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The role of water in the development of The Netherlands – a historical perspective

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Abstract. In this paper an overview is presented of the landscape development of the low-lying parts of The Netherlands. It is shown that water has played an important role in this development. Since prehistoric times, but especially since about 800 AD, man has gradually occupied the low lands along the sea and the main rivers. Through these settlements a chain of actions and reactions of man and his physical environment was set into motion. This chain of events is briefly outlined. It is stated and also illustrated that not only the characteristics of the landscape of the western part of The Netherlands, but also the organization of the Dutch society has been influenced strongly by manÕs need to cope with the omnipresence of water and the threats and opportunities posed by that. It is concluded that the outlined events can only be understood properly if interdisciplinary research takes a more prominent role than it does now.

Keywords: Historical geography; Landscape dynamics; Polder; Water management.

Introduction

The most striking geographical feature of The Netherlands is the large area which has to be protected from inundation by a system of dunes and of sea- and river dikes. Almost half of the countryÕs area lies below sea level. This low-lying part of The Netherlands once used to be a boggy wilderness. Only some thousand years ago man began to drain and reclaim the extensive peat areas (van de Ven 1993). Not only the organization of these reclamations, but also the necessity of protecting land against the sea and inland waters as well as the reclaiming of flooded areas influenced the organization of human society and strengthened the position of a central administration in the coastal areas. Irrespective of these human influences, changes in climatic conditions, sea level rise and changes in the regime and patterns of rivers had their impact upon the geological and geographical development of the Dutch landscape. It is indisputable that water played an important role in the development of landscape and society of The Netherlands.

The earliest period

During the most recent geological periods, the foundation of the Dutch landscape was laid by the flow of sediments from the catchment areas of the rivers Rhine and Meuse to the North Sea basin (Fig. 1). During the Holocene, a series of coastal barriers and tidal inlets was formed at the sea side of the Rhine-Meuse-Delta as a result of a deceleration of sea level rise. The estuaries of the Rivers Rhine and Meuse were bordered by natural levees consisting of sands and clays, and behind the tidal inlets marine sediments were deposited in the perimarine parts of the floodplain. On the landward side of these salt marshes, away from the sea, peat was formed in tidal freshwater and the bordering peat bogs (Pons 1992).

Although the lower parts of The Netherlands were not very well suited for habitation, there is evidence that at least at some places people had settled down in pre-Roman times. Local names of small streams, like the names Vennep, Jisp (both situated not far from Amsterdam), Berkel and Rotte (in the vicinity of Rotterdam) seem to point to that. These names are not named in written sources before the tenth century, but they must be much older.

Until the Roman period (56 BC - ca. 400 AD), only the higher parts of the Dutch landscape were habitable as the periodic threat of flooding prohibited large-spread occupation of the lower regions (Henderikx 1986). Only the salt marshes in the northern provinces (Friesland, Groningen) formed an exception to this rule. Since the beginning of the Iron Age (ca. 700 BC), the local people of these areas proved to be able to make a living out of cattle breeding in a saline environment. They constructed an elaborate catchment system for rain water to ensure the supply of fresh water. In order to protect their houses, movables and herds against the damaging waters of high tides and storm surges, these peoples built artificial dwelling mounds (*terp* in Dutch; plural *terpen*). As a consequence of the continuing sea level rise, it turned out to be necessary to regularly heighten these mounds. Some of them eventually reached a level of 5 m

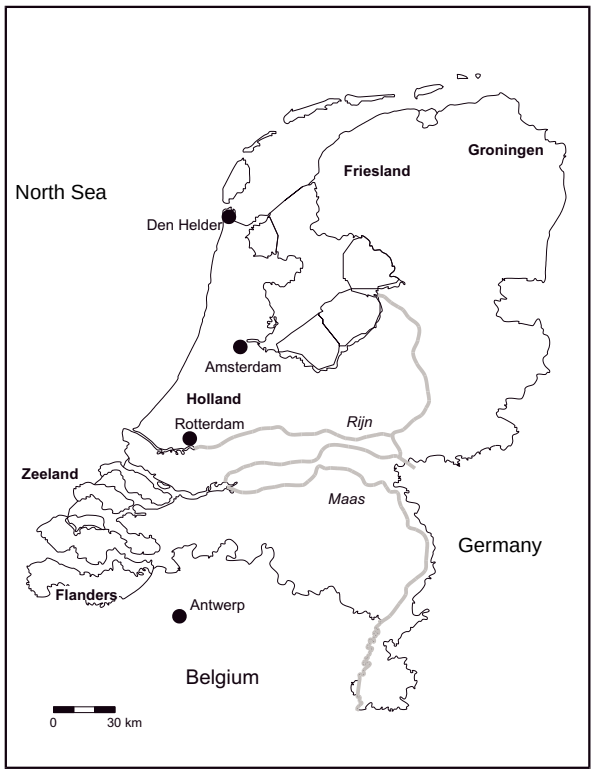

Fig. 1. Map of The Netherlands, indicating the localities mentioned in the text.

or more above NAP (Normaal Amsterdams Peil, Dutch Datum Level). Later on, the introduction of dikes made these artificial heights superfluous, but they continued to be inhabited.

In Roman times, the River Rhine was part of the northern frontier of the Roman Empire (the *limes*). South of that frontier, people were incorporated into a comparatively modern state with a sophisticated market economy. The southern part of the Dutch landscape became romanized and was more densely populated and intensively cultivated than ever before. As far as we know, at that time the first attempts were made to cultivate the waterlogged peat areas of the provinces of Vlaanderen, Zeeland and Holland through draining and soil improvement. Archaeological research has proved the existence of ditches, dikes and culverts in the peat areas of these provinces at that time. No information is available in what way and by what kind of organization these works were maintained and kept usable.

Elsewhere, in Zeeland, in the uninhabitable parts of the province, peat was cut for salt making and lime burning. In doing so, man upset the natural balance between land and sea in the coastal zone. By digging away part of the natural barrier against the sea, man provoked the sea to force itÕs way more strongly into the coastal zone. Thus, as a consequence of human action, large parts of the former peatlands were drowned. This eventually resulted in a total reshaping of the landscape in the southwestern part of The Netherlands. It changed from an extensive peat area crossed by relatively small streams into a delta consisting of various larger and smaller islands, surrounded by salt marshes and vast areas of water.

During the Dark Ages (ca. 400 AD - ca. 750 AD) the political and economic system collapsed and the population declined. This was largely the result of the fall of the Roman Empire and the resulting instability, which caused a decline of the agricultural system and enabled plundering by foreign peoples. Little is known about the pattern of habitation and landscape development during this period, but as much is clear that not all habitation disappeared in the lower parts of The Netherlands. Whereas probably most of the settlements in the Zeeland area were abandoned and possibly even most of the *terpen* in the north became uninhabited, at least some people stayed. The old water names mentioned above bear witness to this fact.

The Middle Ages

A new population growth and a restart of peat reclamation began in Carolingian times (ca. 750 AD - ca. 900 AD). It is not completely clear why people wanted to settle in these parts of The Netherlands since they were so difficult to cultivate (te Brake 1985). The fact that the best lands on the higher sandy soils in the east were already taken, combined with the fact that in the peat area the population would be virtually free from feudal duties and rules, must have had something to do with their urge to go west.

The process of reclamation by draining and soil improvement resulted in a substantial lowering of the soil surface (Borger 1992). Because these early colonists were not yet equipped with the means and the techniques to effectively counteract the negative consequences of this lowering, the sea could easily get entrance to their lands. As a consequence, many of these oldest medieval peat reclamations were drowned during the High Middle Ages (1000 AD - 1300 AD). Only the construction of dike systems could put a stop to the loss of land. The initiative for the construction of dikes was taken by the local people, not by their lords. This probably happened from around 1000 AD onward. Large dike systems stretching along larger parts of the Dutch coast came into being by voluntary cooperation of the people of the villages that needed protection. They themselves decided about the location and the way of construction and maintenance of the dikes, canals and sluices and made arrangements about the expenses.

They were forced to do so, because otherwise their continued existence would not be guaranteed and the land would be in danger. The earliest attempts to organize society against the threat of the water were probably made within the existing framework of the local government. But soon the tasks proved to be too specialized for the local administrations. For that reason, local water management boards came into existence. Their members, whether they were elected or appointed according to a rotation system, were often from the same group of people as the members of the local administrations. Nevertheless, the boards were separate bodies with an autonomous responsibility. They could enforce rules with regard to water management, fine people, or even ban them from their properties, in case the boardÕs instructions were ignored. They mostly governed an area which roughly coincided with the area of one or more municipalities.

The arrangements by the local water management boards were usually effective, but occasionally things went wrong. A good many breaches in dikes were not caused by the violence of storms and floods, but through neglect. Despite these occasional hazards, the system proved well enough to keep most of the reclaimed land dry and to enable the reclamations to go on until the 15th century, when all peat land finally had been taken into cultivation.

The earliest written documents about storm surges and floods date from Carolingian times. As a result of meticulous research on storm surges and river flooding in The Netherlands by Gottschalk (1971-1977), we are well-informed about damage done by the sea in the different parts of the Dutch coastal area. At first sight, it appears that periods of intense and less intense flooding occurred alternately. In the past, it was believed that these periods of transgression and regression took place at approximately the same time along the whole coastline. Detailed regional investigations have made clear, however, that local circumstances played an important role in the way in which transgressions and regressions have influenced the coastal zone.

As a consequence of the ongoing removal of the woodlands in the catchment areas of the Rivers Rhine and Meuse, the water masses of these rivers gradually fluctuated more widely. The increasing frequency of high water levels forced people to build dikes to protect their villages and arable fields. Thus, small water management boards came into existence also along the Rhine and Meuse, which tried to keep the river water from the fields of one or more villages. From the 12th century onward, the local dikes in the river areas were mutually connected to form regional dike systems along the rivers. Ever since the building of these dike systems, the sediments transported by the rivers could not spread widely and the narrow strip between the dikes was gradually heightened because of relatively rapid sedimentation. This did not only necessitate heightening of the dikes time and again, but also, dike breaches became ever more dangerous and more damaging.

During the 13th and 14th centuries the small water management boards developed into large, regional organizations. This increase in scale did not only happen in the coastal zone, but also in the river areas. In the coastal zone this development was accompanied by the beginning of a more offensive way of dike building. In stead of just protecting existing land against the sea, new land was reclaimed. In the 16th century the first groynes were built to strengthen the dike line at locations that were heavily threatened by the tidal flow (Fig. 2).

The improvement of the organization of the water management boards was strongly furthered by territorial lords who dominated the scene in the western parts of The Netherlands. Nevertheless, both here and elsewhere, water management remained a task of the local people, supervised by employees of the territorial lords. This particular form of self-government under detached but effective supervision formed a strong foundation for the democratic structure of the present Dutch society. Even today, the water management boards have kept their special position. In the political organization of The Netherlands they exist separated from, but are equal to the municipalities. However, the tasks of the water management boards are exclusively focused on the maintenance of dikes and the management of local and regional water systems. A dike reeve is on the same hierarchical level as a mayor.

The ongoing lowering of the water table in the polders made natural drainage increasingly difficult. From the 13th century onward, many smaller rivers in the peat area of the province of Holland were dammed near their mouths, in order to keep out the salt water and to be able to use low tides longer and better. The 13th century was also the period that the first towns were established. Population growth, together with a prospering agriculture which enabled levels of food production that surpassed the needs of the farmers themselves, made the establishment of towns possible. Several of the new towns developed around the new dams in the closed-off rivers, as these points of transshipment were suitable sites of residence for tradesmen and craftsmen. One can still recognize these dam-towns by their names, as they often carry the suffix ÔdamÕ, the best-known examples being Amsterdam and Rotterdam.

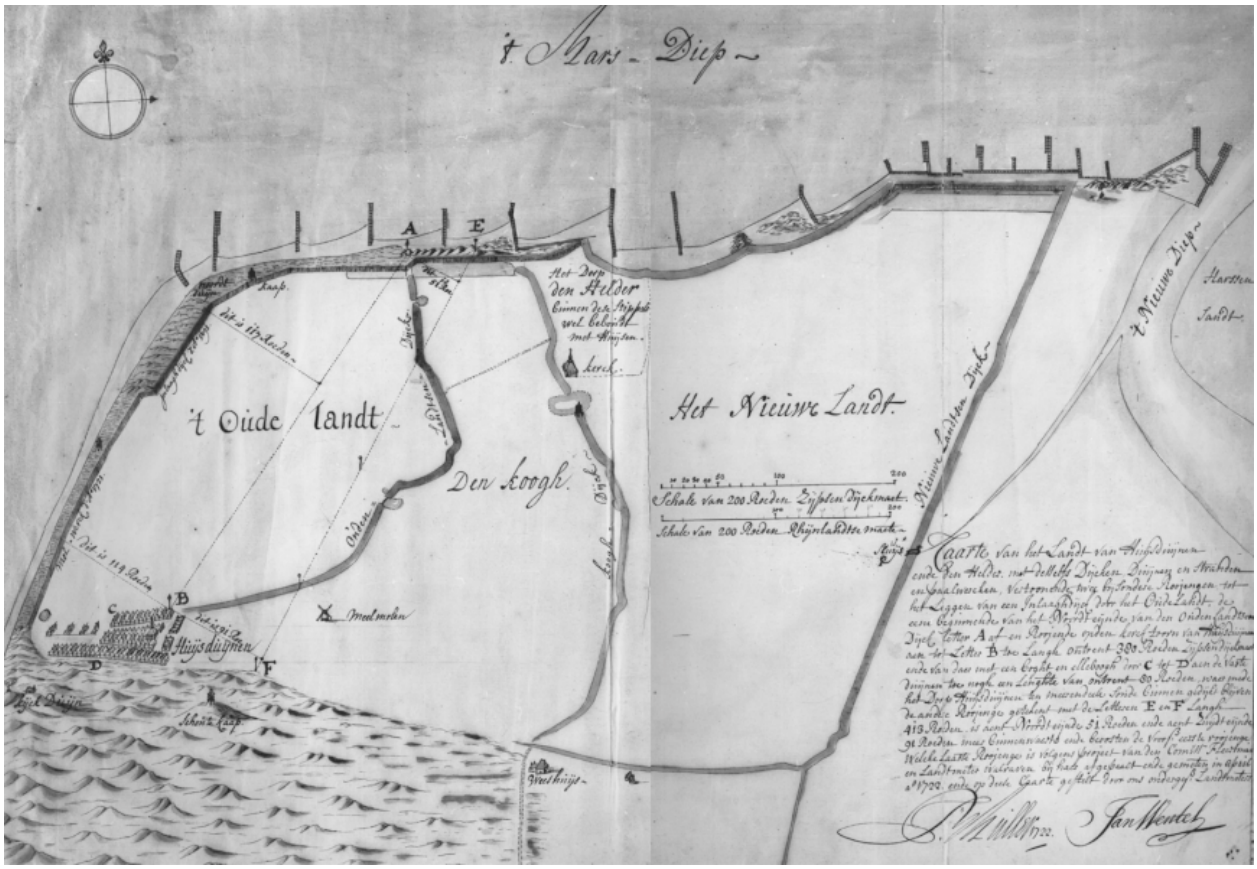

Fig. 2. Map of the dikes of Huisduinen and Den Helder, by P. Muller and J. Wentel, 1722 (Dutch State Archives, The Hague, map VTH 110). From the 16th century onward groynes were used to protect the Dutch coast. On this 18th century map the groynes are depicted that protected the northernmost part of the province of Holland against erosion by the tidal streams of the North Sea.

The post-medieval period

Shortly after 1400 AD, wind-driven watermills came in use for the draining of the polders. This enabled a further lowering of the polder water table, but at the same time effectively ended natural discharge. As a consequence, the number of windmills had to be increased gradually. In many cases several mills were built in a row, each of which pumping up the water over a certain height. In this way the water could reach a height of 5 m or more. In the beginning of the 19th century thousands of windmills had been built in order to keep the soil dry. At many locations, the skyline of the coastal zone was dominated by mills (Fig. 3).

The increasing costs of water management forced people to look for the most profitable ways of land use. In many areas this turned out to be dairy production. Elsewhere people specialized in the cutting and dredging of peat. In the course of time, the area of peat winning expanded and an increasing number of polders turned from grasslands into lakes. These lakes presented a serious danger for the surrounding lands, roads and villages. During the 18th and 19th centuries, many of these lakes were reclaimed. Some of them were over 5m deep. Today, at many places small remains of the medieval landscape can be encountered, bounded by what used to be the lake bottoms. As a result of these human activities remarkable height differences in the formerly flat landscape have arisen.

Until about 1800 the reclamation of the lakes was the result of private initiatives. The financial risk involved in the reclamation of the larger of these lakes exceeded the margins acceptable for private capital. Therefore, the larger peat lakes were not pumped dry until the establishment of The Netherlands as a nation state, in the second decade of the 19th century.

In the 18th century the improvement of the course and the flow of the Rivers Rhine and Meuse was deemed necessary by the provinces through which these rivers

Fig. 3. Aerial photograph of wind-driven watermills at Kinderdijk (in the vicinity of Rotterdam).

take their courses. A regular discharge of the water was no longer possible. Sand banks and wrongly placed groynes hampered the free flow of water, especially in the winter season, which led to a high frequency of river floods. The improvement of the river system asked for the cooperation of the various provinces. This indeed could be achieved and several measures were taken, among which a redistribution of water between the two main courses of the River Rhine. This cooperation marked the beginning of the national organization for water management that later on became known as Rijkswaterstaat. During the 19th and 20th centuries Rijkswaterstaat played an important role in the increase of scale and the improvement of water management in The Netherlands. Extensive research was carried out to get more knowledge about the movements of the water in the rivers and the sea. Moreover, new techniques and materials were developed to enhance the safety of people and investments in the coastal lowlands. The need for this became ever more pressing, because during the last part of the 19th century and the 20th century the western part of The Netherlands became more and more urbanized (Lambert 1985). Thus, the foundations were laid for the important projects of the 20th century aimed at improving the water management in the Dutch landscape: the canalisation of the Rivers Rhine and Meuse, the Zuiderzeewerken and the Deltaworks.

Concluding remarks

Water has played an important role in the development of the landscape and the society of The Netherlands. For a long time, the water of the rivers, the sea and rain were the main agents in creating the Dutch landscape. Later on, man took over this central role. A predominantly urban landscape came into being, artificially kept dry at the expense of relatively much effort and much money. One can wonder why this area, not very suitable for habitation, became so densely populated. This was without any doubt largely due to the advantageous situation of the area with regard to international trade routes. Rotterdam is nowadays one of the largest ports of the world.

At present, even many of the inhabitants of the lower parts of The Netherlands do not realize the important

role of the water in everyday life any more. Most of the time Rijkswaterstaat and the many water management boards efficiently take care of protection, drainage and, if necessary, inlet of fresh water. In return for that people only have to pay an annual fee, depending on the size and value of their properties. Only occasionally, when nature proves too strong for all the measures taken, like during the extensive flooding of the province of Zeeland in February 1953, it was realized how vulnerable the area really is. At those moments new funds for structural protectional measures usually become quickly available and calls for research to improve the possibilities for protection are heard. It is with some remarks about this last topic that we want to conclude this overview.

All over the world, the landscape of delta areas has been created both by natural processes and by human activities, which have interacted during many centuries. Hence, the landscape of coastal zones can only be fully understood if it is studied by different disciplines working together in a coherent interdisciplinary framework. However, a strong tradition in interdisciplinary research on the interaction of man and nature does not exist.

To a large extent, the lack of interest in the interaction of man and his physical environment is due to the organizational structure of science. Since science has been broken up into a still growing number of subdisciplines, mutually exclusive types of data are extensively studied in specialised and isolated research programs. Each of those subdisciplines has its own methods of analysis and theories about how the world works. Scientists are interested in the social and economic conditions which determine the effectiveness of physical planning and of civil engineering programs. Historians, on the other hand, are interested in the effects of physical constraints on the increase in population and the introduction of technical innovations in the past. Separately, both types of research will contribute little to the better understanding of the interaction between man and his physical environment in the coastal zones of the world. The interaction of natural and social processes can only be effectively studied when a coherent interdisciplinary framework forces researchers of different subdisciplines to cooperate.

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