and working at sea, and the existence attached to this in the Zuiderzee villages, were (partly at least) transformed into a thing of the past. The memory of that past has eventually been handed down in the shape of monuments, literature, photography, oral history and – last but not least – museums. The ‘Zuiderzee Works’, in contrast, have grown into an important icon of national identity and of the Dutch water management history. New inhabitants built a new livelihood in Flevoland, where community and landscape gradually fused into one distinctive region with its own history, identity and potential for development. In addition to the development of a ‘new’ history, the reclamation of the former Zuiderzee area also led to an extension of the region’s history further back in time. Prehistoric archaeological sites were found, such as Schokland-P14 (possibly Final Palaeolithic—~2500 BP, Ten Anscher 2012); N23/N307 (9300–6000 BP, Hamburg *et al.* 2012); Urk-E4 (~7850–6300 and ~5400–4600 BP, Peeters 2007); Hoge Vaart – A27 (7800–5300 BP, Hogestijn & Peeters 2001, Peeters 2007) and those within the Swifterbant area (e.g. Van der Waals & Waterbolk 1976, Raemaekers 1999; ~7800–4600 BP, Peeters 2007) (Fig. 1). Apart from these prehistoric remains also forgotten medieval ship-wrecks were located (see Van Popta 2015 for an overview). Furthermore, landscape phenomena (e.g. glacial till ridges) that were formed by the giant ice sheet that covered Flevoland around 150,000 years ago are still present at the surface at some locations (De Waard 1949). It appeared that the ‘new’ land was much older than expected. The deep history of Flevoland is critical to deal with the conceptual ‘emptiness’ of the area that its inhabitants and visitors experience. Showing this history to the general public is a central aim of the Nieuw Land Erfgoedcentrum (Provincial museum of Flevoland in Lelystad, The Netherlands).

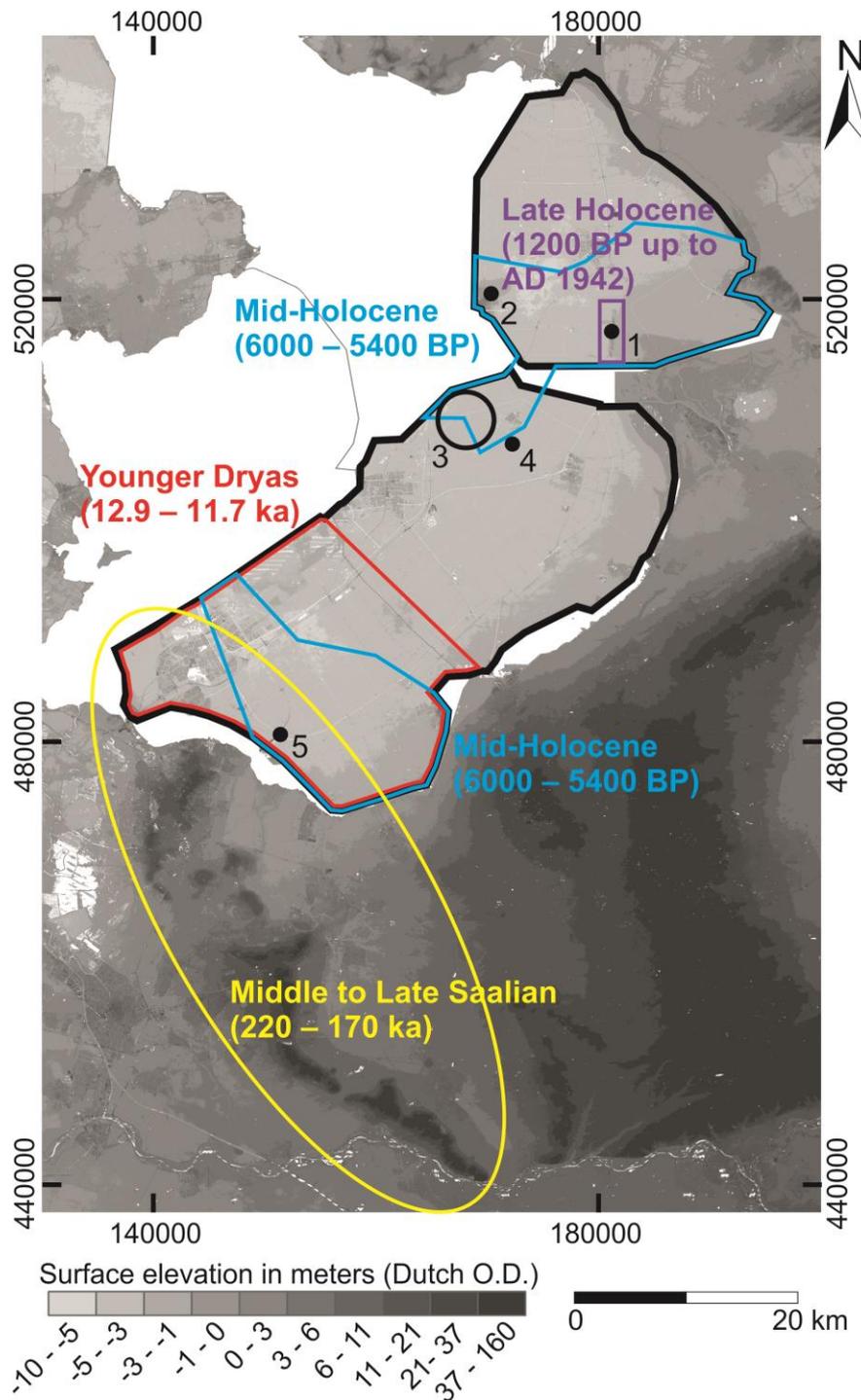


Figure 1 Digital surface elevation map of the central Netherlands (obtained from [www.ahn.nl](http://www.ahn.nl)) with the selected study areas for each period of investigation and the location of prehistoric archaeological sites in Flevoland. Distribution of sites compiled from Peeters (2007) and Hamburg *et al.* (2012): (1) Schokland-P14; (2) Urk-E4; (3) Swifterbant area; (4) N23/N307; (5) Hoge Vaart - A27. The map has a 'Rijksdriehoekstelsel' coordinate system and the elevation is indicated in meters relative to Dutch Ordnance Datum (O.D., ~ mean sea level).

Due to excellent preservation conditions information on habitation history and landscape evolution is well preserved. Although there are numerous studies that deal with this history (e.g. Modderman 1945, Van der Heide & Wiggers 1954, Raemaekers 1999, Hogestijn & Peeters 2001, Peeters 2007, Hamburg *et al.* 2012, Ten Anscher 2012), these investigations focus on the Holocene period. Studies that deal with the potential of the area for archaeological remains dating to the Saalian and Weichselian do not yet exist.

Furthermore, although there are a few studies that combine archaeology with the earth sciences to deal with the hominin – environment interaction of the area (e.g. Van der Heide & Wiggers 1954, Peeters 2007), these studies focus on a short time frame (i.e. few hundred to few thousand years). However, the good preservation condition of the subsurface of Flevoland and its rich archaeological record provides an excellent case study to investigate the long-term social and environmental history of the area.

Within the framework of its ‘scientific + program’ the Nieuw Land Erfgoedcentrum has stimulated various research programs to improve the fundamental scientific knowledge of the past and present of Flevoland. These research programs are carried out in collaboration with Dutch universities (e.g. University of Groningen, Delft University of Technology, University of Amsterdam, Radboud University Nijmegen and Vrije Universiteit Amsterdam) and are executed in the form of PhD and Postdoc research programs. The results of these programs are used to inform the general public on the past and present of the former Zuiderzee region (via exhibitions, lectures, education programs, etc.) and maintain and develop the cultural heritage of the region ([www.nieuwlanderfgoed.nl/museum](http://www.nieuwlanderfgoed.nl/museum)).

One of the research programs within the ‘scientific + program’ is the project ‘Biography of the New Land’. It started on the 1<sup>st</sup> of September 2009 and forms a collaboration between the Research Institute for Heritage and History of the Cultural Landscape and Urban Environment (CLUE) of the Vrije Universiteit Amsterdam and the Nieuw Land Erfgoedcentrum (Lelystad).

The overall aim of the project ‘Biography of the New Land’, with five subprojects (PhD projects) in various disciplines, is to reinforce the coherence and applicability of scientific research into the (pre)-history, development and heritage of Flevoland. These various disciplines are: (1) cultural history, (2) water management history, (3) economics, (4) public administration and (5) geoarchaeology. The project contains three broad (pre)historical themes (subprojects 1, 2 and 5) and two additional studies that are specifically aimed at translating historical knowledge into current social applications (subprojects 3 and 4).

The dissertations of the PhD projects have an added value for the Erfgoedcentrum in both scientific and educational sense. Furthermore, in each PhD project the educational aims and knowledge ambitions of the Erfgoedcentrum are taken into account. These aims and ambitions are:

- to conduct research to inform the general public on the (pre)history of Flevoland and the reclamation of the Zuiderzee;
- to provide innovative research results for presentations in the museum of the Erfgoedcentrum or in the polders themselves. These results can also be used for sustainable conservation and development of the heritage in Flevoland;
- to realise a general increase in the knowledge of the past and present of Flevoland.

The project includes dissemination of the (preliminary) results through the means of seminars (for the general public), held in April 2011 and November 2014 at the Nieuw Land Erfgoedcentrum in Lelystad. The following provides a glimpse on the four other PhD projects within the research program ‘Biography of the New Land’ (subprojects 1–4). Subsequently, the aim and outline is given of this PhD thesis (subproject 5: geoarchaeology).

The dissertation on the cultural history of the Zuiderzee region deals with the question how Flevoland as a physical and imagined landscape is shaped by local heritage practices. Based on the idea that cultural heritage contains stories and that through these stories people feel connected with their local surrounding, leading to a local identity, the stories that are being told about heritage form the key in this study (Van der Maas 2014).

The PhD project dealing with the history and perception of floods in the Zuiderzee area focuses on the memory of those floods. This memory seems to have faded away with the construction of the Zuiderzee works. A comparison between the perception and memory of the floods of AD 1675, 1775, 1776, 1825 and 1916 forms the red thread of this survey (Pieters, in prep.).

The public sector plays a key role in the development and maintenance of cultural heritage. However, who or what determines which heritage is worth developing and preserving? The aim of the PhD project dealing with the economic evaluation of heritage is to assess the value of cultural heritage for society. To determine this value the recreational behaviour of visitors was investigated (Van Loon 2014).

Apart from economic challenges, the maintenance and development of cultural heritage is also affected by the different discourses of actors involved in heritage policy decisions. The PhD project on governance structure of heritage management in Flevoland focuses on the clash between the different discourses and how this affects heritage policy regarding selection, development and maintenance of heritage (Rodenberg, in prep.).

## 1.2 Aim and outline of this thesis

Both the professional world (historians, geographers and archaeologists) as well as policy makers and administrators are not sufficiently aware that the subsurface of Flevoland consists of a stacked sequence of stratigraphic environments that provide evidence of multiple past landscapes. In addition, evidence for the nature of hominin activity in these landscapes is present. The information on past landscapes and hominin activity is exceptionally well-preserved because Flevoland was covered by water for almost a millennium (until the reclamation in the 20<sup>th</sup> century), hereby limiting distortion of the subsurface by anthropogenic impact. Furthermore, partly as a result of the revised Monuments Act (since 1988; see Willems 1997 for an overview of archaeological heritage management in the Netherlands), there is a growing number of archaeological and geological reports that contain a wealth of data and offer good perspectives for a synthesis on the subsurface of the polders. The current research has four objectives. The project aims to demonstrate that:

- the substratum of Flevoland consists of a stacked stratigraphic sequence of different landscapes that contains valuable information on hominin activity;
- this archive is relatively very well preserved because of the sedimentary environment and the depth below ground level;
- a succession of well-preserved ‘relict landscapes’ can be found in this archive over large areas, containing valuable information about landscape development, hominin habitation and landscape exploitation in the region;
- insight into the geological composition of the subsurface is necessary to place known archaeological remains in the context of the landscape.

The objectives of this research are studied by respectively a geological and an archaeological approach which were combined: i) Landscape reconstructions of the past 170,000 years, with ii) The presence or absence of traces of hominin activity in a changing landscape.

To attain the objectives of this research four periods of investigation are selected that fall within the last 220,000 years. For each investigated period a study area in Flevoland was selected (Fig. 1). Areas adjacent to Flevoland were included in the research whenever this was necessary to reconstruct the landscape and habitation history of Flevoland for a selected period. The areas and time periods that were selected contain important landscape transformations and (possible) traces of hominin activities. From old to new, the four periods of investigation are:

- Late Middle to Late Saalian (220–170 ka, ka = thousands of years before AD 1950 (BP); early Middle Palaeolithic)
- Younger Dryas (12.9–11.7 ka; late Final Palaeolithic)
- Mid-Holocene (6000–5400 BP; Early Neolithic)
- Late Holocene (1200 BP up to AD 1942; Medieval period and Modern history)

Together, these four periods cover the landscape with the oldest known traces of hominin activities in the central Netherlands (late Middle to Late Saalian) up to AD 1942, the year that the reclamation of the first polder (Noordoostpolder, northern part of Flevoland) was completed.

Chapter two of this thesis, *A niche construction approach on the central Netherlands covering the last 220,000 years*, gives an overview on landscape development and habitation history of each of the four periods of investigation. The time frames between the periods of investigation are discussed briefly (Van den Biggelaar & Kluiving 2015).

In Chapter three, *Gravel size matters: Early Middle Palaeolithic artefacts made from local Rhine and Meuse deposits in the central Netherlands*, an overview is given of the landscape setting of the central Netherlands during the late Middle to Late Saalian. Furthermore, it is assessed whether the gravel fraction of the Urk Formation along the line Rhenen – Almere (central Netherlands) is large enough for the production of artefacts (Van den Biggelaar *et al.* accepted).

In Chapter four, *Predictive modelling of Younger Dryas archaeological remains in southern Flevoland (central Netherlands)*, an inductive predictive modelling approach is used to select areas in southern Flevoland (central Netherlands) which are most likely to contain archaeological remains dating to the Younger Dryas (YD) (12.9–11.7 ka) (Van den Biggelaar *et al.* 2016).

Chapter five, *Landscape potential for the adoption of crop cultivation: Role of local soil properties and groundwater table rise during 6000–5400 BP in Flevoland (central Netherlands)*, presents a geoarchaeological perspective on the adoption of crop cultivation in wetland areas. To better understand the reason for this adoption in the Eem and IJssel/Vecht valleys (Flevoland), the mid-Holocene inundation history and soil condition of these valleys were investigated (Van den Biggelaar *et al.* 2015).

In Chapter six, *Storms in a lagoon: Flooding history during the last 1200 years derived from geological and historical archives of Schokland (Noordoostpolder, The Netherlands)*, the clay sequence of Schokland was studied to reconstruct the island's flooding history during the last 1200 years (Van den Biggelaar *et al.* 2014).

Chapter seven, *Optical dating of Late Holocene storm surges from Schokland (Noordoostpolder, The Netherlands)*, provides OSL dates of the sandy laminae of Late Holocene storm surges in the clay deposit on the former island Schokland. These dates improve the age model of the island's flooding history during the last 1200 years (Van den Biggelaar *et al.* in prep.).

In Chapter eight, *General discussion*, the main questions and results of this dissertation are discussed. Furthermore, this chapter also presents directions for future research (Van den Biggelaar *et al.* in press).

### 1.3 Synergy between archaeology and the earth sciences

Since the first appearance of the term geoarchaeology in 1973 (Butzer 1973), there is a growing interest in studies that bridge the interface between archaeology and the earth sciences (see e.g. Goldberg *et al.* 2001, Goldberg & Macphail 2006, Rapp & Hill 2006, Butzer 2008, Diskin *et al.* 2013, Engel & Brückner 2014, Kluiving *et al.* 2015). In most of these studies geoarchaeology is viewed as a discipline that uses earth science methods to answer archaeological questions. However, as argued by Butzer (2008), geoarchaeology should go beyond this. Geoarchaeology should be used to study the interaction between hominin behaviour and landscape change. Understanding this interaction is of major importance to deal with current and future environmental and climatic challenges (Butzer 2008, Diskin *et al.* 2013).

Neither archaeology, nor the earth sciences as a discipline in isolation can deal with the complex interaction between hominins and their environment. Only the synergy of both disciplines makes it possible to reconstruct this interaction as due to this combination bottlenecks of both disciplines can be overcome. An example of an earth sciences bottleneck is the resolution of radiometric dating techniques (e.g.  $^{14}\text{C}$  and OSL). Archaeological material and/or historical sources could help to further constrain the age of the material dated with these techniques (see e.g. Stock *et al.* 2014). A bottleneck in archaeological studies is the scale of analysis. In these studies the focus predominantly lies at the archaeological site. However, by integrating an off-site study with the investigation at the site-level the context of the archaeological remains within the larger environment can be investigated. Therefore, a formal definition of geoarchaeology should emphasize the synergy between the earth sciences and archaeology. Such a definition is given by Engel & Brückner (2014), who indicate that geoarchaeology is the research discipline that combines concepts and methods of the natural sciences (e.g. earth sciences) with those from the humanities (e.g. archaeology) to study the interaction between humans and their environment. However, this interaction should not be limited to modern *Homo sapiens* as pre-modern *Homo sapiens* most likely also affected their environment (see e.g. Riel-Salvatore 2010). Therefore, in this dissertation geoarchaeology is defined as the synergy between archaeology and the earth sciences to deal with the interrelationship between hominins and their environment.

For the two oldest periods of investigation in this dissertation (Chapters 3 and 4), the application of this synergy is challenging due to the nature of the archaeological data. In contrast, for the two most recent periods of investigation (Chapters 5 and 6), there was sufficient data to provide new insight into this interrelationship (see Chapter 8). In addition, in Chapter 8 the hominin – environment interrelationship was compared between the four time frames investigated. A comparison of this interrelationship over long time periods (e.g. (tens of) thousands of years) can take the synergy between archaeology and the earth sciences to the next level.