

The remarkable history of polder systems in The Netherlands^{1 2}

Summary

The traditional polders in The Netherlands have been formed from the 12th century onwards, when people started creating arable land by draining delta swamps into nearby rivers. In the process, the drained peat started oxidizing, thus soil levels lowered, up to river water levels and lower. Throughout the centuries farmers have been adapting their agricultural system to lowering soil levels and occasional floods and invented new ways to organise themselves and keep sea and river water out – resulting in the building of hundreds of drainage windmills and later pumping stations to pump water from polders into the rivers and the sea.

This development resulted in the creation of present-day polder landscapes that are characterised by grasslands on peaty soil with drainage channels, economically sustained by dairy farming, which harbour a rich flora and fauna. These systems function in a context of (among others) rising sea and river levels, continued lowering land levels, increasingly multi-functional use of land (urbanisation, recreation and tourism, nature conservation, culture conservation), interference of agricultural policies, and other interests. A plethora of government, non-government and private parties with intense negotiation practice make up the polder governance arena. The oldest of such organisations are the “water boards” with the mandate to provide safety from water threats for all citizens. The physical and institutional polder culture is indeed a crucial aspect of the Dutch national identity.

1 Introduction

Delta geology The Netherlands is a state in the deltas of three European rivers. The biggest river is the Rhine, which flows from the northern Alps through western Germany right through The Netherlands (Figure 1). The Meuse flows from France through Belgium through the south of the country, and the largely Belgian Schelde shaped an area in the south-west of the country. Geologically, this area is shaped by sand banks put up by the interference of water streams from these rivers, and the north-east bound current of the North Sea. After the last ice age, twelve thousand years ago, both at the river sides and at the north sea coast, there were long-shaped stretches of sandy banks. Such banks allowed for human settlement in the years 600-1200 that form the historical centres of present-day towns. Only after World War-II, present-day outskirts were built, often in the areas with peat (or heavy clay) soils.

¹ This paper was prepared on request of Dr Parviz Koohafkan, Director, Land and Water Division and Coordinator of the Globally Important Agricultural Heritage Systems (GIAHS) Initiative, FAO, Rome. Its objective is to document a potential GIAHS system that featured coping strategies for rising sea water levels in the context of climate change. The paper was also presented during the International Consultation on “Agricultural Heritage Systems of the 21st Century” that was hosted by the M S Swaminathan Research Foundation on 18 February 2010 in Chennai, India.

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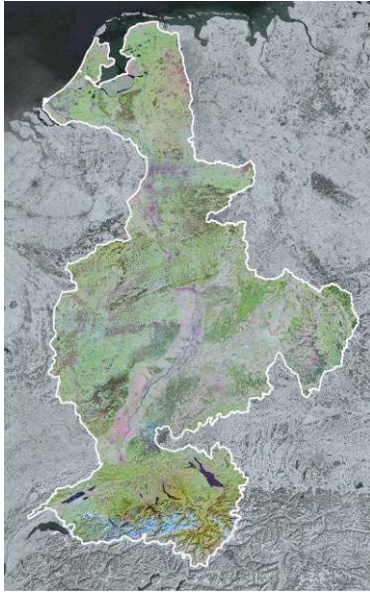


Figure 1. The Rhine catchment area with the delta in the north-west.

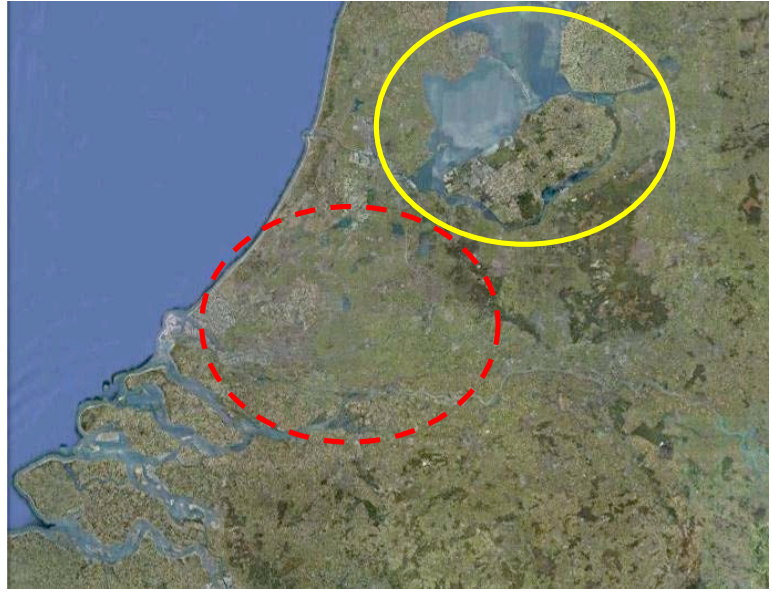


Figure 2. An area with traditional polders (red, dotted circle) and area with modern polders (yellow circle).

Modern polders The state of The Netherlands has a long history of creating “polders” - sub-sea level (or sub-river level) land, that is protected – or even reclaimed - from the sea. In the mid-20th century the state commissioned the realisation of polders in the then “Southern Sea” (Zuiderzee) that with the construction of dykes now is a lake (called IJsselmeer). The then Zuiderzee was and is in the centre of the country (yellow circle, Figure 2) and the Government indeed reclaimed land from the (shallow) sea. It was the Dutch State who carried out this land reclamation and created a modern agricultural landscape, with occasional modern towns that were built after the 1960s.

Traditional polders Besides these large-scale modern polders, there are polders that have been created in the course of history and that may be one to a few hundred years old. The so-called “Green Heart of Holland” (red, dotted circle) is situated between the cities of Rotterdam, The Hague, Amsterdam and Utrecht consists of different polders. These polders are not exactly land reclamations, they are rather conserved areas – as they have not been reclaimed from the sea but rather protected from the sea.



Figure 3. In the 1990s river levels reached dangerous heights, sparking off a new policy with regards to river management.

River threats Both water from the river catchment areas and water from the sea threaten large parts of The Netherlands. Over the last century, river catchment areas both in Germany and in The Netherlands improved drainage systems both in cities and in rural areas. Therefore, during wet periods in the catchment area, rivers get a more irregular water regime, challenging the dykes along the river. After a couple of near-floods in densely populated areas in the early 1990s (Figure 3), The Netherlands decided to deepen the river and widen the areas fit for flooding. This project is called “Room for the River” and allows for more traditional nature and agriculture in a wide band along the rivers in the middle of the country.



Figure 4. River and sea levels are strongly related up to a hundred kilometers from the coast. Accompanying polder landscapes have been formed as part of the river landscape.

Sea threats The sea poses a more structural threat. As the rivers only go down by a few meters over an area of 100 km, the tides are being felt up to almost a hundred km inside the country. With global warming, both polar ice melts and sea water expands, resulting in a steady rise of the sea. This has serious implications for all areas close to the rivers, because a higher sea level also means that river levels get higher – and that areas so far inhabitable might flood, or that water will seep through the dykes into the lower-lying land.

The question is: to what extent is a rising water table a new development? How have the Dutch coped with water in the course of history? As an illustration we look into the history of the Alblasserwaard, one of the traditional polders 25 km east of Rotterdam, along one of the Rhine arms called de Lek.

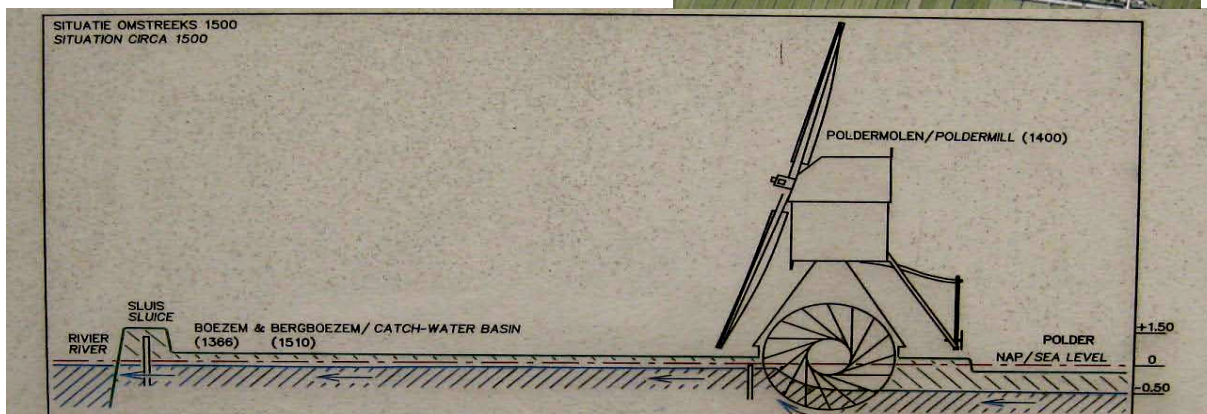
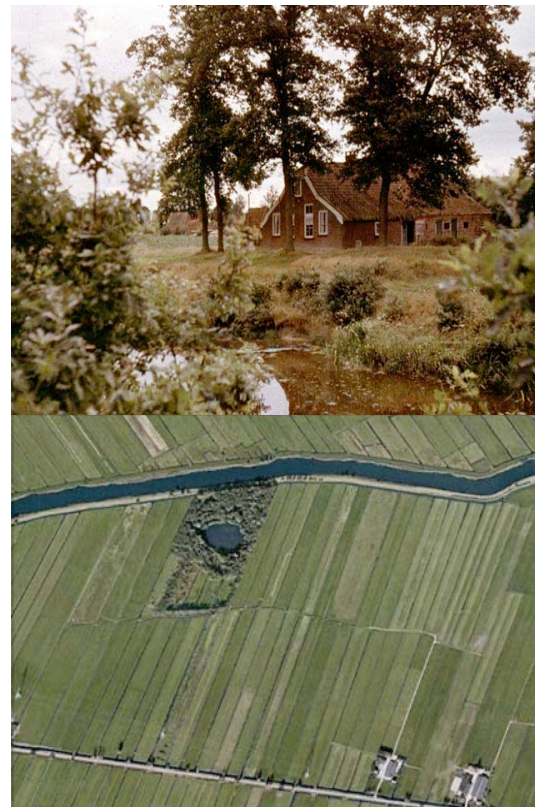
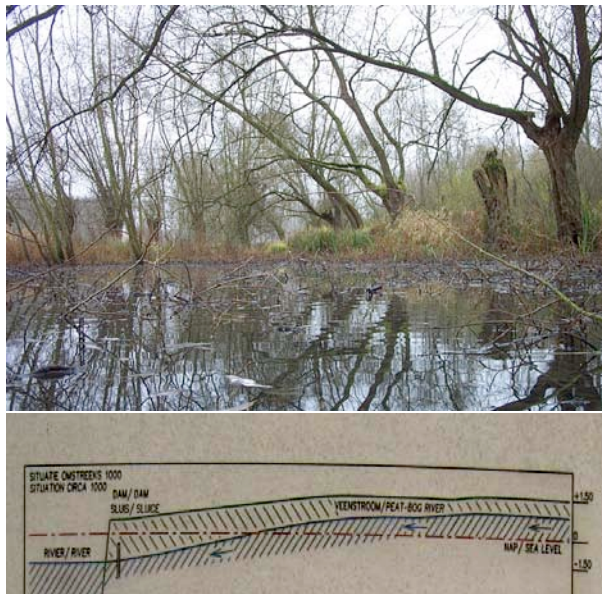


Figure 5. In the Alblasserwaard, as in many traditional polders, swampy areas were drained to create arable land from the 12th century onwards.

1000 years ago In the 10th-11th century the now Alblasserwaard area was swampy (Figure 5). In the course of geological times (after the last ice age) peat had built up in-between the sandy banks along the river. In the 12th century, people started draining the area. As the peat was above the river and sea level, this was a relatively easy job: they could dig drainage canals to the nearby river that led to the sea. At that time, the seawater level was a few decimetres lower than now. So, when people settled in the swampy areas, both the land was higher, and the sea was lower than nowadays.

Draining the swamps People drained water from the swamps into the river. In this period, farmers shaped the structure of the landscape: a complicated set of canals – from small drains to larger canals. This allowed farmers to grow crops. The canal – stream structure of the land can be seen until today.

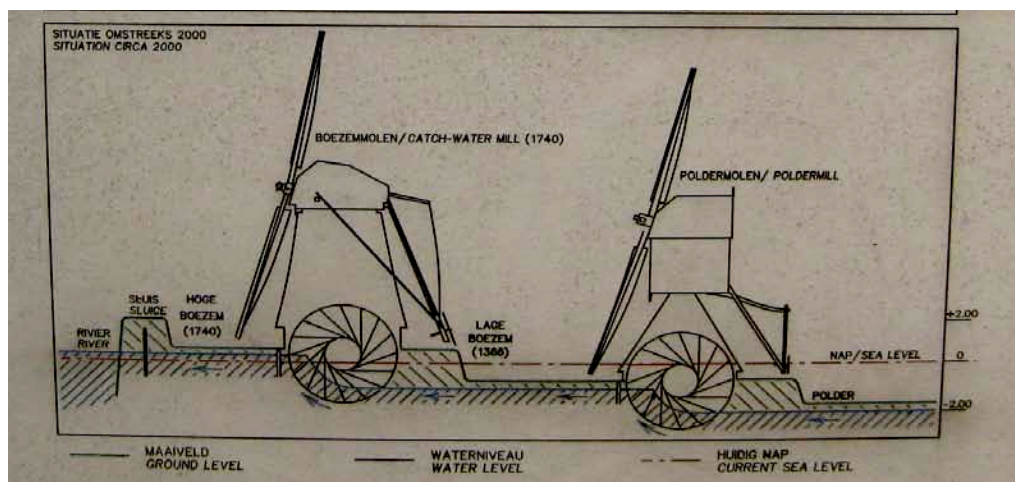
Pumping needed The soil in the area was (and is) made up of peat. Due to grazing and drainage, the peat growing process was halted – while peat oxidizes when directly in contact with air. This resulted in gradual lowering of the soil level, to an extent that after a few hundred

years, the soil had lowered to approximately the level of the river. Thus, natural drainage did not suffice anymore to keep the area clean of water, and people needed to start pumping. Originally pumping was done by human power, but as this appeared not sufficient, farmers developed wind-driven pumping systems. The original structure of canals was still used to drain, but the water was pumped out at the end of the channel.

Dyke building At the same time, people needed to build minor dykes to keep the tidal river water out. Originally these dykes were built by individual farmers or small communities. However, if your neighbour's dyke burst, your land flooded as well, so some form of co-ordination was needed to keep water out. In some areas, such co-ordination failed, and the water took over the land. In other areas, farmers organised in local "water boards" that set down rules to responsibilities, and fines were imposed in case of failure. In the Alblasserwaard, already in the 12th century, Count Floris the Fifth ordered the organisation for building of a ring-dyke all-round the Alblasserwaard, to be managed by different water boards. The result was the establishment of a "polder": land that is protected from surrounding water levels that are higher than the land surface.

Land levels lowered In the following centuries, the process of soil lowering continued. Dairy farming is more water-tolerant than crop cultures and surplus labour moved from the swampy areas to nearby towns, where people started trading for a living. After some floods in the 18th century, people realised that the system did not suffice to keep the water out. The water table had become below one meter of the lowest river levels and it was difficult to keep the land dry enough for production and safety. As a consequence, an extra step of pumping was needed to keep the polder dry. Near the town of Kinderdijk, at the western-most point of the Alblasserwaard, people built a complex of 19 windmills to pump the water out.

The windmills have been functioning for about a hundred years. In the mid-19th century, extra mechanical pumping power was installed, but the windmills remained in function. During World War II, when the country ran out of fuel, the windmills were the only pumping system to save the Alblasserwaard from flooding. Soon after the war another pumping station was installed, and the windmills have gone out of function. The Kinderdijk windmills are now a World Heritage Site. In many other places, drainage mills were broken down, but at the same time, many windmills have been saved as a local monument, for touristic purpose.



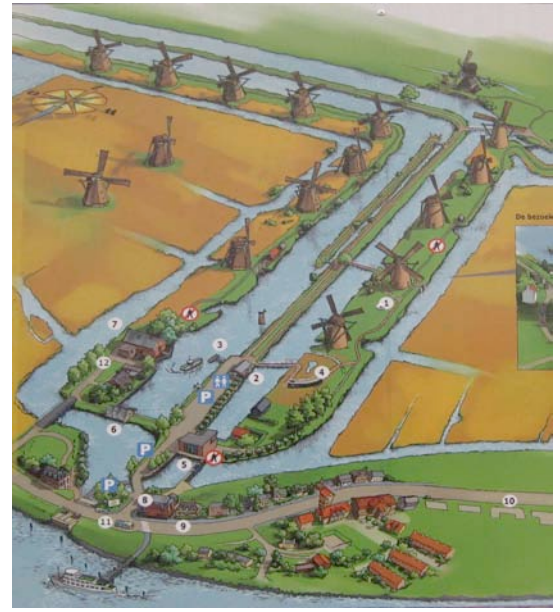


Figure 6. The water management system consists of many interlinked elements that need continuous maintenance.

Water discharge system The drainage of the Alblasserwaard is based on the systems that have been developed from the 12th to the 18th century. Numbers in the figure show where different activities take place. Figure 6 shows only the lowest part of the Alblasserwaard polder. (1) Water is drained from fields and pumped into (2) a canal. (3) is the place where lines of 19 windmills used to pump water into the (4) reservoirs. (5) during low tide the water is discharged in the river Lek that (6) takes it to the sea.



Figure 7. Many windmills built in the 18th century have been preserved, such as this impressive line of mills at Kinderdijk, which is a UNESCO World Heritage Site. Technology of such windmills is intriguing; the whole top can be turned following the wind direction.

Windmill-pumps Windmills have been around in The Netherlands since the 15th century. The windmill-technology is complicated and robust. For example, the miller can turn the blades with a span of 20 m towards the direction of the wind (Figure 7). The (white) wheel to the front was used to turn the entire upper part of the mill; while the wheel to the back was the pump to bring water up for about 1.5 m from the right to the left. The windmill therefore must be flexible as well as extremely strong, to stand the occasional storms.

About 1100 windmills in The Netherlands have been preserved with support of Government or private initiative. Many of them are used and they can be visited for touristic purpose.

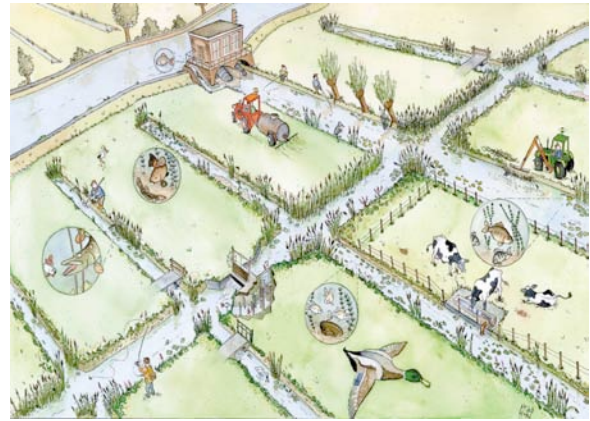


Figure 8. Traditional polder structures such as drainage channels and water ways still make up much of the polder landscape.

Water table tug-of-war Water management in the polder is the result of weighing many different interests. Lower water tables are good for production of grass and therefore for the farm economy on the short term. With cutting-throat economic conditions, farmers are often forced to go into short-term benefits. But lower water tables also cause oxidation of peat, and gradual lowering of the soil surface. The result is an on-going lowering of the soil level, at present between 10 and 50 cm a century – which in the very long run will result in difficulties to keep sea and river water out. Higher water tables both keep soil lowering to a minimum, and are good for biodiversity, as most wild field-species are water-loving. Thus, the optimum water table is a result of different and opposite interests.

Water boards The above mentioned technical development was made possible through a parallel process of institutional development. In 13th to 16th century, farmers created polders by organising themselves. To begin with, a few households co-operated to jointly protect their fields, but later, the scale of organisation went up, and communities formed “water boards” that were a council of most influential farmers who joined hands to build and maintain provisional dykes. Later, more complicated and ever-evolving drainage systems were put in place like the one in the Alblasserwaard, starting from the 1200s. The water boards are in fact a “traditional” – you can say “tribal” form of governance. The water board system of governance developed largely independent from the development of cities, provinces and the state that occurred from the 14th to the 19th century. Water boards are a unique feature in Dutch society and the oldest form of governance in the country. They are the institutions that weigh all interests and regulate the water table accordingly. Historically, locally organised water boards have been merging into larger ones, which is an on-going process. In 2010, The Netherlands is divided into 21 water boards (Figure 9) – that have very different borders than the political subdivision in provinces and towns, as water boards are often defined by watersheds or islands.

The present-day political discussion focuses on the idea to do away with the water boards, and bring them under the provincial governments (of which there are 12).

Water boards still stand at the base of the Dutch tradition of consensus politics, where decision-making bodies talk long until an agreement is forged. This kind of politics dominated the political culture until the 20th century. Possibly, the emergence of the internet is challenging this culture of consensus politics.



Figure 9. Water boards form a separate administrative layer in the Netherlands' governance system. Their borders are determined by watersheds; not so much by political entities.

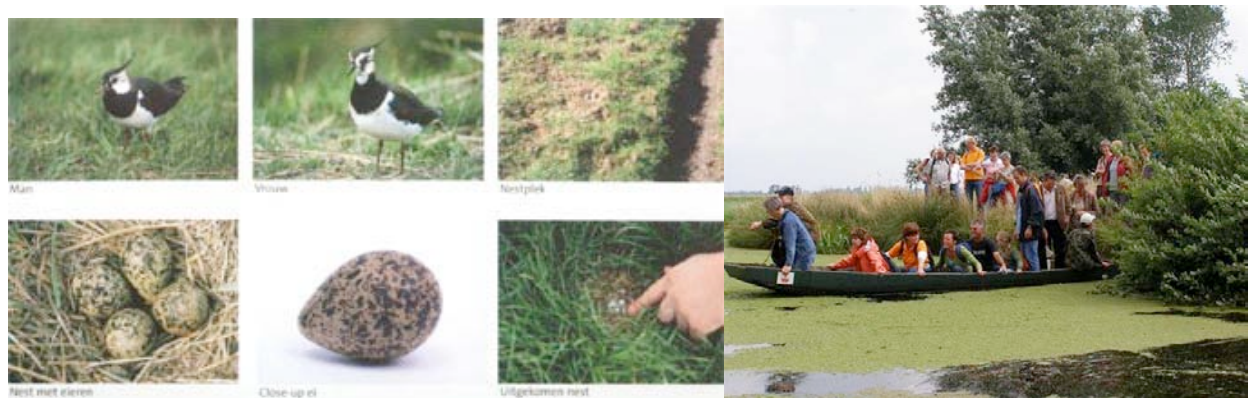


Figure 10. Polder landscapes harbour a unique ecosystem. Citizens both from the rural area and nearby towns and cities, and also farmers, pick up bird watching and botanical knowledge as a hobby.

Flora and fauna The polder system has a characteristic flora and fauna. A particular category of “field birds” include various kinds of ducks, waders (*Charadriiformes*) such as the Northern Lapwing (*Vanellus vanellus*), Eurasian Oystercatcher (*Haematopus ostralegus*), Black-tailed Godwit (*Limosa limosa*), Common Redshank *Tringa tetanus*, Grey Heron (*Ardea cinerea*). These birds flourish in places with shallow, slowly moving water, with fish and insects. A variety of songbirds lives in or nearby grassy fields, such as Larks (*Alaudidae*), meadow pipit (*Anthus pratensis*), Yellow Wagtail, (*Motacilla flava*), and many others. The polders harbour a wide variety of grass species and plants that grow in swampy areas and shallow water. Some tree species are resistant to water logging, such as certain types of willows. One willow species used to be cut every few years and formed typical crowns of branches (“knotwilg”) and these branches were used for all sorts of activities, among which the building of a kind of mats that was used for the construction of dykes.

Society perceives farming In the 1970s, besides high productivity, the green Revolution had brought pollution and reduction of biodiversity. Nature organisations started protesting such farm practices and in some areas, they bought quite some farm land to establish nature reserves. While managing these reserves, they realised that farming was an essential activity to conserve the typical field biotope. After the 1970s, a new generation of farmers sought to marry productivity and nature conservation goals. In some nature reserves, restricted farming takes

place, exactly to preserve the particular farm-induced biotopes. But also in mainstream farming areas, nature organisations and farmers are now co-operating. For example, farmers get rewarded for the number of birds' nests in their fields, leaving the management regime to farmers while still adhering to nature conservation objectives. In quite a few areas farmers established nature clubs, who seasonally take nearby citizens into their grasslands, showing how they manage to produce as well as maintain the number and variety of birds.



Figure 11. Farm houses are mostly built on natural or artificial sand banks in the polder landscape. Municipalities often have policies in place to maintain traditional buildings by giving it new functions; even if at time modern buildings are constructed in-between.

Farm houses Traditionally, farms were built on the occasional sandy banks that occurred here and there in the polder. Houses were built so, that in case of high water, cows could be safely put on a second floor. Many such farms are still in place, even if the interior is often overhauled every new generation, to keep fulfilling the needs of the day. Therefore, even today you can see inhabited old farmhouses – sometimes by a farming family, but also by other citizens, who enjoy the traditional beauty of the house.



Figure 12. Modern dairy industry is built on traditional technology and institutions, such as the co-operative dairy factory.

Diary industry Due to the steady outflow of people from rural into urban areas, urban centres such as Schiedam, Rotterdam and Dordrecht provided a good market for milk products from the Alblasserwaard. Thus, from the 15th century onwards, farmers produced milk for the market. Market-oriented production has some intriguing features. Cows produce irregularly, and milk had to travel 20-50 km, which at the time took a day or so. Farmers thus needed ways to preserve excess milk. It must have cost a lot of experimentation to figure out that rennet from the cow's stomach was helpful to take out the solid parts of the milk, and prepare cheese. This traditional method is still the basic process of present-day cheese making. The process was

invented on individual farms, and around 1890, the first co-operatives took over milk processing and production of all sorts of cheese. Such co-operative factories have developed into a flourishing dairy sector that exports about 60% of its produce with an annual turnover of around €600 m. Even today, these factories have a co-operative structure of governance.



Figure 13. In every town in The Netherlands there are stalls that sell many different kinds of Dutch cheese, which is part and parcel of the diet of every Dutch household.

“Dynamic conservation” of traditional food Holland is famous for its wooden shoes, but besides tourist attractions, you would rarely find a citizen or a farmer use them nowadays. The situation is very different for traditional cheese. Cheese manufacturing in The Netherlands represents a rich and developing food culture. Every town has a weekly market with cheese stalls; an each stall has its particular collection of cheeses. Supermarkets easily sell a hundred different kinds of cheese and other milk products. Every year, new kinds of cheese are developed that take over segments in the market. A recent addition for example is the spread of goat cheese as a regular feature in Dutch households. Some 300 wholesalers (cheese, butter and powder) and 6,000 sales outlets are involved in the trade in and sales of dairy products. The dairy sector as a whole provides around 62 thousand jobs, and the money consumers spend on cheese in fact help maintaining the polder landscape in the Alblasserwaard.

The future of the polder system There is a series of developments that determine the future of the polder agricultural system.

Lowering of soil as well as rising of the sea level pose an ever-growing threat to the polders. The polder soil is unstable, and the country has to do large investments to keep the area inhabitable. But, at the same time, most polders are in the wealthiest parts of The Netherlands, and it is likely that society will keep being able to sustain maintenance of the complicated water system. There are visions for a big sea-dyke along the coast, which will protect the country integrally. Such a structure would be unique, as even river water from the big rivers the Rhine and Maas would have to be pumped out.

Increasing influence of Europe is a driver for change. For example, subsidies to production have changed the farming system towards high-input and market-driven. When subsidies were diminished gradually and production quotas were put in place, many farmers went bankrupt, and neighbour farms took land – now the average farm size is around 40 ha with 55 cows. European agricultural policy is thus directly influencing developments in the polder dairy sector.

Diversification of economic activities to realise multi-functional agriculture is the strategy to maintain the polder landscape. There are experiments with the creation of regional products, tourism, care farming, etc – to make farming more lucrative. Farmers get additional income from maintaining landscape elements such as the pruned willow, or the number of birds nests

in their land. Such efforts get nice publicity, but dairy farming remains the economic stronghold of the area: more than 90% of economic activity relies on dairy production.

National identity Yet, diversifying economic activities have more than economic significance. It also signifies that society and farming are again at speaking terms, that citizens and farmers work together to preserve the unique system, that underpins the Dutch national identity as much as other flagships such as international trade. All schoolchildren in The Netherlands learn about the polder system, the dairy industry, and the associated culture and identity. The polder system is there to stay, even if it is ever-changing, responding to new developments in society as well as in the world as a whole.

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