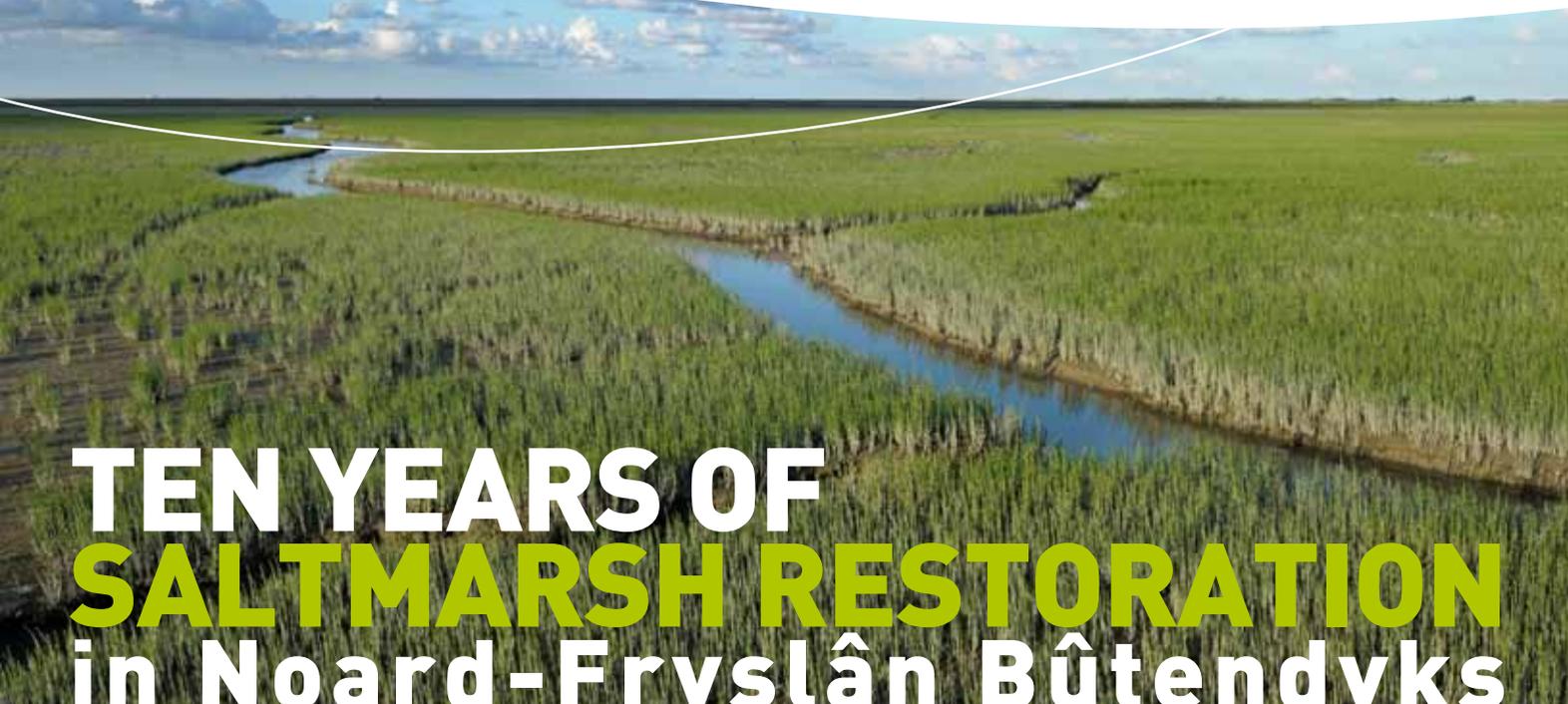




*It
Fryske
Gea*



**TEN YEARS OF
SALTMARSH RESTORATION**
in Noard-Fryslân Bûtendyks





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With its wide-open spaces, magnificent colours and ever-changing skies, Noard-Fryslân Bûtendyks is an area with a raw kind of beauty. Part of the Wadden Sea, a World Heritage site, it stirs our sense of primeval nature. The nature conservation organisation, *It Fryske Gea*, is committed to preserving the natural values of this area just outside the seawall and so, in 2001, initiated a trial to restore saltmarshes in the area. The bank of a 123-hectare summer polder was breached in three places to let seawater in; then, for the next ten years, researchers carefully investigated the effects on the flora and fauna, the changes in marsh-surface level, soil salinity – everything involved in the restoration of a saltmarsh. The research, financially supported by the *Waddenfonds*, produced a wealth of information and insights that will be useful for future projects. The results from this research have been recorded in various reports and in articles in scientific journals. This brochure contains the highlights of this research.



Sea aster

Henk de Vries: 'Saltmarsh restoration trial a great success'

Friday, 14 September 2001 was the big day: an excavator took a large bite out of the summer-polder bank. Saltwater flowed into the experimental saltmarsh, an area of 123 hectares in Noard-Fryslân Bûtendyks. Henk de Vries, now the director of *It Fryske Gea*, was present. He looks back with satisfaction. 'Saltmarsh restoration works. The area has successfully changed from a summer polder into a saltmarsh.'

There was a long run-up to the trial. The plan to transform summer polders into saltmarshes was devised more than ten years earlier. According to Henk de Vries, this was partly the result of the international Wadden Sea strategy which recommends restoring thousands of hectares of saltmarsh. One way to achieve this is to expose summer polders to tidal flooding again. 'Noard-Fryslân Bûtendyks (North Friesland outside the seawall) was regarded as the area with the greatest chance of success. After all, it contained a thousand hectares of summer polder and so, plenty of potential for saltmarsh restoration.' The trial was much in the news at the time, with detailed coverage in both local and national media. By testing saltmarsh restoration, *It Fryske Gea* was taking the first step; they were pioneers. 'Never before had such a large tract of agricultural land been returned to the sea. Saltmarsh development was possible in theory, but we needed real-world proof. That was why we first did this pilot study. It was also to let the local community see what happens when a saltmarsh is restored.' Actually, it was not the very first time this happened. In the 1970s, a summer polder further up the coast near Paesens was transformed into

a saltmarsh. This, however, was not intentional. 'After storms caused breaches in the bank of the summer polder, it was decided not to repair it,' De Vries explained. In the early 1990s two summer polders near the Holwerd ferry causeway went the same way.

Method works

An intensive monitoring programme would show whether saltmarsh restoration actually worked. Over a period of ten years many things were monitored, from soil salinity, changes in surface elevation and vegetation development to the effects on bird populations. The main conclusion, according to De Vries, was that the method worked. 'Saltmarsh restoration proved to be straightforward: you make an opening in the bank and nature fends for itself. After a while, the uniform agricultural fresh grassland was replaced by various saltmarsh plants. We had expected the vegetation to die off all at once, but the changes were gradual.' The aim was to learn from this experiment and De Vries believes many lessons can be drawn from the project. The natural dynamics of the area, for example, were an eye opener for him, a case in point being the creeks that were dug out. 'The excavator driver had done his utmost best to make meandering creeks. It turned out that wasn't necessary. In fact, the seawater found its own way, while some of the creeks silted up really quickly. Controlling nature was more difficult than we'd thought.'

New insights

The remaining summer polders provide us with an excellent opportunity to increase the area of saltmarsh even further, but De Vries does not want to convert all summer polders into saltmarshes as was originally planned. New insights and bird counts have made it very clear how valuable the summer polders are. 'Polders contribute to the value of the area for nature conservation. It's there you find avocets, terns and meadow birds in huge numbers. Good polder management allows us to keep the geese away from the agricultural land inside the seawall.' The summer polders are also essential for the safety of livestock. 'Thousands of animals are grazed outside the seawall. During periods of extremely high water we need to keep the animals in the summer polders because it's almost impossible to get them over the seawall in time - as we know from the occasion in 2006 when a herd of horses were trapped by high water and were rescued only with considerable effort. The polders also contain valuable historical features such as rows of wooden posts, pits dug to provide grazing animals with water, and patterns of linear features in the landscape. We want to conserve such elements.'

Official start
of the trial
saltmarsh in
2001





Henk de Vries:

'Nature, recreation and climate-proof water management could profit from each other in Noard-Fryslân Bûtendyks.'

It Hallumer Ryt

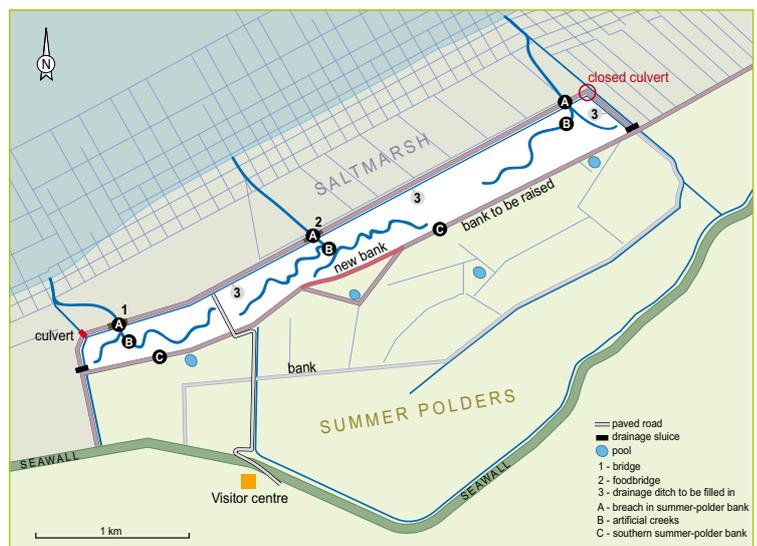
All the same, *It Fryske Gea* is looking to create more saltmarshes. The trial was followed up in 2009 by the conversion into saltmarsh of a 48-hectare summer polder in the Bildtpollen, another area in Noard-Fryslân Bûtendyks. The next project on the list is *It Hallumer Ryt*. The local water board is planning to build a new pumping station called Vijfhuizen in the seawall south of the saltmarsh restoration area. This project kills two birds with one stone. It will increase the capacity for water discharge from the polderland inside the seawall and, at the same time, restore a gradual transition from fresh to salt water outside the seawall. De Vries is enthusiastic about this project. 'We are re-introducing an element that was lost from our saltmarshes long ago, namely, river water.' He already has areas in mind for further saltmarsh restorations. 'First of all, we must prepare the area so it meets a number of specified conditions such as creating sufficient space for meadow birds,' he explained.

Collaboration

Noard-Fryslân Bûtendyks presents a challenge to the community. A vast saltmarsh area which has international appeal is not only in the interest of nature conservation but also benefits local residents, holiday-makers and business. 'Nature, recreation and climate-proof water management can profit from each other in Noard-Fryslân Bûtendyks. We are doing our best to involve the local community: there's our new visitor centre, the *Kweldercentrum Noarderleech*, our school programme, and we organise excursions and encourage discussion. By pulling together we can create new natural habitats outside the seawall that will benefit everybody. We have to work together.'

Setting up the saltmarsh trial

To let seawater into the trial restoration area, three openings (A) were made in the northern bank of the summer polder, and the ditch behind the bank was filled in. Over a total length of five kilometres, three creeks (B) were excavated in the area. These creeks were then connected outside the trial area, to existing creeks in the adjacent saltmarsh north of the trial area. To prevent the adjacent summer polders becoming brackish, the south bank (C) of the summer polder was raised and widened.



Ten years of research into saltmarsh restoration

How has the saltmarsh restoration experiment affected the natural environment? Has a salinity gradient developed from the salt-water influence? Is the marsh level rising along with the sea? A team of experts has been looking into these questions since the beginning of this century. In fact they started work even before then – they collected data to record the situation before the trial started. More than ten years later they did the final measurements. This long-term project has produced a wealth of useful information for organisations such as *It Fryske Gea*.

'Gather detailed information about the process of saltmarsh restoration.' That is what *It Fryske Gea* asked the researchers to do. The monitoring of sedimentation, increasing salt levels, plant growth, staging geese and breeding birds was integrated into the project and carried out over a long period. During the first five years this happened intensively, and then twice more – in the seventh and tenth years. Numerous organisations took part in the monitoring programme (see inset) and many researchers worked in the area collecting data. They now know the saltmarsh like the back of their hand, working there almost every day during the season for years on end – carrying around equipment, collecting data on plant growth and measuring the increasing height of the brand-new marsh. Before their eyes, they saw the area change from a summer polder with closely grazed fresh grassland into a saltmarsh with salt-tolerant plants.

Valuable information

This monitoring project was unique. The researchers involved believe few other saltmarsh restoration projects have been so thoroughly researched over such a long period. Projects involving saltmarsh regenera-

Monitoring report

An extensive research report describing the ten-year monitoring programme, its methods and results has been published. It can be found at www.itfryskegea.nl or it can be requested from *It Fryske Gea*.

tion have been carried out in various parts of Europe over the last few decades, but most have not been well documented so hard data is missing. This kind of research has to be long-term because certain processes like elevation change and vegetation development only become apparent after ten years have passed. Without this research we would not have known, for example, that the surface level in the trial area increased by seven centimetres. The monitoring has now finished but it would be useful to keep following developments, if not with the same intensity. It would be interesting to measure the marsh level and map vegetation development in the restored saltmarsh again around 2020.

Parties involved in the monitoring

The monitoring research was commissioned by *It Fryske Gea*. During the first five years, the parties jointly implementing the programme were consultancies *Koeman en Bijkerk* and *Altenburg & Wymenga*, and the Wadden Sea Birds Working Group (*Wadvogelwerkgroep*) of the regional field-biology association (*the Fryske Feriening foar Fjildbiology – FFF*) under the supervision of Alterra-Texel (now part of IMARES-Wageningen). Financial support for the five-year research project came from the EU (LIFE-Nature programme), the then Ministry of Agriculture, Nature, and Food Quality, *Rijkswaterstaat* (the Directorate-General of Public Works and Water Management), the province of Friesland (*Provinsje Fryslân*), the *Prins Bernhard Cultuurfonds*, the University of Groningen and *It Fryske Gea*.

During the second period of five years, the research was extended step-by-step. After a storm surge occurred on 1 November 2006, the *Prins Bernhard Cultuurfonds* provided funding to investigate the influence of storm activity on developments in the trial marsh, so in 2007 researchers were able to repeat an important part of the monitoring process. A *Waddenfonds* grant allowed a further re-run in 2011/12. The parties involved in this follow-up project were PUCIMAR ecological consultancy, *Bosgroep Noord-Oost Nederland*, IMARES-Texel, *Altenburg & Wymenga* consultancy and the FFF Wadden Sea Birds Working Group.

Noarderleech receives a full salt bath



From fresh to salt water

Since September 2001 - when the polder received its first salt bath – salt water has flowed into the restoration area with every incoming tide. The water spreads further via the creeks, bringing salt into the area.

117
times in ten years:
that was how often
the saltmarsh trial
area was completely
flooded

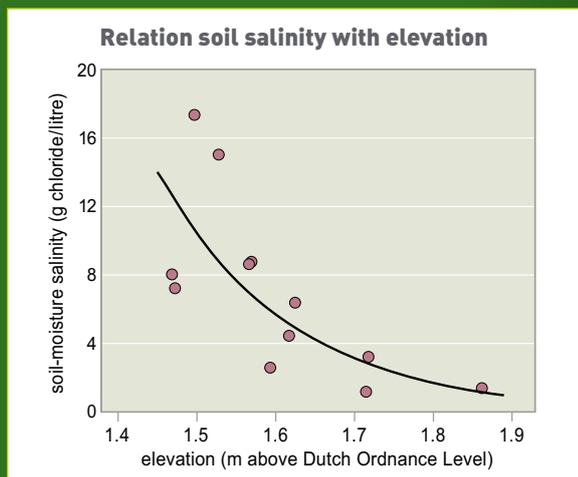
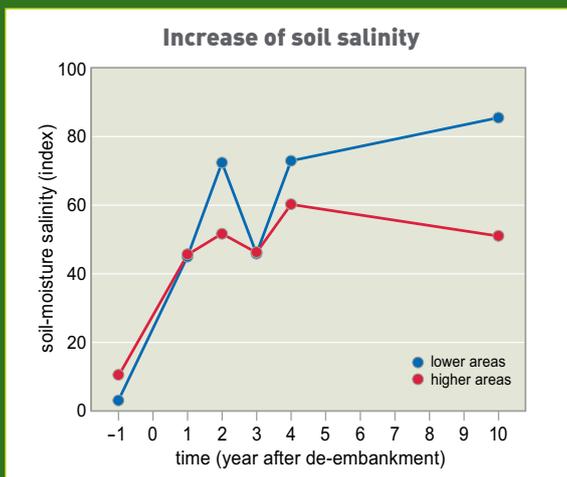
The figure below shows that salt levels rose quickly in the first year after seawater was let in. After this sudden leap, the increase levelled off. In fact the salt content of the soil in the trial area is still lower than that of the adjacent saltmarsh.

The lowest parts of the trial area are submerged fifty to a hundred times every year; in the higher areas this happens more sporadically. Because of the difference in the number of flood events, there is an inverse relationship between soil salinity and marsh elevation. Salinity is lower at higher elevations.

Now and again the whole trial area becomes submerged. During the ten years, this happened 117 times, which amounts to about twelve times a year. Before seawater was allowed in, submersion happened less than once a year.

Salt levels in the soil can vary enormously. Long and heavy rainfall causes salt levels to fall, while considerable flooding causes them to rise. In the summer, the salt content is often higher than in the winter. During dry summers, salty groundwater rises towards the surface, so the soil becomes saltier than in the winter.

The seawater has not made the adjacent summer polders any saltier. Raising the summer-polder bank proved to be adequate to prevent this from happening.





History:

saltmarshes under pressure

Saltmarshes are scarce. Where the landscape of North Friesland once consisted largely of saltmarsh interspersed with raised inhabited mounds, now only a narrow strip running along the outside of the seawall is left. It is a strip of great value.

Saltmarsh
workers

At first glance, there would appear to be no shortage of saltmarshes in Noard-Fryslân Bûtendyks. Walking through the area, the scale is vast and impressive. Internationally, however, saltmarshes are under great pressure. In the Netherlands no less than 80% of all the mainland saltmarshes has disappeared. Around the year 1600, saltmarshes along the northern mainland coast covered still some 14,000 hectares but only 3,300 hectares remain today, 1,500 of which in Noard-Fryslân Bûtendyks.

Terpen landscape

Saltmarshes are a natural feature of the coastal area of the Northern Netherlands. In fact, the coast used to be an immense saltmarsh area stretching some twenty kilometres towards the sea – as far as the present sea clay landscape now reaches inland. The inhabitants of the area lived on dwelling mounds called terpen (or terps) which stood just a few metres above the saltmarsh surrounding them; this is how they 'kept their feet dry' at high water. Nowadays the sea is kept out by a seawall but the former terpen landscape, which is regarded as one of the most ancient man-made landscapes in the Netherlands, can be seen wherever one looks with terpen villages and winding watercourses a reminder of a time when the saltmarshes dominated the area.

Bunker

In the middle of the trial saltmarsh there is an old bunker from the Second World War when the German occupying forces used the Noarderleech area for their military training. From this bunker they watched as their airmen practiced their bombing techniques on two model ships especially placed in the area for that purpose. The bunker still serves as an excellent lookout point across the saltmarsh but, these days, not for soldiers but for nature lovers, giving the cultural heritage site a public function. A panel fixed to the bunker provides visitors with information about how the war impacted on the Noarderleech.

Embankments

That time is past. The struggle against the sea has been gloriously won. Step by step, dike after dike man pushed back the sea. The first ring-dikes in North-West Friesland appeared in the tenth century AD and around 1200, the embankment of the Middle Sea was begun. Little remains of the wide saltmarshes of the past, the coastline has been moved towards the sea and only a narrow strip of saltmarsh still runs along the coast. Indeed, in a lot of places including the west coast of Friesland, there are no saltmarshes left at all; a decline which has occurred not just in Friesland but along the entire coast of the Dutch Wadden Sea.

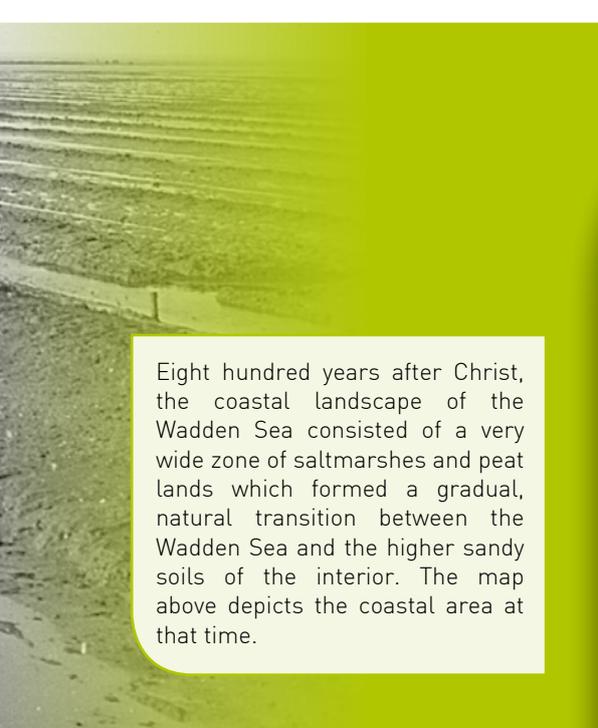
Saltmarsh-works

Today's saltmarshes are man-made creations which have been claimed from the sea using ditches and brushwood groynes. In the past, ditching was applied to drain the seawater and promote vegetation development. By enclosing intertidal areas with brushwood groynes so-called sedimentation fields were created for the sediment carried in on the flood-tide to settle out. Formerly, such saltmarsh-works were applied to acquire new land for farming, but nowadays only the groynes are maintained to protect existing saltmarsh from erosion.

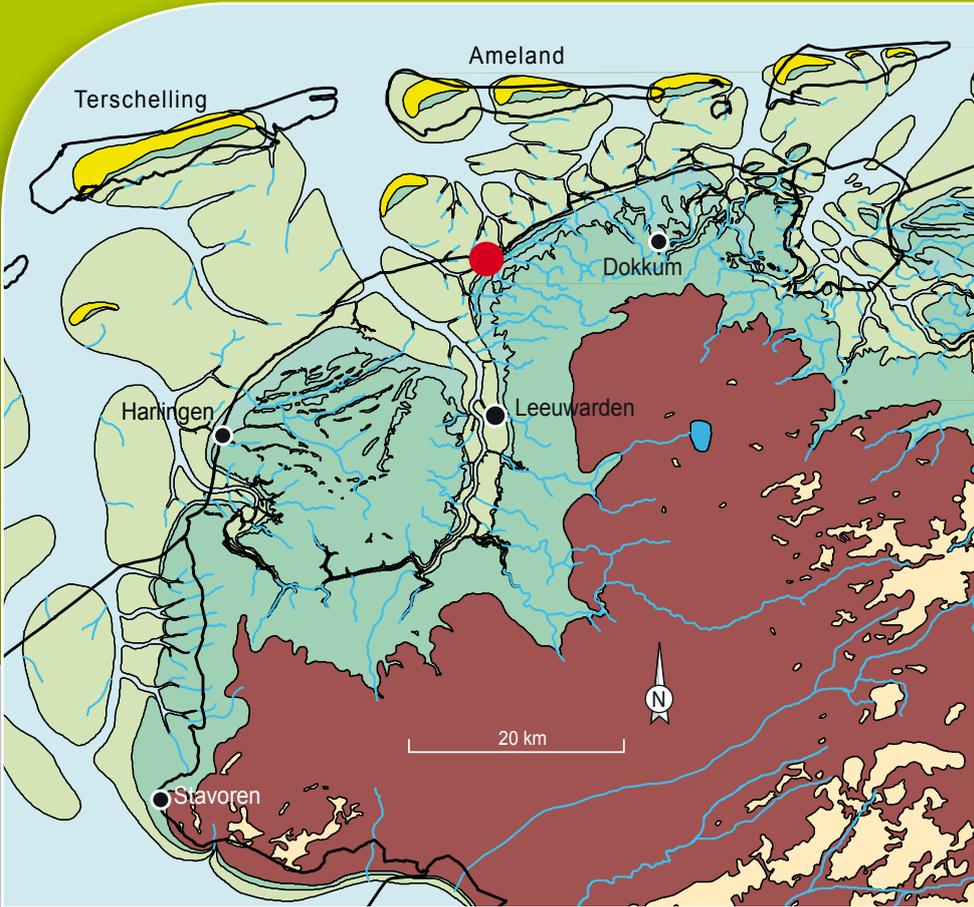
The summer polders in Noard-Fryslân Bûtendyks are of a relatively recent date, being claimed from the sea by private landowners between 1892 and 1956. The polder of the saltmarsh restoration trial dates from the year 1909 and for almost a century served as grazing pasture.

Heated debate

Noard-Fryslân Bûtendyks was very nearly embanked too, if this had happened it would be potatoes not saltmarsh plants growing there today. In the 1970s serious plans to embank the saltmarsh were put forward. Before this time, even more drastic plans to claim large parts of the Wadden Sea had been devised. All of this led to heated debate with agricultural interests and nature conservationists fiercely opposing each other.



Eight hundred years after Christ, the coastal landscape of the Wadden Sea consisted of a very wide zone of saltmarshes and peat lands which formed a gradual, natural transition between the Wadden Sea and the higher sandy soils of the interior. The map above depicts the coastal area at that time.



| | |
|--|-------------------------|
| Intertidal area, dry during low tide, flooded during high tide | Fresh inland water |
| Saltmarshes which are flooded during storm surges and occasionally in winter | Salt seawater |
| Saltmarsh ridges which are rarely flooded | Coastal dunes |
| Sand left after the last Ice Age | Present coastline |
| Peat | Noard-Fryslân Bûtendyks |

But, at some point, attitudes changed. The ecological value of the saltmarshes and the Wadden Sea was recognised *and* there was political room for new policies. Then, in 1986, a decision was taken not to embank Noard-Fryslân Bûtendyks. Thanks to this decision we now have a unique area of saltmarsh seaward of the seawall. After centuries of combatting the sea, people realised that the international Wadden Sea was short on saltmarshes and would benefit from the creation of new ones. Saltmarshes are important as breeding grounds for birds that forage on the mudflats. They also provide a natural habitat for dozens of plant species and are a spawning area for fish.

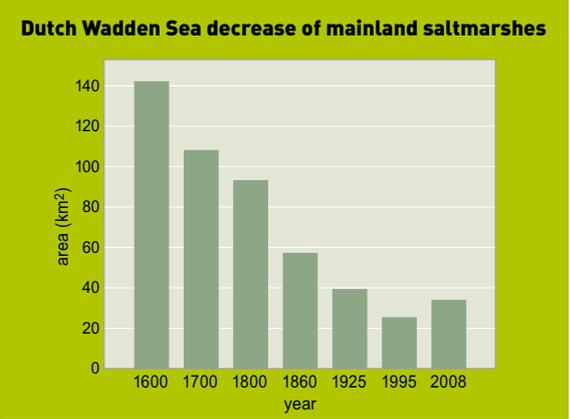
New saltmarshes

At the time, it was agreed that not only the existing saltmarshes should be preserved but that the total area of saltmarsh should be extended as well and a number of international agreements were made to this end. Because of the exceptional value of the Wadden Sea as a foraging area for migratory birds, extending seaward was not an option; instead, the dikes were to be set back inland. Noard-Fryslân Bûtendyks was chosen as the most suitable location for creating new saltmarshes because of the summer polders available in this area – a good 1000 hectares. In 1990, shortly after the planning decision had been taken, a plan to convert these summer polders into saltmarshes was developed, a plan which would make Noard-Fryslân Bûtendyks one of the largest continuous saltmarshes in Europe. Re-establishing saltmarshes struck a sensitive chord with a number of people from the local community who, in some cases from their own experience, knew just how much time and effort it had taken to claim the polders from the sea in the first place. Restoring saltmarshes was completely at odds with their long and proud history of claiming land from the sea. Because of all the opposition to the plan, *It Fryske Gea* decided to carry out a trial restoration first.

Traces

Noard-Fryslân Bûtendyks is not only a valuable saltmarsh area but has its own unique cultural history too; a history which has left its mark on the landscape in many different ways. The banks, the land-use pattern, the ditches, the banks of the summer polders and the watering points reveal the story of centuries of sedimentation and the struggle against the sea. *It Fryske Gea* wants to preserve these cultural and historical elements so that people can see with their own eyes what Friesland looked like in the past.

From: Vos & Knol. 2014. *Paleogeografische kaarten van het Wadden-gebied tussen Marsdiep en Weser 500 v. Chr. – heden.* © Deltares, Utrecht.



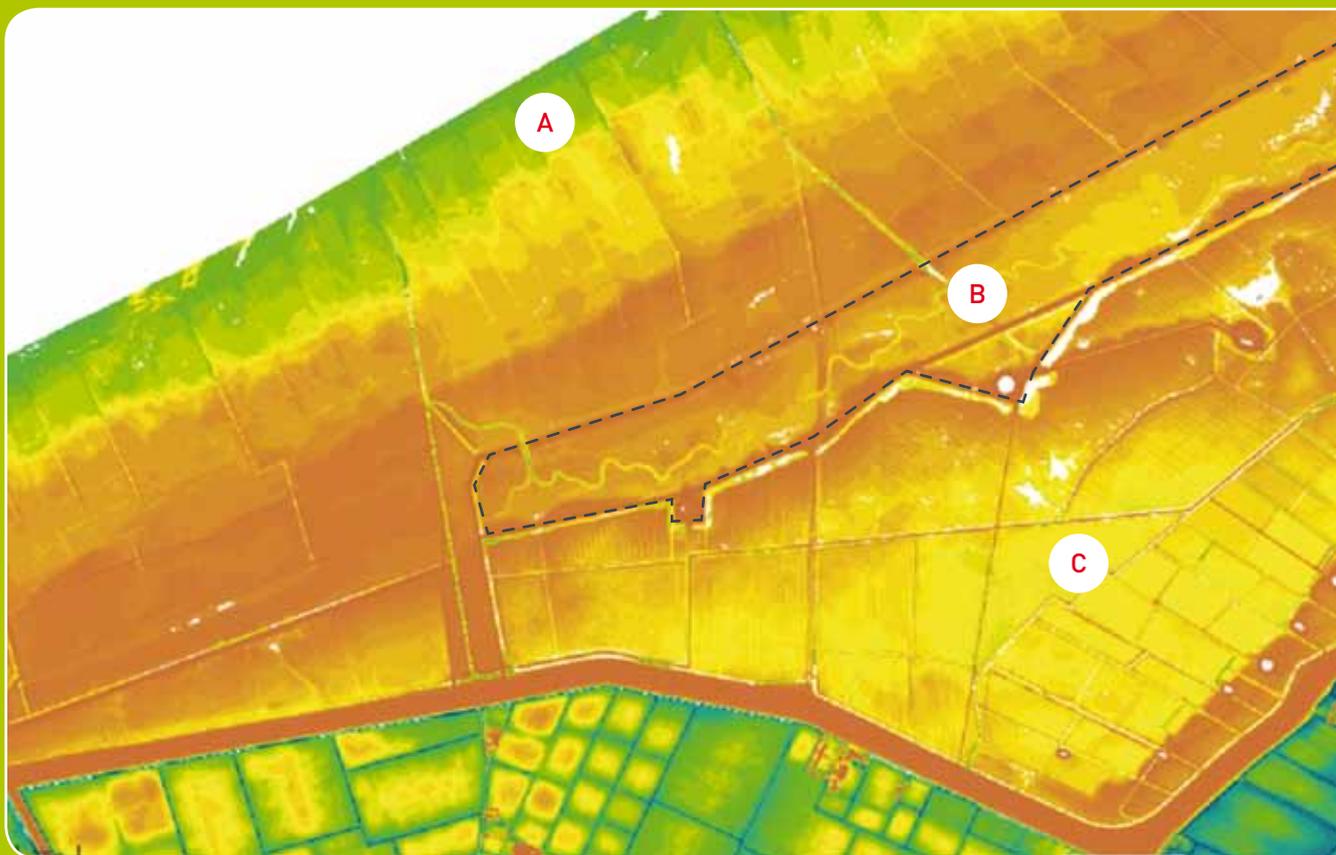
Saltmarshes are climate-proof

Saltmarshes are climate-proof. This is because they grow with rising-sea levels. Summer polders don't: over time they become bathtubs which the water can't escape from. Aided by the tides, the trial saltmarsh is quickly catching up. In just ten years' time its level has increased by seven centimetres.

Sea level is rising; over the past century the sea level along the Dutch coastline has risen by more than twenty centimetres and continues to rise, possibly accelerated by global warming. There is no doubt that our climate is changing and that a higher sea level could seriously threaten valuable nature areas outside the seawall.

Saltmarshes can offer a measure of relief from this process. With every flood-tide a thin layer of sediment is deposited on the saltmarsh so that it grows upward as the sea level rises. Because of this function, saltmarshes are regarded as 'climate buffers', natural

areas which limit the effects of climate change. Summer polders, however, are not climate-proof. Whilst the surface level of saltmarshes increases as the sea level rises, summer polders do not grow in height. When a summer polder is inundated during an extreme storm surge, the water coming into the polder is held in by the surrounding dikes and the polder acts like a bathtub without a plug to let the water drain away. 'If we do nothing, in future we will be pumping seawater from our summer polders. That is unthinkable,' said Chris Bakker, who is responsible for the Quality of the Natural Environment at *It Fryske*



Gea. He believes in keeping up with the rising sea level. 'That way we utilise natural processes. With every flood-tide the sea brings in new sediment, all for free.'

Keeping up with the sea-level rise

Saltmarshes keep up with the rise in sea level; this is a fact backed up by measurements. For almost a century the trial area in Noard-Fryslân Bûtendyks was only flooded occasionally. In comparison to the sea level, the polder lagged behind by about twenty centimetres, but as soon as the first floods occurred, it began to accrete sediment and grow upward again. Over a ten year period the surface of the trial saltmarsh rose by seven centimetres. The surface of the adjacent saltmarsh rose much faster during this period, by 21 centimetres on average, partly because it is located closer to the sea where more sediment is deposited. The upward growth of the trial saltmarsh was more than enough to keep up with the rising sea level; in fact, a third of the deficit has been made up. 'Keeping pace with sea level is working brilliantly,' is Bakker's conclusion. 'The trial saltmarsh will make up the deficit completely within a few decades.' The surface of the trial saltmarsh is not rising at the same

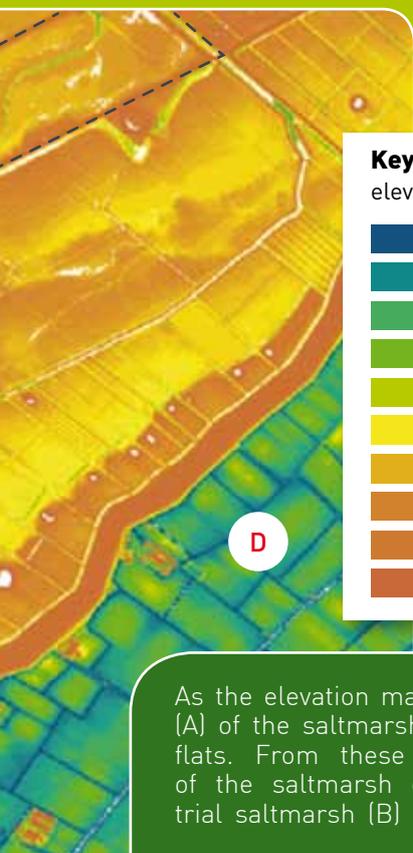
rate everywhere. Sediment has been building up a lot quicker in the lower part than the higher part; three times as quick, in fact. This is because the lower part is flooded more frequently and for longer periods of time so that more sediment is left behind. The same applies to the creeks in the area; on average, the areas next to creeks increased in height faster than the areas further away.

Coastal defence

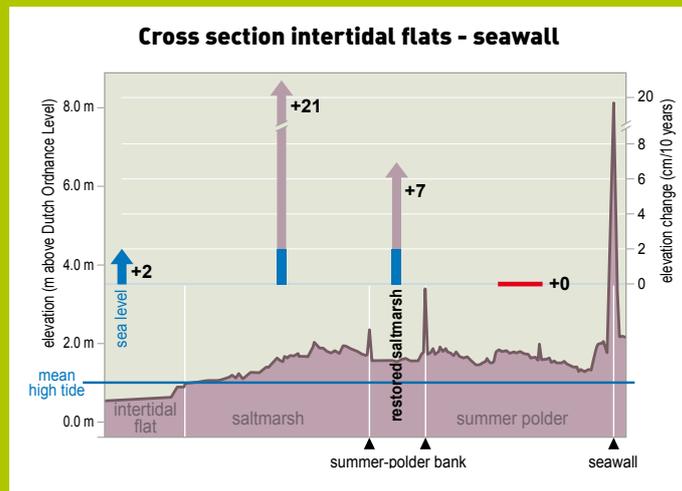
Keeping up with sea-level rise doesn't only benefit the saltmarshes but makes us safer too. Acting as a buffer, a saltmarsh reduces the force of the waves rolling in towards the dike. Without this damping effect the waves would roll on and pound the dike, potentially causing a lot of damage. Bakker: 'Awareness is growing that the areas outside the seawall, like Noard-Fryslân Bûtendyks, are strategically important for coastal defence. They increase the safety afforded by the seawalls. Converting more summer polders into saltmarshes can contribute to the creation of a climate-proof dike zone. If we don't do this, thirty or so years from now there will be a permanent lake of water standing in the low-lying summer polders next to the seawall.'

Chris Bakker:

"Areas seaward of the seawall such as Noard-Fryslân Bûtendyks are important for coastal defence."



| Key | |
|---------------|-------------|
| elevation (m) | |
| | < 0.25 |
| | 0.26 - 0.50 |
| | 0.51 - 0.75 |
| | 0.76 - 1.00 |
| | 1.01 - 1.25 |
| | 1.26 - 1.50 |
| | 1.51 - 1.75 |
| | 1.76 - 2.00 |
| | 2.01 - 2.25 |
| | > 2.25 |



As the elevation map shows, the lower parts (A) of the saltmarsh border on the intertidal flats. From these flats the surface level of the saltmarsh gradually increases. The trial saltmarsh (B) has grown upward but is

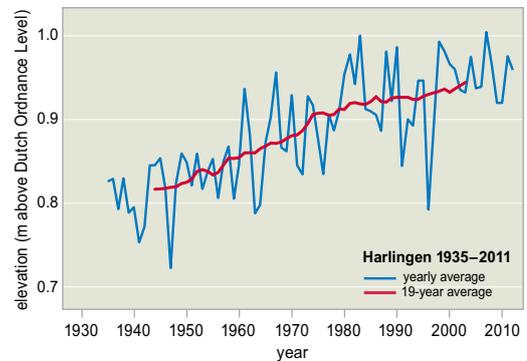
still lower than the adjacent saltmarsh. The summer polders (C) are a lot lower again. The land inside the seawall (D) has not been accreting since the seawall was built and is, therefore, lower.



How is sediment accretion of a salt-marsh measured?

Sediment accretion in the trial saltmarsh was measured in several ways. Out in the field, researcher Peter Esselink points at two posts standing two metres apart. 'I would rest a bar on the top of these posts and then use a measuring rod to measure the distance from this bar to the surface.' Posts like these were sited at over a hundred different places in the project area. Nine months before the saltmarsh trial began a number of initial measurements were taken. Then in the years up to 2005 the researchers visited three times a year. In 2007 and 2011 a single set of measurements were taken in late summer. The researchers also buried 56 stainless steel plates in the ground which they later located using a metal detector: By pushing a measuring rod vertically into the sediment until it hit the plate, they were able to monitor each year's sediment accretion.

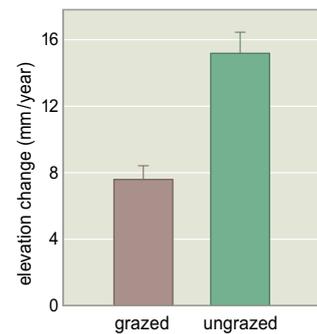
Sea-level rise



Grazing retards sediment accretion

Grazing inhibits the accretion of sediment because the animals trample the soil and compact it. In grazed areas, vertical accretion was sixty per cent lower than in ungrazed areas.

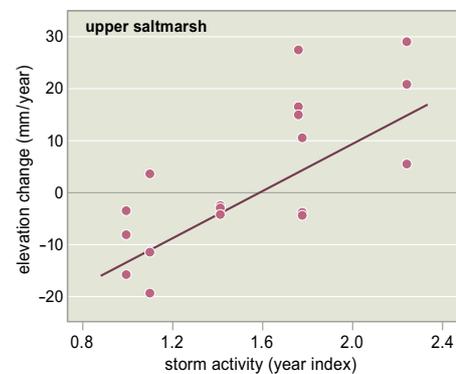
Livestock grazing and elevation change



Storms speed up sediment accretion

Storms accelerate the accretion of sediment. The more violent the storm, the more sediment is deposited on the saltmarsh. Why is this? For one thing, during a storm seawater carries a larger number of particles than usual, then there is the additional impact of a deeper layer of water above the saltmarsh during a flood. In years with many storms the surface level of the trial saltmarsh increased more rapidly than in other years. The accretion rate also differs throughout the year. Vertical accretion of the saltmarsh is more rapid in autumn and winter when most of the storms occur. In years with few floods, surface elevation of the saltmarsh may even decrease as a result of soil shrinkage, induced by dryness in summer, and trampling by livestock.

Effect of storms on elevation change



Johannes Kramer: 'Saltmarsh restoration stirs up strong feelings'

Restoring a saltmarsh raises the ecological value of the natural environment. This is what Johannes Kramer, a member of the Friesland Provincial Executive, believes. He passionately supports saltmarsh restoration, but also understands how sensitive various issues can be.

Kramer regularly visits Noard-Fryslân Bûtendyks. If he happens to be in the neighbourhood, he drives to the seawall to see how the land beyond it is faring. 'The wide-open spaces, the changing skies, the water. It looks different every time, but it's always beautiful,' he said. The land beyond the dike fascinates him. For him, it is an area of contradictions. 'You can look at it in many different ways. You could call it a wild landscape where nature is in control. Yet it is totally created by human intervention, an important piece of Friesland's cultural history.'

Commitment

Kramer believes that increasing the total area of saltmarsh by exposing summer polders to salt water from the Wadden Sea is a task facing the province and associated parties. There is an international commitment to saltmarshes, agreed on as part of European and national policy, according to Kramer. 'The Natura 2000 and the Water Framework Directive both deal with matters outside the seawall.'

A member of the provincial government, he is very committed to this particular cause. He believes the saltmarsh restoration trial begun in 2001 is enhancing the natural environment. 'Although I'm not a biologist, I can see that the project is having a positive effect on the ecological value of the area.' The role of a saltmarsh as a roosting place for migrating birds during high tide is an especially important one, Kramer feels. Furthermore, a saltmarsh grows at the same speed as the sea level rises. 'In this way, saltmarshes help to defend our coastline. Summer polders do not increase in height; they are simply a low-lying basin next to the seawall.'

Communication

All the same, as an administrator Kramer has to take other aims into account as well, such as the Province's ambitions for meadow birds and the support from local residents. 'The plans cause friction, especially within the local community. The debate about the land outside the seawall has gone on for decades. It stirs



up strong feelings. The forefathers of some of the local people created the land with their bare hands. Saltmarsh restoration – something they see as giving the land back to the sea – causes them pain. It's in their genes. As far as they're concerned it's first-rate farmland.'

Kramer always keeps the dialogue open. He receives all sorts of queries from worried residents, farmers and politicians. Communication is crucial, he believes. He is paving the way with enthusiasm. 'I've done my very best to convince the local council. People are beginning to understand what it's all about, although it's still a sensitive issue. We have to adequately explain what we're doing and ensure the benefits for the area are visible. *It Fryske Gea* does this really well, for example, with their visitor centre and publications such as this brochure.' Kramer emphasises that the region benefits from the natural saltmarsh environment outside the seawall. 'The spectacle of nature draws more visitors and the whole community profits from small-scale, high-quality tourism.' He regards the experiment with saltmarsh restoration as a touchstone for the future. 'We can learn from this and improve our methods for future restoration projects.'

Winners and losers

There are winners and losers in saltmarsh restoration. Salt-tolerant plants benefit from seawater whereas meadow birds prefer to seek refuge in a summer polder. Here we show seven plants and animals characteristic for the area. How are they doing?



Avocet

Length: 42-46 centimetres,
span 77-80 centimetres

Colour: white body, black crown and
black markings on back and wings

Trend: decreasing in the Netherlands and
Noard-Fryslân Bûtendyks,
including the trial area

The thousands of avocets in Noard-Fryslân Bûtendyks are an amazing sight with their black-and-white markings, slender legs and upturned bills. The numbers of avocets are decreasing probably due to predation, certainly in Noard-Fryslân Bûtendyks. Outside the seawall, the number of breeding avocets has fallen by 25% over the last twenty years. When the saltmarsh restoration trial began, the numbers increased initially, but after 2006 there was a sudden drop. In 2002, a year after seawater was let in, there were 79 breeding pairs. In 2011, only nine.



Redshank

Length: 27-29 centimetres,
span 45-52 centimetres

Colour: grey-brown with bright
orange legs and bill

Trend: increasing in the whole of Noard-
Fryslân Bûtendyks, including the trial area

The redshank is doing well in Noard-Fryslân Bûtendyks. In 2011, there were 392 territories; 59 more than round 2000. Redshanks like saltmarshes. They breed in the rougher areas. Redshank numbers are increasing in the trial area.



Oystercatcher

Length: 40-45 centimetres,
span 80-86 centimetres

Colour: black back and crown, white belly;
distinctive long orange-red bill and legs

Trend: decreasing in the Netherlands,
in saltmarshes as well

The numbers of oystercatchers are decreasing dramatically in the Netherlands, partly because of disappearing mussel beds. The population of oystercatchers has more than halved since 1990. This long-term trend also applies to Noard-Fryslân Bûtendyks, with decreasing numbers in both the saltmarsh and trial area. The population is stable only in the summer polders.



Seaside alkali grass

Length: 30 to 70 centimetres

Colour: grey-green

Flowering season: June to September

Trend: increasing substantially in the trial area

Seaside alkali grass (*Puccinellia maritima*) copes well with salt. The plant grows on low saltmarshes that are regularly flooded by seawater. On the grazed saltmarsh, it can form a dense mat. Seaside alkali grass is nourishing, being rich in protein. It appeared from nowhere during the first year after the polder was flooded. In the years following, the grass spread rapidly, especially in the low-lying areas. Subsequently its development has varied from place to place. At some spots, the grass has become less common due to inadequate drainage, being trampled by grazing animals, etc. At other places it has increased.



Glasswort

Length: 2 to 30 centimetres

Colour: flowers are green, rest of plant dull green

Flowering season: July to October

Trend: increasing substantially in the low parts of the trial area

Glasswort (*Salicornia europaea*) grows in the wettest and saltiest parts of a saltmarsh. Where the saltmarsh merges into intertidal flats, glasswort turns the marsh dark red in late summer. This annual plant has spread very rapidly in the trial area. In the low-lying eastern area, glasswort has been doing especially well in recent years and now dominates half the area.



Great white egret

Length: 85 - 100 centimetres, span 1.45 to 1.70 metres

Colour: white body and wings, black legs, yellow bill

Trend: increasing all over the Netherlands, including Noard-Fryslân Bûtendyks

The great white egrets – brilliant white in colour – are an imposing sight in the saltmarshes. The species is increasing explosively in the whole of the Netherlands. Just ten years ago, this egret was rare and now it is part of our winter landscape. It is remarkable that the birds have recently started visiting saltmarshes.



Barnacle goose

Length: 58 - 70 centimetres, span 1.20 to 1.42 meter

Colour: yellowish white face, black nape and breast, grey-white belly, black legs and bill

Trend: decreasing in spring, increasing in autumn

Noard-Fryslân Bûtendyks has been an important staging post for geese for some time. Geese use the trial area mainly in autumn. In spring, few geese are seen in the restoration saltmarsh because the vegetation – glasswort and common seablite (*Suaeda maritima*) – is not a suitable feeding habitat for geese in this season. In the autumn these two plants become edible so that, when the geese arrive from their breeding grounds, they find sufficient food in the trial saltmarsh.



Noard-Fryslân Bûtendyks

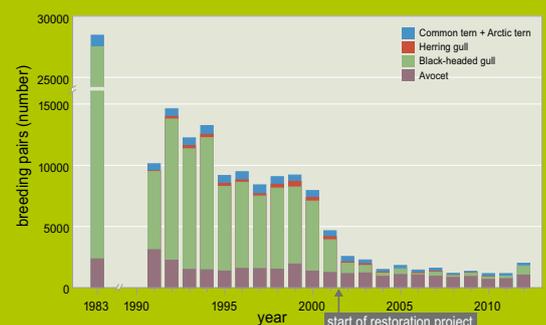
as bird paradise

Noard-Fryslân Bûtendyks is one of the best bird areas in the Netherlands. In the winter, as many as 100,000 geese alight there, with 40,000 of them making for the *Noarderleech*. It was to be expected that converting a summer polder to a saltmarsh would have an effect on the bird populations. After all, each landscape has its own distinct birdlife. The birds on agricultural land are different from the ones on natural saltmarshes. Daan Bos, a biologist and researcher at *Altenburg & Wymenga* provides some answers to the key question: what is the effect of saltmarsh regeneration on bird populations?

BIRD COLONIES: big reduction before saltmarsh trial

Noard-Fryslân Bûtendyks has always been known for its imposing flocks of birds, with huge numbers of black-headed gulls, common terns, Arctic terns and avocets breeding there. Until the end of the last century. Since then, the number of colonial birds has been decreasing. 'This is most probably because predators such as foxes are on the rise,' Daan Bos explained. He also mentioned other causes, such as the way the area is managed and the availability of food in the Wadden Sea. Bos emphasised that the decrease was not simultaneous with saltmarsh restoration. What's more, the large colonies which have disappeared did not live in the restoration area. 'That's why I don't believe there's a direct relationship between the saltmarsh trial or any other saltmarsh restoration in the past and the decrease in colonial nesting birds,' he said.

Decrease of colonial birds in Noard-Fryslân Bûtendyks





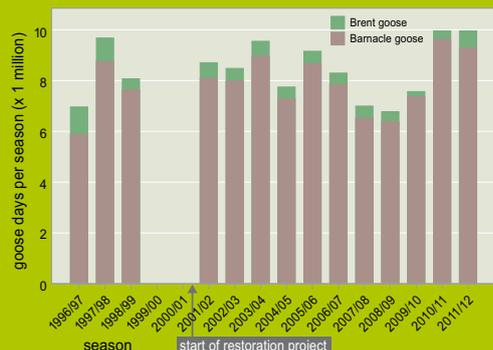
Daan Bos:

'A significant percentage of the geese can be found on the grazed saltmarshes.'

GEESE: total numbers remain stable

Brent geese, in particular, have a strong preference for saltmarshes, but barnacle geese are also found there in large numbers. 'In Noard-Fryslân Bûtendyks, a significant percentage of the geese are present on the grazed saltmarshes,' Bos related. Yet hardly any geese visited the saltmarsh restoration area in the first spring of the trial. Since then, the geese have been re-establishing themselves and now, just as many geese graze there as before the trial started. But only in the autumn period; in spring the numbers are still low. Bos blames this spring decrease on inadequate drainage and overgrazing. 'These two factors make the lower parts of the saltmarsh trial area less suitable for geese. Hardly any vegetation suitable for geese, like seaside alkali grass and sea plantain (*Plantago maritima*), grows on the bare soil in spring.' Nevertheless he believes the results are positive. 'Eventually, plants that geese can eat will establish themselves there. Areas with suitable food sources will increase – partly because of natural sedimentation and partly because of better grazing and drainage.' Since the trial area was de-embanked the total geese population in Noard-Fryslân Bûtendyks has remained stable, this applies to both barnacle and brent geese. Bos believes the saltmarsh restoration has not had any effect on the numbers of geese staging in the total area outside the sea-wall, partly because of the limited scale of the trial. 'Noard-Fryslân Bûtendyks has always been an important staging post for geese and still is. There was concern that the geese would look for alternative places inland but that hasn't happened.'

Goose numbers in Noard-Fryslân Bûtendyks



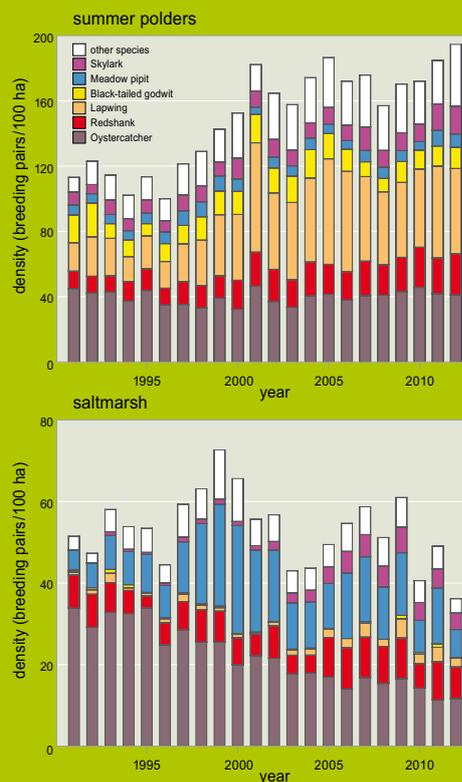
MEADOW BIRDS:

more in summer polders than on saltmarshes

Black-tailed godwits, redshanks, meadow pipits and skylarks are present in the whole of Noard-Fryslân Bûtendyks in large numbers, but the populations differ somewhat: in the summer polders, the density of meadow birds has increased whereas on the saltmarshes there has been a slight fall. 'In the trial area the number of meadow birds has fallen to the levels usual in an average saltmarsh. This decrease was to be expected. Black-tailed godwits and lapwings are typical farmland birds. If you convert a summer polder into saltmarsh, the density of meadow birds will obviously decrease,' Bos said, at the same time emphasising that saltmarshes are just as valuable for meadow birds as they are for geese. 'Fewer meadow birds per hectare nest on saltmarshes, but in absolute numbers the saltmarshes are incredibly important. And this will certainly be the case once saltmarsh management has been optimised. Then you can expect more of these birds.' Not all species have declined, according to Bos. You now hear the characteristic *teuk-teuk-teuk* call of the redshank more and more on the saltmarsh of Noard-Fryslân Bûtendyks, while it is becoming less common elsewhere in the Wadden Sea. The skylark is doing well too, whereas inland it is decreasing. Bos is glad to see that the number of species is increasing both in the summer polders and in the saltmarshes.

Even though summer polders probably score higher on the whole, there are specific differences between individual polders. Meadow birds generally benefit from marshy areas with pools, fairly low vegetation at the start of the breeding season, extensive management with hardly any use of fertiliser, carefully planned grazing and little disturbance. That is the case in some summer polders and the results are convincing. Bos: 'The summer polders managed by *It Fryske Gea* are probably among the best areas for meadow birds in Friesland.'

Breeding birds in summer polders and saltmarsh





Goose droppings and grazing

Goose droppings reveal how many geese have been grazing in an area. To measure the extent to which birds use an area, researchers counted the number of droppings per square metre in May. They did measurements at eight spots in both the livestock grazed and ungrazed areas. In grassy vegetation – in the high-lying western section and inside the fenced-off areas – more geese droppings were found. In the low areas where drainage was inadequate, grazing by livestock had a strongly negative effect on goose activity.

Debate: saltmarsh or summer polder?

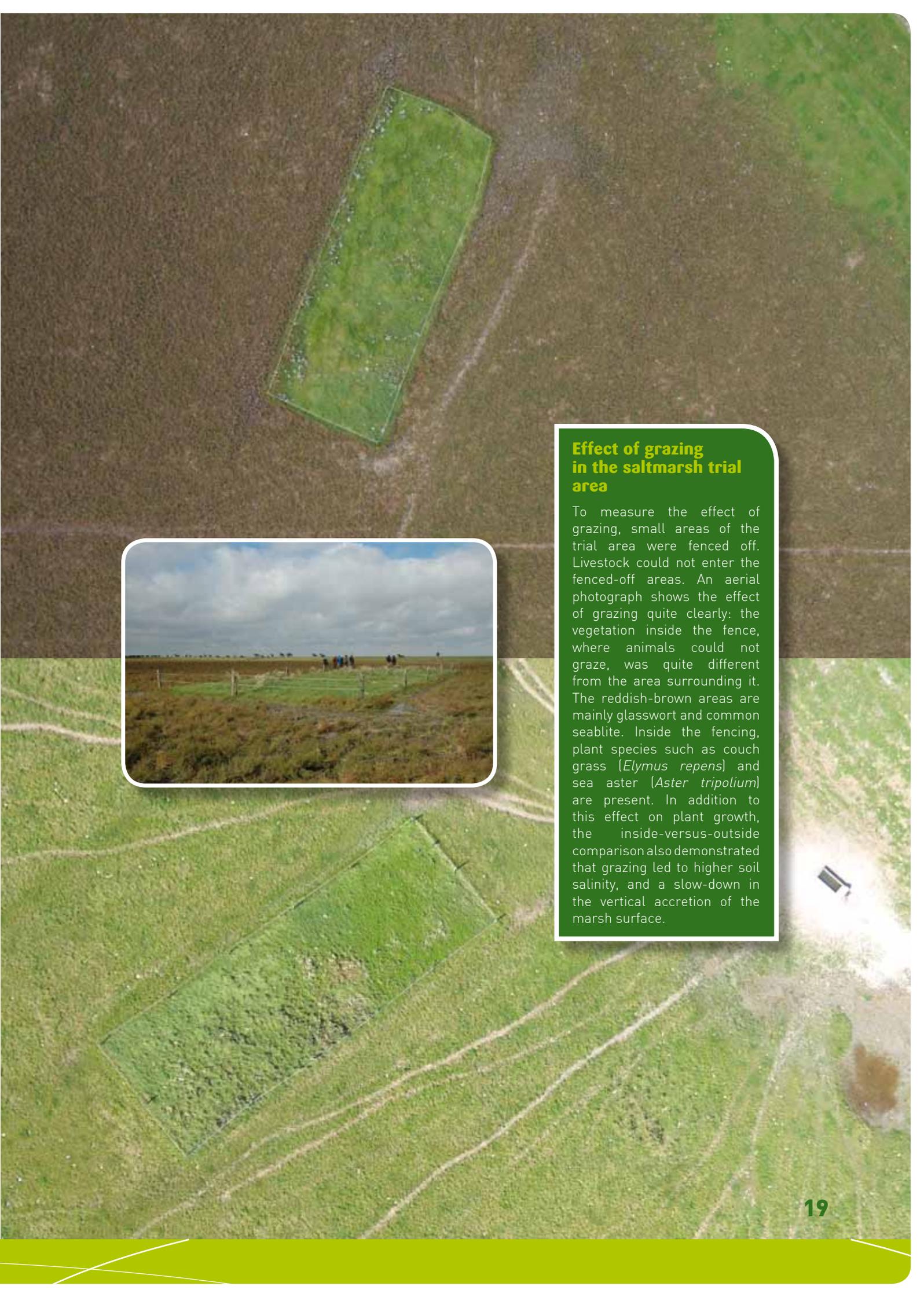
Plans to create more saltmarshes in Noard-Fryslân Bûtendyks have not been enthusiastically received by the FFF Wadden Sea Birds Working Group in Friesland. Volunteers in this working group have been counting the breeding and migrant birds outside the seawall for decades. They are very concerned about the reduction in numbers of breeding birds that accompanies saltmarsh restoration. They are afraid there will be less room for black-tailed godwits, avocets and other breeding birds. 'Our working group does not agree with this saltmarsh restoration. It is quite clearly detrimental to the breeding bird population. These summer polders are the most heavily populated breeding areas in Noard-Fryslân Bûtendyks,' explained Sieds Boersma, a member of the FFF and an excursion leader for *It Fryske Gea*. He is less worried about the geese. 'They'll find another place outside the seawall.'



Breeding bird trends

In Noard-Fryslân Bûtendyks, 99% of the breeding birds belong to just sixteen species. The list below shows breeding trends for these species between 1991 and 2012. A green arrow pointing upwards means an increase, a red arrow pointing down is a decrease, and a double arrow means a big decrease. A dash means the population has remained stable.

| | Noard-Fryslân Bûtendyks | The Netherlands |
|---------------------|----------------------------|--------------------|
| Skylark | ↑ | ↓ |
| Lapwing | ↑ | ↓ |
| Redshank | ↑ | - |
| Coot | ↑ | - |
| Reed bunting | ↑ | ↑ |
| Shelduck | - | ↓ |
| Black-tailed godwit | - | ↓ |
| Arctic tern | - | ↓ |
| Meadow pipit | - | ↓ |
| Mallard | - | ↓ |
| Yellow wagtail | ↓ | - |
| Oystercatcher | ↓ | ↓ |
| Avocet | ↓↓ | ↓ |
| Black-headed gull | ↓↓ | ↓ |
| Herring gull | ↓↓ | ↓ |
| Common tern | ↓↓ | ↓ |



Effect of grazing in the saltmarsh trial area

To measure the effect of grazing, small areas of the trial area were fenced off. Livestock could not enter the fenced-off areas. An aerial photograph shows the effect of grazing quite clearly: the vegetation inside the fence, where animals could not graze, was quite different from the area surrounding it. The reddish-brown areas are mainly glasswort and common seablite. Inside the fencing, plant species such as couch grass (*Elymus repens*) and sea aster (*Aster tripolium*) are present. In addition to this effect on plant growth, the inside-versus-outside comparison also demonstrated that grazing led to higher soil salinity, and a slow-down in the vertical accretion of the marsh surface.



Saltmarsh plants are advancing

An ordinary grassland with salt-intolerant plants: that is what the polder was in 2001 before it was exposed to the tides. Then the vegetation began to change. After just one year, salt-tolerant plants had appeared everywhere and even dominated some parts of the marsh. This transformation continued steadily in the following the years.

100
of the targeted species are already growing in the trial saltmarsh

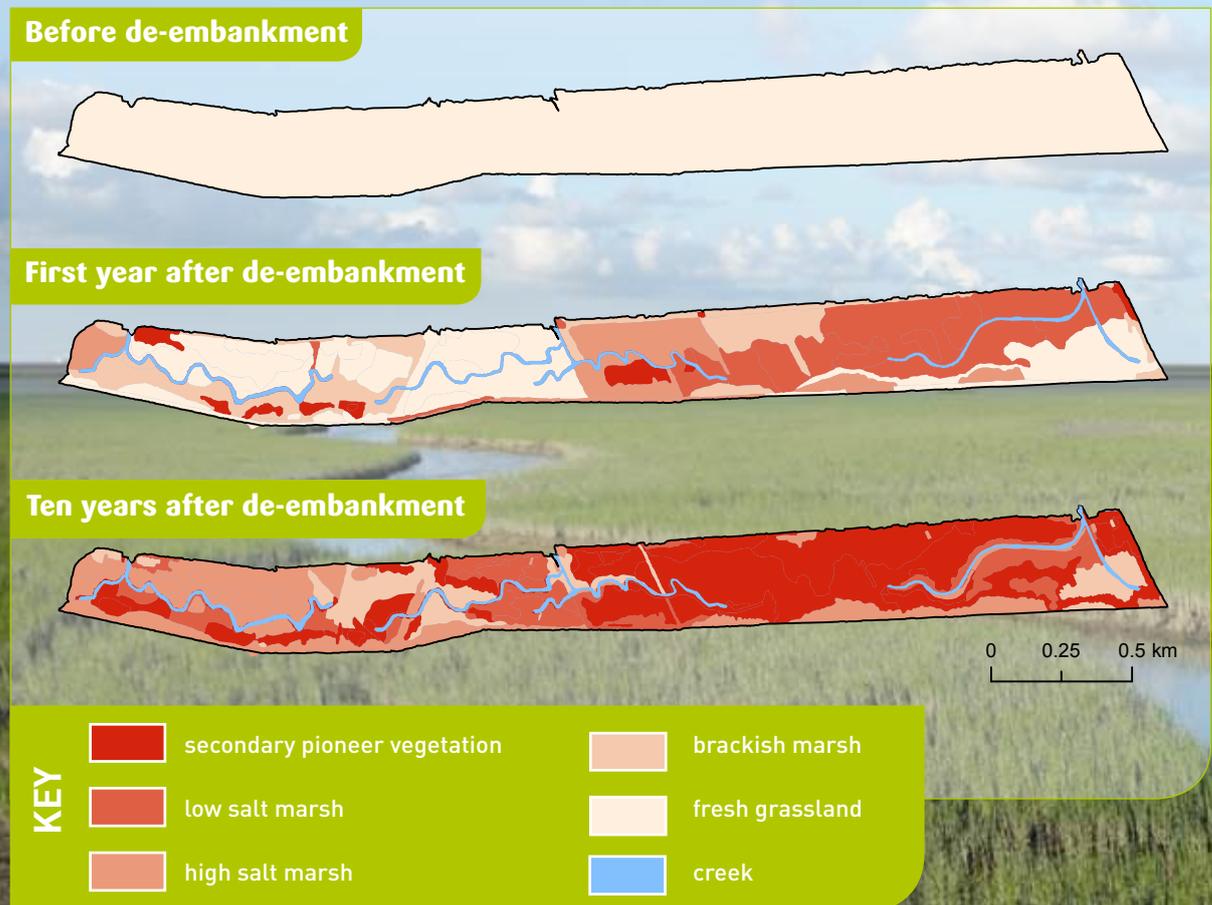
Salt-tolerant plants can be found everywhere on the marsh. Glasswort, common seablite, sea aster, lesser sea-spurrey (*Spergularia marina*) ... the mere sound of the names conjures up the sea. The transition from plants that cannot tolerate salt to salt-tolerant ones has been a great success. Before saltmarsh formation began, researchers had drawn up a list of 23 salt-tolerant plants. If those appeared, saltmarsh formation could be regarded as successful. 'All the target species now grow

there and are spreading,' according to Roos Veeneklaas, who is a researcher for *Bosgroep Noord-Oost Nederland*, an association of woodland managers. Late in the summer of 2011, she collected data on the vegetation in the trial area; first with aerial photographs and then in the field, where she drew the boundaries with the aid of GPS. The vegetation map she made is shown on this page together with the two maps made earlier by the *Rijkswaterstaat*. The three maps illustrate how salt-tolerant plants are advancing. Before salt water was let in, there was fresh grassland with perennial ryegrass (*Lolium perenne*) and practically

no salt plants. Now the area has a rich variety of saltmarsh plants. The seawater ensured that large numbers of these salt-tolerant plants could establish themselves in this area even in the very first year. Ten years later, the fresh grassland had disappeared.

Gradients

A saltmarsh consists of zones. If you walk from the seawall towards the sea, you will notice how the vegetation changes in a natural saltmarsh. In the higher and dryer areas, you will find plants such as red fescue (*Festuca rubra*) and sea couch (*Elymus athericus*). Near the sea – where the saltmarsh is





Roos Veeneklaas:

'Saltmarsh vegetation is forever developing.'

Glasswort

lower and the tides have a greater influence – you will find plants like seaside alkali grass and sea aster. There the soil is wet and salty. In the transition zone to the bare mudflats these factors play an even bigger role; glasswort and common seablite stick out of the mud here and there. This gradient from wet to dry and from very saline to almost fresh, can also be found in the trial area – but not at right angles to the coastline as in a natural saltmarsh. Instead it is parallel to it. The eastern part of the saltmarsh trial area is lower than the western part. Vegetation belonging to a high saltmarsh should therefore be on the left-hand side of the map with on the right-hand side, vegetation from a low saltmarsh. The high saltmarsh is clearly visible, but the low-lying saltmarsh much less so. This is because, in the eastern part, so-called 'secondary pioneer vegetation' dominates. 'This part of the saltmarsh is full of glasswort and common seablite. It is these two plants that give the saltmarsh its reddish colour early in the autumn,' Veeneklaas explained.

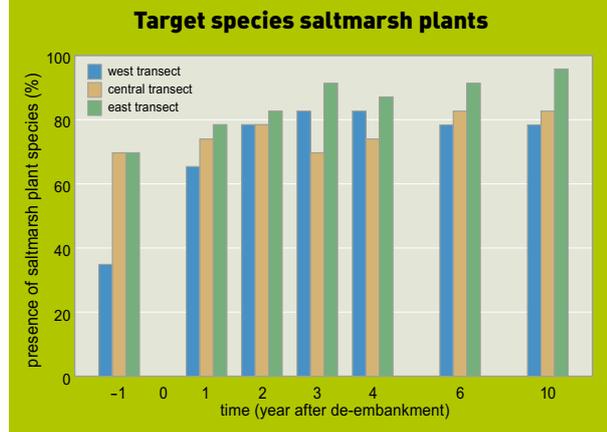
Re-wetting

At the moment, glasswort and common seablite are dominant

in at least half the area. Roos Veeneklaas is surprised by this. 'At this surface level you would expect low-marsh vegetation with grasses such as seaside alkali grass. However, this is not the case.' Glasswort and common seablite normally grow in the transition zone to the bare mudflats. The eastern section is equally wet and saline. 'The reason for this is that the ditches have become blocked up, so water doesn't drain away properly. Seawater flows back very slowly. That, with the impact of grazing livestock means that grasses can't survive here.' She does not believe this trend is a problem. 'Plant growth will change again at some point. Saltmarsh vegetation keeps changing, so if the drainage improves and the area silts up then the grasses will return automatically.'

Plant survey

In order to monitor changes, information about plant growth was collected in various ways. The year before the trial began, 105 squares were pegged out, each 4 m x 4 m: in the saltmarsh trial area 72, and in the adjacent saltmarsh 27, plus 6 in the adjacent summer polder. Since then, all the squares have been checked seven times. In addition, three 100-metre-wide strips were set out at right angles to the coastline. Almost 40 different species of plants were monitored in these three transects.



Sea couch not yet entirely dominant

If no grazing takes place, a saltmarsh eventually becomes covered by tall-growing plants. The higher levels will soon be dominated by sea couch. This grass species displaces other saltmarsh plants by growing as a thick, featureless mat on which meadow birds and colonial birds cannot live so easily. Sea couch can take over very quickly and can completely dominate a saltmarsh within five to ten years. In the restored and ungrazed Peazemerlannen saltmarsh, for instance, sea couch became dominant in the entire area. *It Fryske Gea* does not want to this happen everywhere. In the trial area sea couch has not yet taken over anywhere. During the ten years of the trial, sea couch did in fact establish itself here and there, especially in the twelve fenced-off areas from which grazing animals were excluded, but it did not come to dominate. Which demonstrates that grazing can have a favourable effect on plant diversity.



Mosaic management in Noard-Fryslân Bûtendyks

It Fryske Gea always aims for variety. A mix of short and tall vegetation in the grazed summer polders and the semi-natural saltmarshes is the best way to ensure biodiversity. Grazing is essential, but it has to be well-balanced and varied.

The saltmarsh restoration experiment was meant as a learning experience. Chris Bakker, in charge of Quality of the Natural Environment at *It Fryske Gea* emphasised this point. 'We wanted to learn by doing.' Ten years of saltmarsh research has produced a wealth of ideas for managing the area. For example, the effect of filling in ditches was enlightening for Bakker. 'We believed there shouldn't be any ditches in a natural saltmarsh so we filled them in. But what we got was a huge mud-bath full of glasswort and common seablite where water was retained for a long time. Breeding birds don't like such conditions. They

would have been better off if there had been ditches.' Grazing only exacerbated the problem because the animals trampled the soil and prevented plants like seaside alkali grass becoming established. 'We've learned from this sort of thing. If we had put in less livestock – or none at all – seaside alkali grass would have established itself more quickly. These are points to take with us to the next restoration project.'

Management regime

There was never any doubt about the importance of grazing. Cattle, sheep and horses keep the vegetation under control. If the animals were to disappear, the whole area would become overgrown by tall vegetation. The question was, what animals are the most suitable and what should the population density be? Bakker adopted some ideas from a previous management experiment (see inset) which was carried out on the adjacent saltmarsh with horses and cattle in low and high densities. Each grazing regime led to different types of vegetation, insect population and birdlife. Which is precisely what *It Fryske Gea* wants: a varied landscape, because that is the best way to

Five lessons we have learned

1. Give the sea enough space. Allow water to flow in and out freely without obstacles so the saltmarsh can increase in depth along with the sea level rise.
2. There is no point in planning creeks so they meander in a particular fashion. In the end, natural processes determine where the water flows.
3. Choose a varied grazing regime to achieve a mosaic of grazed and ungrazed areas.
4. Do not allow too many animals into an area if water drainage is inadequate. This leads to muddy flats where plants normally found in low saltmarshes do not stand a chance.
5. Ensure that water flowing inshore does not form standing pools but can flow back to sea. Eventually, a mixture of areas with limited and good drainage will develop naturally.



An experiment: cattle or horses or both?

In 2010 a long-term grazing experiment began on the saltmarshes to the north of the trial area. Three PhD researchers and countless students and lecturers – all involved with animal and plant ecology – worked on this joint project set up by *It Fryske Gea* and the University of Groningen. The key question was: What effects do different forms of grazing have on a saltmarsh? The effects on plants, birds and insects were tested by means of trials. Fifteen fenced-off areas, each of about eleven hectares, were used to test grazing by horses and cattle. In some of the areas the density was one animal per hectare, in others it was less – half an animal per hectare. Rotation grazing was tested as well: one year of intensive grazing and one year completely without grazing. The differences proved to be enormous. Interestingly, a combination of management regimes appeared to be best for the natural environment. Where cattle grazed at low density, a varied mosaic of shorter grazed and rougher patches developed. High-density grazing attracted the most birds in winter. Horses galloping over the marsh not only trampled the soil but smashed nests and eggs as well. An experiment with clay pigeons which were buried just below the surface proved this. In the breeding season, horses trampled an amazing 40% of all the clay pigeons to bits.



Chris Bakker:

'We're aiming for variety in this area.'

achieve a diversity of life forms. Bakker: 'We like to see a range of grazing regimes. Our aim is variety, not just a rough saltmarsh dominated by sea couch or a grassland as smooth as a golf green, but both, or more: a level green lawn for geese and meadow birds; sea-couch-dominated marsh for the short-eared owl and meadow pipit; and a large area of low-intensity grazed saltmarsh with a variety of characteristic saltmarsh vegetation and a diversity of insects.' At the moment, the density of grazing animals appears to be too high in some areas and there are certainly too many horses. *It Fryske Gea* has adjusted the management regime. 'We're aiming for a better balance and will let fewer horses in, this year,' he revealed. Bakker wants to vary the vegetation using what is called mosaic management. That means closely-grazed areas with salt plants, grazing geese and nesting meadow birds, plus areas with taller vegetation where young birds can find refuge. 'It is this variety that makes the area ideal for plants, insects and birds. In the rougher areas, short-eared owls breed and sea asters attract rare saltmarsh insects, while geese graze on the green lawn.'

Meadow birds

Not only saltmarshes are important for Bakker's mosaic, so are summer polders. They complement each other perfectly. Black-tailed godwits can breed on large stretches of agricultural land but the young birds can then quite happily feed on the saltmarshes. In the summer polders, Bakker has opted for a specific sort of meadow-bird management. 'Some of the polders are being grazed too intensively at the moment so that there are hardly any meadow birds. Farmers are even using slurry to manure the land.' It is not easy to get the management for meadow birds right because it demands mosaic management, rough stable manure, high groundwater levels and an efficient way of dealing with foxes. This combination does work, as research into meadow birds in the whole of Friesland has proved.

Bakker is now setting his sights even further: inland as well. At the moment the seawall is a distinct barrier between the two worlds, whereas Bakker would like to link up the areas seawards and inland of the seawall. 'I'd like to bring together certain dike-related aspects such as water management, cultural history, nature conservation and recreation. The land inwards of the dike is getting saltier and soil build-up is not going at the same pace as sea-level rise. There are opportunities here for nature, but also for recreation. To this end, we're collaborating with the *Aerden Plaats*, which provides archaeological advice as well as a culture and visitors' centre. Together with this centre, we offer activities for visitors.'

'Size a unique feature of this saltmarsh'

The immensity of Noard-Fryslân Bûtendyks makes it unique. It has the potential to accommodate one of the largest areas of continuous saltmarsh in Europe. 'Here it really is possible to create a wide saltmarsh, with the sea and seawall a long way off from each other', said Jaap de Vlas, a saltmarsh expert.

Almost all the saltmarshes along the coast are narrow. An exception is Noard-Fryslân Bûtendyks opposite the Noarderleech, where at the widest point it is three kilometres from the seawall to the seaward marsh edge. This is a unique situation which harks back to the huge saltmarsh area that existed at this spot in the past. 'We now have the chance to re-establish an ancient landscape in Noard-Fryslân Bûtendyks. Most areas of primeval nature, such as ancient forests, can no longer be regenerated on a large scale in the Netherlands. Our country has become too cultivated. In saltmarsh areas, however, there are still possibilities, but we need to use the complete width of Noard-Fryslân Bûtendyks. It is precisely the wideness of the area that makes it so interesting.' Jaap de Vlas appreciates how valuable the summer polders outside the seawall are for meadow birds and other bird species, but pointed out that habitats that are ideal for meadow birds can be created in other places too. 'A broad strip of saltmarsh, however, is possible here and nowhere else.'

Specialists

If you just take a quick look at a saltmarsh you see only grassland. Yet it is much more varied and dynamic than it might seem at first sight. 'Differences in height and grazing pressure are reflected in the vegetation types. Saltmarshes contain unique plant species which flourish nowhere else. Only the real specialists can survive the conditions there: the saline soil and being flooded with seawater,' De Vlas explained. And there are not all that many specialists. According to De Vlas, some 25 different plant species grow on mainland saltmarshes. In amongst them live 300 to 500 species of insects, spiders and other invertebrates. De Vlas: 'These creatures, just like the plants, have to be able to cope with seawater.' Many saltmarsh plants are home to certain insect species. On a sea aster, especially, you will find about twenty different types of insects and they are all dependent on this plant. In turn they form a food source for young birds. In addition, large numbers of breeding birds visit saltmarshes. Some species such as avocets,

Jaap de Vlas:

'A broad saltmarsh is possible here and nowhere else.'

Saltmarsh ridges

In Noard-Fryslân Bûtendyks there are numerous zones with saltmarsh ridges and low-lying areas in between. Upon de-embankment of a polder, these differences in surface elevation become particularly obvious in the vegetation. The southern landward area with a low surface elevation will remain relatively wet. These basin areas are ideal for vegetation

now rarely seen along the coast outside the seawall. Examples are reeds and rushes in a possibly brackish environment. As the soil becomes more saline, the type of vegetation is also determined by water drainage. These basin areas sometimes give rise to new saltmarsh creeks. Such developments aid diversity – something which is not possible in narrow saltmarshes.



Essex skipper (*Thymelicus lineola*)

oyster-catchers and skylarks prefer short, open vegetation interspersed with grassy tussocks. Redshanks and reed buntings breed in the rougher areas. 'Some breeding birds such as short-eared owls and harriers need a large area of saltmarsh in order to breed,' De Vlas added.

Size

De Vlas also mentioned another opportunity the immensity opens up, namely, a transition zone from fresh to salt water. 'The Noarderleech is wide enough to allow this zone to move back and forth with the tides,' De Vlas explained. He applauds the project known as 'Gemaal Vijfhuizen' which the water board hopes to implement in Noard-Fryslân Bûtendyks and which involves fish ladders. 'That will make the area even more valuable. Migrant fish such as eels and three-spined sticklebacks search out these transition zones in spring so they can swim inland. Brackish water areas are crucial to countless animals including common prawns.' De Vlas is convinced that brackish water is an essential but often missing link in saltmarshes. 'Doing away with water outlets



Campiglossa plantaginis

Saltmarsh aspirations everywhere

The desire to re-establish saltmarshes is widely supported. The ecological value of saltmarshes is recognised by policymakers not just in the province of Friesland but also nationally and on a European scale. The Frisian saltmarshes are part of the Dutch Ecological Network which links up a variety of nature conservation areas, while the Wadden Sea – including Noard-Fryslân Bûtendyks – has been designated a nature protection area of European importance (Natura 2000).

and building causeways have more or less led to the disappearance of these links. In Noard-Fryslân Bûtendyks we now have an excellent opportunity to break through a solid boundary and allow the gradual change from fresh to salt water to be restored. There is a condition attached to this: fresh water should be able to flow from the saltmarsh to the sea during periods of drought. Otherwise the brackish zone will disappear.'

De Vlas is very enthusiastic about the saltmarsh restoration trial. 'This concept has proved itself. The new saltmarsh area looks splendid. Now they need to carry on the good work and start up other saltmarsh projects without delay. De-embanking summer polders in Noard-Fryslân Bûtendyks is one of the few ways to ensure broad saltmarshes are regenerated.'

Where bird migratory routes intersect

The Wadden Sea is an essential stopover site for between ten and twelve million migrant birds on the East Atlantic Flyway. The birds arrive in late summer after nesting in the North. Some of them overwinter, the rest continue on their way southwards. Early in spring, the bird migration starts up again in the reverse direction. There are

52 bird species of which more than 1% of the world population use the Wadden Sea. Of some species including oystercatchers, avocets, brent geese and wigeons, it is more than 50%. Most of these species forage for food on the mudflats at low tide. At high tide they make for the saltmarshes and take a rest there. This function of the saltmarsh as a high-tide roost is important for these birds. Geese and wigeons also look for food in the saltmarshes.

Noard-Fryslân Bûtendyks enriches the whole region

Noard-Fryslân Bûtendyks is more than just a saltmarsh. The whole area benefits from this piece of nature: local residents take walks there, tradespeople serve more customers and holiday-makers enjoy the wide open spaces and the silence. The new visitor centre, *Kweldercentrum Noarderleech*, has helped to stimulate recreation and the economy in the whole region.



Sieds Boersma:

'I let people experience the silence.'



Ramblers, nature lovers, birdwatchers, people seeking peace and quiet, artists; Noard-Fryslân Bûtendyks is attracting more and more people. 'The number of visitors is increasing, with the natural land outside the dike adding to the appeal of the region, certainly now that we have the new visitor centre,' enthused Kirsten Zwijnenburg, the secretary of the association of local recreation businesses. She is certain this nature conservation area is benefiting the region. Camping grounds, B&Bs (*Bêd & Brochjes* in Frisian), restaurants: they all profit. 'They can send their visitors here. The *Seedykster Toer*, a local business which organises trips into the area in a tractor-drawn coach, have also converted an old grain silo into a look-out tower. I think the saltmarsh centre is a wonderful leisure attraction. Visitors are given information so they can explore the saltmarshes themselves.' What local business people are really pleased about is that during the breeding season – at the same time the high season for tourists – you can still wander around the area. Although you must keep to the paths. 'Outside the breeding season you can wander all over the saltmarsh and that's an amazing experience.'

Kirsten Zwijnenburg:

**'I think the saltmarsh centre is
a wonderful leisure attraction.'**

Jan de Boer:

**'Those who come here on
a visit always return.'**

Special package

Kirsten Zwijnenburg visits the saltmarsh often, living just a stone's throw away. She is an artist and also the coordinator at the *Aerden Plaats*, a cultural centre for visitors in Oude Bildtzijl. '*Bildt* means 'silted-up ground'. It used to be a saltmarsh just like Noard-Fryslân Bûtendyks, but over the centuries was gradually turned into a polder. Our historical exhibition gallery provides information about the saltmarsh-engineering works and the stepwise embankment of the area.' The *Aerden Plaats* works closely with *It Fryske Gea*. They have recently put together a package including both a cultural and nature walk and a stop-over in both centres *en route*. 'We're giving each other a boost,' she explained.

The area outside the seawall is a real favourite with local residents. 'I know lots of people who visit the dike frequently. "To blow away the cobwebs," they say. It's a wonderful place for that,' said Jan de Boer, who coordinates the *Kweldercentrum Noarderleech*. The centre opened its doors last year and De Boer is a proud man. 'More and more people are discovering where we are. It looks very inviting, don't you think? Although we have several volunteer hosts and

hostesses, the centre itself is unmanned and everyone is free to walk in and out, look at the exhibition and drink a cup of coffee.' De Boer makes a big effort to network with the local people. 'We promote the region with leisure packages and the sale of local products during our open days. We also have a room upstairs which local people can use for lectures, meetings and such.'

Excursions

De Boer believes it is important lots of people see and experience the saltmarsh. 'We organise numerous excursions every year so visitors can see for themselves how remarkable this piece of nature is. Many are coming here for the first time. For them, the wide open spaces and the silence is a wonderful experience – even if the birds do make a tremendous racket during the breeding season, especially above the paths where they warn continually.' People are beginning to become more aware of the area, Jan de Boer thinks. 'Those who come here on a visit always return.'

Sieds Boersma is a volunteer for *It Fryske Gea*, taking people on excursions at least once a month. During such excursions he tells people about this landscape and the cultural history. 'I help people to read the landscape and let them experience the silence. On summer evening walks we go and sit somewhere and listen to the silence for several minutes. Some people find that threatening, others are fascinated.' Sieds Boersma was born and brought up in the area. He often goes to Noard-Fryslân Bûtendyks, mainly to collect data on the birds. He is very enthusiastic about the bird populations there. 'The area outside the dike is crucial for migrating birds because they need a staging post *en route*. On busy days in the winter, more than a hundred thousand barnacle geese can be sitting there. There is a wide variety of birds: tufted duck, dunlin, sandpipers, grey plover, avocet. Each bird species chooses its own habitat. These vary enormously and include mud fields, pioneer saltmarshes, high-lying saltmarshes, pits and summer polders.'

Wadden gold

Last spring, the *Kweldercentrum Noarderleech* received the regional hallmark of quality: Wadden gold. Tineke Schokker, a member of the provincial government of Friesland, presented the award. This is what Henk Pilat from the *Stichting Waddengroep* had to say about the prize winner. 'Our seal of approval stands for unique products, companies and services in the Wadden Sea area. The *Kweldercentrum Noarderleech* is one of these unique services.' The award, he feels, is not just for the visitor centre but also for the piece of nature outside the seawall, the saltmarsh management and the excursions over the saltmarshes. 'They make up a complete package,' said Pilat. He is delighted that *It Fryske Gea* is seeking to collaborate with local business people. 'We believe in a network economy in which companies and organisations in the Wadden Sea area pool their resources. The whole region is suffering from a weak economy so this sort of collaboration creates new opportunities. *It Fryske Gea* is working hard to secure this.'

Saltmarshes for nature and people

- **Local residents**, who go for a walk there
- **Leisure organisations**, who are attracting more and more customers
- **Holiday-makers and day-trippers**, who enjoy this nature conservation area
- **Birdwatchers**, who come to see a huge variety of birds
- **Tenant farmers**, who put their animals there to graze
- **Saltmarsh plants**, which have space to live there
- **Migrant birds**, who find a resting place and food there
- **Breeding birds**, that have a place to nest
- **Water board**, who speaks highly of the additional safety provided by the saltmarsh

Noard-Fryslân Bûtendyks adds to the appeal of the region for those who want to live, work or visit there



Colophon

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in Noard-Fryslân Bûtendyks

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