INFLUENCE OF THE TIDE ON THE DROWNED LAND OF SAEFTINGHE

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Abstract
The Drowned Land of Saeftinghe is a large-scale, salt marsh wilderness, situated in the province of Zeeuws-Vlaanderen. The influence of the tide on the Drowned Land of Saeftinghe is clearly visible. Water is continuously changing the landscape. This protected area mainly consists of three regions: sand banks, mud banks and salt marshes. Sand and mud banks are barely vegetated, but they house many small animals. We compared the vegetation on the different banks and found that these regions are extremely important foraging areas for birds. In addition, the salt marshes are dry during both low and high tide and are therefore suitable for plant growth. This makes these grounds important breeding and resting grounds for many bird species.

The fieldtrip to the Drowned Land of Saeftinghe is part of an annual exchange project organized by Maurick College. During this fieldtrip, students work on their theoretical knowledge about ecology and perform fieldwork as well. They investigate both biotic and abiotic factors that influence life in the Drowned Land of Saeftinghe. Based on their findings, students answer the main question: *To what extent does the tide affect the Drowned Land of Saeftinghe?*

Keywords: Polder, salt marshes, mud banks, tides, biodiversity, Drowned land of Saeftinghe.

The main goal of the research:
The goal of this research is to find out how tides effect the landscape. To find an answer to this question our project was divided into subtopics: measuring soil composition, inventorying plant species, finding traces of zoobenthos, inventory of bird species and lost and found. Various examinations were performed at low and high tide to analyse the differences. Our hypothesis is that tide has an effect on the soil composition, the soil composition will affect the vegetation, the vegetation will have its effect on which benthos will live there and the benthos will eventually have an effect on the different bird species. So, tides will lead to a chain reaction. With our investigations we want to show what the importance is of the natural processes on the flora and fauna in this particular area. With this knowledge we can understand these natural influences.

Introduction to The Drowned Land of Saeftinghe
The most important and largest saltmarsh in Europe is 'The Drowned land of Saeftinghe'. It has a surface of 3600 hectares. It is situated on the border between The Netherlands and Belgium, located in the province of Zeeland. It is adjacent to the Westerschelde. The land was, as the name suggests, once struck by many floods caused the land to become an extensive nature reserve [1]. Why is the drowned land of Saeftinghe so incredibly special? There are several reasons. One of the reasons is the difference between high and low tide which amounts to an average of 4.80 meters. At spring tide, it can even rise to more than seven meters. This is the biggest tidal difference in the Netherlands.

History
From the twelfth century, the village and surrounding area of Saeftinghe was threatened by many floods. Therefore, the land of Saeftinghe was eventually claimed by the sea. In order to reclaim land, sea walls were built. The result of these walls were that the intertidal area of Saeftinghe was no longer influenced by the tide. Farmers benefitted from this dried area because the soil in Saeftinghe was very fertile and therefor suitable for agriculture. This lasted until the 'All Saints flood' in 1570. Because of this disaster, seawalls were broken by water and the land of Saeftinghe was almost completely flooded again.
At that time the village of Saeftinghe was of great strategic importance. All ships passed along Saeftinghe on their way to the harbor of Antwerp. But also the existing of the village of Saeftinghe came to an end during the 'Eighty Years War' (1568-1648). The last undamaged seawalls were broken down by the Dutch soldiers to protect Antwerp. As a result, the village of Saeftinghe was flooded by the sea.

Until the 1950s there were plans to 'dry out' the Drowned Land of Saeftinghe. For this reason, the Rijksdam, from Emmadorp to the north, along with different high dikes along the Schaar van Ouden Doel, were planned to build. In the end, this plan wasn´t executed, because Belgium objected to the plan as during storm surges The Drowned land of Saeftinghe served as 'komberging' (a Dutch word similar to 'water bufferzone'). Without the Drowned land of Saeftinghe parts would eventually flood. So, the Drowned Land was given back to the nature. [4]

In the 1950s a plan was devised to shorten the waterway to Antwerp by constructing a channel, the so-called Baalhoek channel. This plan has also been abandoned. In order to make the waterway suitable for Antwerp and keep it accessible for large ships, the channel eventually was dredged in the Westerschelde.

In 1965, the so-called Gasdam was constructed parallel to the sea dike of the ´Hertogin Hedwigepolder´. This dam is a sand body of about five meters high and a few dozen meters wide. This 3-kilometre-long dam gave place to large transport pipes for gas, water and chemicals. The strip of land between the sea dike and the Gasdam together has a surface of more than 100 hectares. Water could only pas the dike by means of a narrow opening on the east side. As an extra service to the owner, the makers of the Gasdam installed a summer quay in this opening, so that the water could no longer penetrate. In this way a small ´polder´ arose without an official status. This strip of land was popularly known as 'het Selenapoldertje'. This ´polder´ was leased to farmers. However, the summer quay was overflown and the harvest in the polder was lost. After the breakthrough during the heavy storm on November 13, 1990, the quay was no longer restored. Partly due to the efforts of the 'Nature, Forest, Landscape and Fauna Directorate of the Ministry of Agriculture'. In 1992 the owner offered the private part of Saeftinghe, including 'het Selenapoldertje' for sale [2]. The Zeeland Landscape Foundation eventually bought the area. The purchase was financed for a substantial part from a legacy of Mr. B.S. Sieperda, who was associated with the Middelburg court. As an appreciation for that contribution, the Selena polder was renamed 'Sieperdaschor' in June 1993. The consequences for nature of this spontaneous depopulation' have been well researched. The studies show that many bird species have benefited from this depopulation [3].

Depolderisation politics

Nowadays, there are plans to give the whole area of the drowned land of Saeftinghe back to nature [5]. That is because in other places of the Netherlands we take 'land or water' from nature to have more building space for our growing population. Without interference, natural processes such as storm, flooding, wave action, wind erosion (resulting, for example, in dune formation), water erosion, sedimentation and soil formation, and ecological processes such as the extinction of populations, settlement and succession can't occur naturally.

The reason why politicians are hesitating to give land back, is because they are afraid there might be floods because of 'depolderisation'. The WNF has said: 'To keep the living area of the migratory birds in the Westerschelde alive, we should give land back to nature'. After a lot of discussion, it was decided to give the land back in the future. They realized that the main aspects, such as the economy, nature, recreation and safety, would all improve, or would at least not be damaged by the plan. So, overall, they decided that proceeding with the plan was the best option.

Animal life

Saeftinghe is best known among nature lovers for its richness of different bird species. Thousands of coastal birds use the Drowned land of Saeftinghe as breeding ground, including redshanks, silver and black-headed gulls, common terns, and oystercatchers. The reed beds are important breeding grounds for Red List species such as bearded male (*fig. 1*), blue throat, reed singer and marsh harrier. Saeftinghe is also important as a resting place for many migrating (*fig. 2*) and wintering birds. Besides the bird fauna, the area also has a lot of value for various other groups of species. Therefor the Westerschelde and Saeftinghe are now on the 'Natura 2000' list.

Saeftinghe lies close to the sea, which brings along even more different plant species and therefore also different bird species. Saeftinghe has the ultimate conditions to house a big variety in flora and fauna [6].

The 'Nature 2000' status is based on the international importance of the area for a great number of birds. The soil of the mud- and sand banks are filled with countless small animals and are therefore suitable as foraging grounds for birds. Because of the zoobenthos, many fishes and crabs can be found in the waters between those particular banks.

Figure 1: Bearded Male (Punarus biarmicus): 'baardmannetje'. Native bird of Drowned Land.

Figure 2: Grutto (Limosa limosa). Migrating bird which uses The Drowned Land as breeding area

All animals that are associated with life in or on the soil belong to the zoobenthos. Some animals, including the *Tubifex* and the Peppery Furrow Shell (*Scrobicularia plana*), have been able to adapt to life in the anaerobic conditions thanks to bacteria in some parts of the mud banks. The biodiversity of benthos is relatively low, due to the small number of species that have adapted to the extreme conditions.

The way the animals acquire their food can vary in many ways. For instance, the filter feeders feed by filtering the food particles from the water like the mussel (Mytilus edulis) does. Deposit feeders actively take up food particles from the soil. An example is the Lugworm (*Arenicola marina*). This worm lives in a burrow in the sand of the mud

banks of the Land of Saeftinghe. The Lugworm forms a delicious meal for countless birds, fish, crabs and centipedes. The largest part of the worm is buried deep underground in a tunnel that can be approximately 30 cm deep. However, the tail of the worm is located near the surface because it has to be able to deposit its feces. As a result, the tail is an easy catch for predators. On average, this worm loses the top of its tail 2 to 4 times every month. The zoobenthos serves as an important food source for countless other animal species.

Methods

Soil composition

The composition of the soil was determined by sampling the top layers of the salt marshes and mud banks and using the soil triangle (fig 3). First a soil sample was taken from the top layer. The big pieces of gravel, shells and remains of plants were removed. Thereafter the samples were placed in a glass jar and filled to approximately one quarter soil. Subsequently tap water was added until the jar was completely filled. After adding a few droplets of dishwashing soap, the jar was nicely mixed. A night of rest gave the particles time to sink. After that, three layers should appear. One of lutum, one silt and one sand. Layers were measured with a ruler. The thickness had to be measured on four different sides, because the layers are not equally spread. After this the ratio of the sand- silt- and lutum contents were determined

Inventory of plant species

For these results samples of three different places were taken: the lower and higher salt marshes and the pioneer zone. First a quadrant with a measuring tape, a rope and 4 pins had to be set up. The quadrant had to be one square meter without interference of human footsteps in the quadrant for accurate results. The next step was to determine the plant species in the quadrant by consulting a plant guide.

Zoobenthos

Benthic animals were determined by identifying the tracks at the salt marshes and the mud banks. A measuring tape, rope and 4 sticks were used to set up the quadrant. The quadrant had to be a reflection of the whole area. A guide was used to determine which track belonged to a certain soil animal. The number of tracks that have been found was also recorded.

Bird species

Bird species were investigated on an open, wide and quiet area. An inventory of the bird species in the mud banks and salt marshes using binoculars was made during mid-day and the afternoon, high and low tide. The highest amount of birds in vicinity were written down at one certain moment.

Lost and found

Unnatural objects like plastic products, shells were collected while hiking in Saeftinghe. These were later categorized into different sections like, human waste, natural waste and animal waste products.

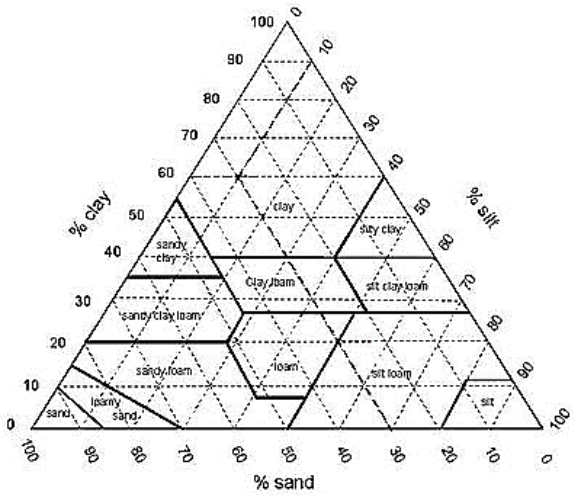


Figure 3. Example of soil triangle, which is used to determine the type of soil of a certain sample by using the percentage shares of every layer and drawing lines.

Results

Soil composition salt marches and mud banks

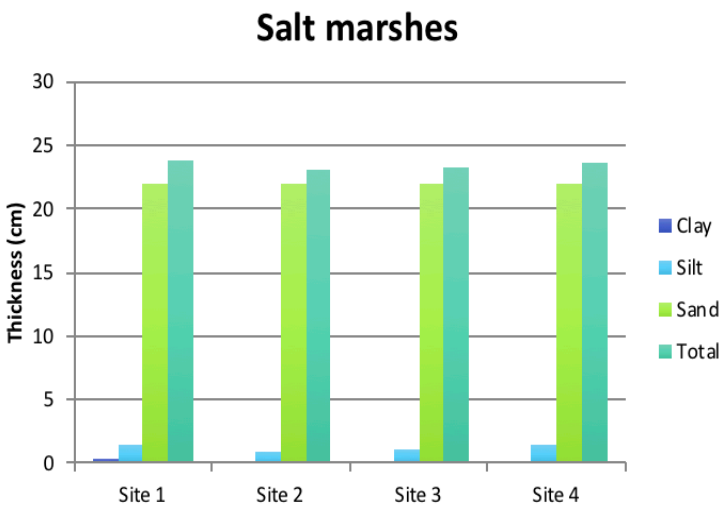
The results of the mud banks measurements are given in table 2 and graph 2, those for the salt marches in table 1 and graph 1. Our results showed that the soil composition in the mud banks consists of 0.66% clay, 4.39% silt and 94.95% sand. The soil composition in the salt marshes is 0,80% clay, 5,30% silt and 93,8% sand. Sand is clearly the main component.

Table 1 the soil compositions: salt marshes

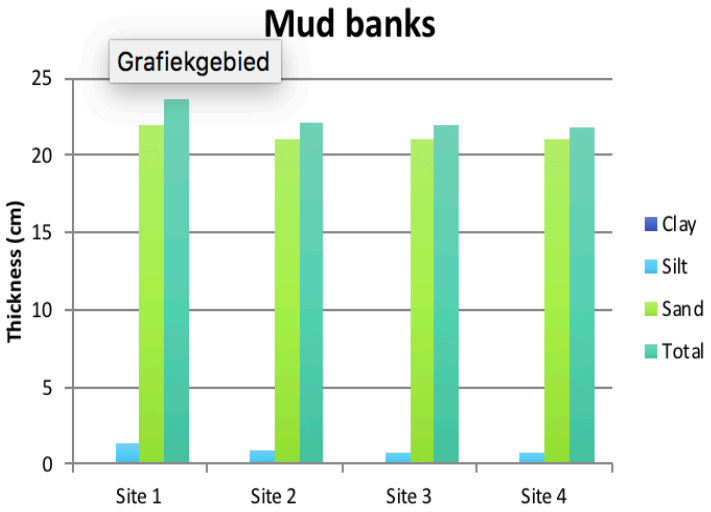
Layer	Site 1	Site 2	Site 3	Site 4	Average thickness (cm)	Percentage (%)
Clay	0.33 cm	0.15 cm	0.13 cm	0,2 cm	0,2025 cm	0,80 %
Silt	1.5 cm	0.95 cm	1.1 cm	1.4 cm	1.2375 cm	5.30 %
Sand	22 cm	22 cm	22 cm	22 cm	22 cm	93.8 %
Total	22.48 cm	23.1 cm	23.23 cm	23.6 cm	28.44 cm	100 %

Table 2 the soil composition: mud banks

Layer	Site 1	Site 2	Site 3	Site 4	Average thickness (cm)	Percentage (%)
Clay	0.17 cm	0.17 cm	0.13 cm	0.12 cm	0.1475 cm	0.66 %
Silt	1.4 cm	0.97 cm	0.83 cm	0.73 cm	0.9825 cm	4.39 %
Sand	22 cm	21 cm	21 cm	21 cm	21.25 cm	94.95 %
Total	23.57 cm	22.14 cm	21.96 cm	21.85 cm	22.38 cm	100 %



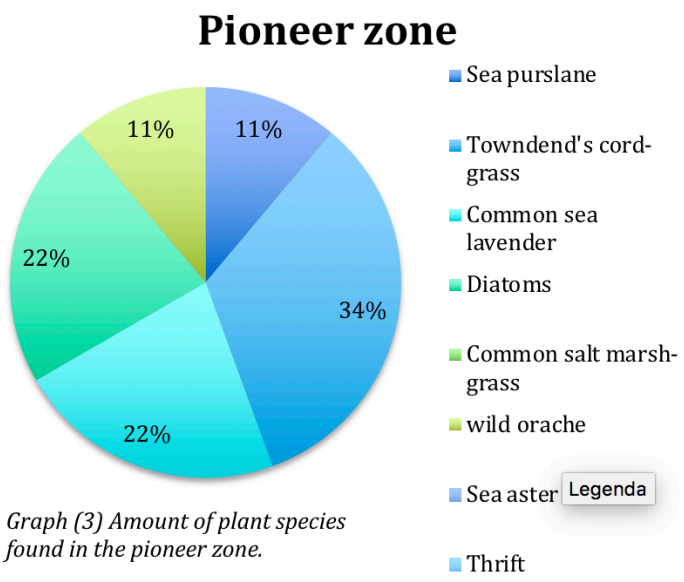
Graph (1) Soil composition in the Salt Marshes



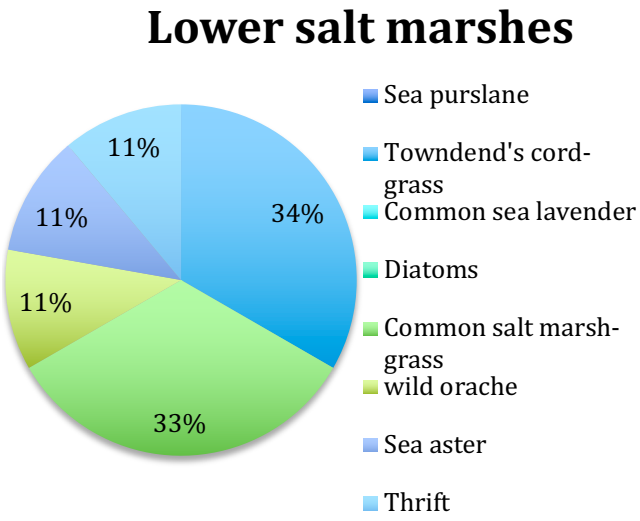
Graph (2) Soil composition in the Mud Banks

Inventory of plant species[1]

As shown in graph 3, Townsend's Cord-Grass was the most found plant species in the pioneer zone (34%). Besides this species, also some other plants were found. In the lower salt marshes (graph 4) Townsend's Cord-Grass and common salt marsh-grass were found to an equal amount. Thrift was the only specie found in the higher salt marshes therefor no graph is shown.



Graph (3) Amount of plant species found in the pioneer zone.



Zoobenthos[2]

The most found invertebrate in the soil in the mud banks and in the saltmarshes is the mud shrimp (table 3,4 and graph 5, 6). In the salt marshes 18 mud shrimps were found and 12 in the mud banks. In the salt marshes were also 13 baltic clams found and 8 king ragworms. More invertebrates were found in the mud banks than in the salt marshes. The lavar spire shell, the dun sentinel and the Baltic isopod were found in the mud banks, in the salt marshes none of these species were found.

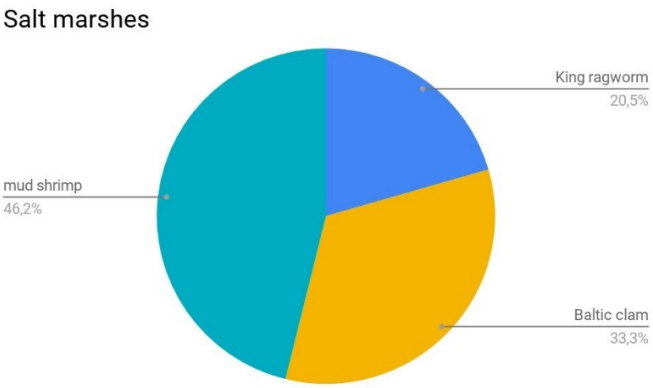
Table 3: Amount of invertebrates found in the salt marshes.

King ragworm / Alitta virens	8
Crab / Brachyuara	-
Baltic clam / Limecola balthica	13
Ragworm / Nereidae	-
Dun senitel / Assiminea grayana	-
Mud shrimp / Thalassinidea	18
Slender / Oppo ssum shrimp	-
Baltic isopod / Idotea balthica	-
Laver spire shell / Peringia ulvea	-

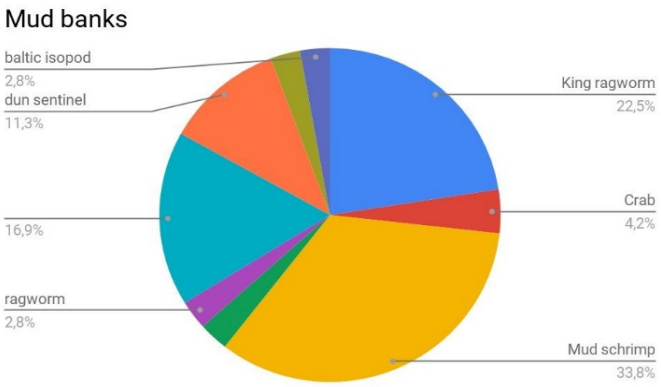
Table 4: Amount of invertebrates found in the mud banks

King ragworm / Alitta virens	8
Crab / Brachyuara	1,5
Mud shrimp / Thalassinidea	12
Baltic clam / Limecola balthica	1
Ragworm / Nereidae	1
Lavar spire shell / Peringia ulvea	6
Dun sentinel / Assiminea grayana	4
Slender / Oppossum shrimp	1
Baltic isopod / Idotea balthica	1

[1] See attachment 'plant species'
[2] See attachment 'other animals'



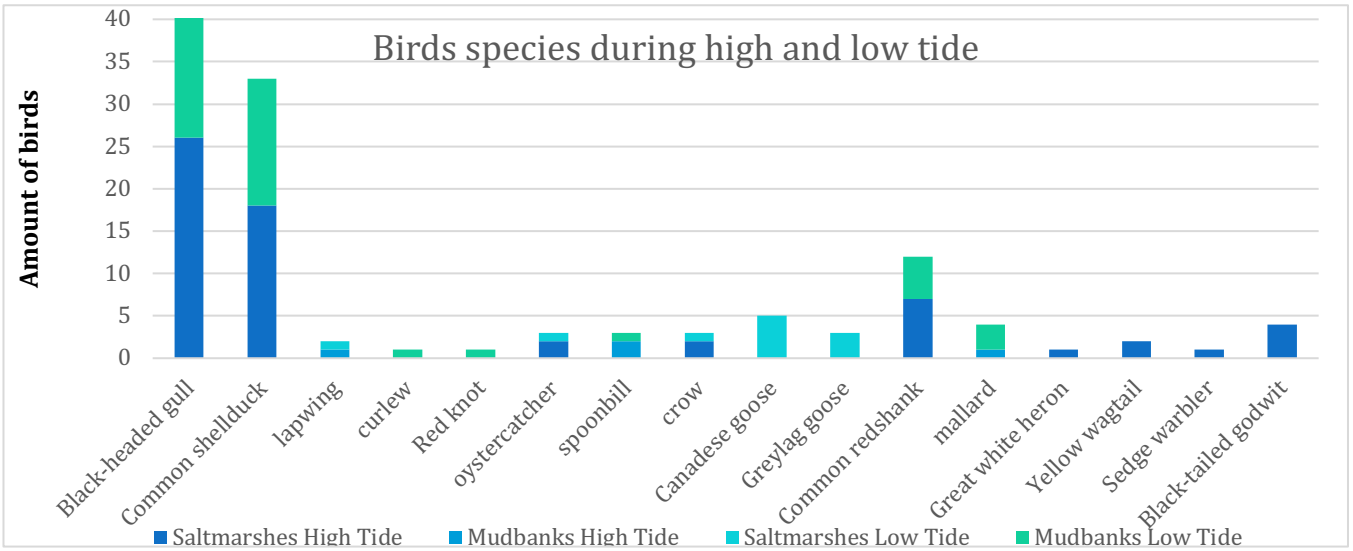
Graph (5) Number of invertebrates found in the Salt marshes



Graph (6) Number of invertebrates found in the mud banks

Inventory of bird species[3]

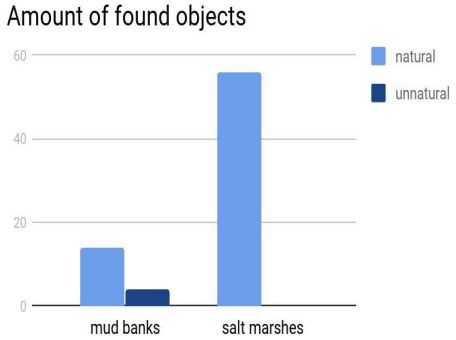
The most bird species were found on the salt marshes at high tide. At low tide the birds were mainly found on the mud banks. The black-headed gull and the common shell duck are the most common bird species on the salt marshes and the mud banks. There were 26 black-headed gulls and 18 common shell ducks on the salt marshes. 19 black-headed gulls and 15 common shellducks, 5 common redshanks and 3 Mallards were found on the mud banks. As seen in graph 7 also someother waterbirds were seen, however to a lesser extend (see table 'amount of birds' in attachment).



Graph (7) Amount of bird species during high and low tide, salt marshes and mud banks.

Lost and found

As seen in graph 8 the amount of natural common objects that were found in the saltmarshes were higher than in the mud banks. These objects came from nature such as plants and pieces of crab. In the mud banks were also some unnatural objects found, like plastic whereas in the saltmarshes none of them were found. Many more objects were found in the saltmarshes than in the mud banks.



Graph (8) Amount of objects found in the Drowned Land of Saeftinghe.

[3] *See table 'Amount of birds' in attachment*

Conclusion

soil composition

Silt is a particle with a diameter of around 2-61 µm, this is smaller than sand with a diameter of 0,062-2 mm, but bigger than clay particles with a diameter smaller than 2µm [14]. Our data shows that the percentage of silt and clay is slightly higher on the salt marches then on the mud banks, the percentage of sand is higher on the mud banks. You would expect to find the majority of clay and silt on the salt marshes. Because the water in mud banks moves quite fast, the clay and silt particles don't have much time to settle on the bottom. The salt particles are bigger and settle much easier than clay and silt. This is why we would expect to find the highest percentage of sand in the mud banks. When high tide shows up, the water sometimes floods the salt marshes, where it is pretty calm, which gives the silt and clay particles time to settle down.

Inventory of plant species

Plants that have adapted to life in an alkaline environment mostly live in the pioneer zone and the plants that can't handle such high osmotic values live in the upper salt marches, this is also confirmed by the found literature [8].
Thrift *(Armeria maritima)*, for example, is a grass type that can't grow in salty environments [9], which is detectable in our results: thrift *(Armeria maritima)* only lives in the upper and lower salt marshes. In these areas the osmotic value is much lower than in the pioneer zone. In the lower salt marshes, a wide variety of species occurs. There are plants that can withstand high salt concentrations [9-12], and plants that don't have this ability as well. This suggests that ocean water doesn't reach the lower salt marshes very often. This has affected the population of plants on the lower salt marshes.
On the upper salt marshes, we only found thrift *(Armeria maritime)*. Thrifth thrives because it doesn't have to sustain a complex system that removes salt from itself. In contrary the plants that can live in alkaline environments do waste energy on keeping their salt removing systems running, even when they are not using them because of being settled on the higher salt marshes [13].

Zoobenthos

The difference in the number of animals on the salt marshes and the mud banks is very visible. In the mud banks is also a much wider variety of species living on and under the ground. The Baltic Clam *(Limecola balthica)* sometimes digs himself to a depth of 20 meters [15-17], on this depth the amount of water is equal under the salt marshes and the mud banks. And because the salt marshes cover a larger area, we found more Baltic Clams *(Limecola balthica)* there.
The mud shrimps *(Corophium volutator)* were everywhere. They are small animals, up to 11mm long, that move through the mud with relative ease [18-19]. Because of their small bodies, they do not need much food to survive. These factors combined explained the abundance of these crustaceans.
With eight sightings the King Ragworm *(Alitta virens)* was also one of the commonly found species in our research. This large annelid worm is very common on the shores of the Netherlands, they feed on seaweed and microorganisms [20-22]. So, these traits explain their presence in the mud banks. All of the other animals that were present in the mud banks can be commonly found in this habitat. So, it makes sense that we found them there.
The mud banks are the perfect environment for small animals that feed on organic material. They can easily hide in the wet sand where they feed on phytoplankton and other small life forms [23]. While the salt marshes are very dry and life-less.

Inventory of bird species

Lots of Black-headed gulls *(Chroicocephalus ridibundus)* and common shellducks *(Tadorna tadorna)* were spotted. This isn't surprising since these are very commonly found around the coastline. They feed mostly on small animals living in the water/mud. This explains why they are mostly found on the salt marshes during high tide; it is a more difficult time to forage in the water. When the tide is low, and the water has retreated, the soil animals are easier to be found and sometimes animals are trapped in so called tide pools. This makes hunting a lot more efficient.
During low tide, the diet of Spoonbills (*Platalea leucorodia*) and Curlews (*Numenius arquata*) consists primarily of animals living in the water. This is the reason for their absence on the salt marshes; there are no water animals to be found here. In contrast to the Spoonbills (*Platalea leucorodia*) and Curlews (*Numenius arquata*), Canadese gooses (*Branta canadensis*) and Greylag gooses (*Anser anser anser*) are herbivores, so they were not seen in the mud banks. We only saw these birds on the salt marshes, eating grass and other plants and seeds and travelling in between them in the air.
There are some exceptions to the birds named above. We saw some Yellow Wagtails (*Motacilla flava flava)* and a Sedge Warblers (*Acrocephalus schoenobaenus*), these birds are animals that do not specifically live near large bodies of open water. These birds are found in woods as well. But if the conditions are right they can definitely survive.

Lost and found

We found that 'the Land of Saeftinghe' wasn't very polluted by macro products like plastic (no research on microproducts). We did find some unnatural products, but it was not that much. We mostly found organic waste material from other plants or animals. But this is a common phenomenon in a natural environment. This number of unnatural products was probably mostly washed ashore with the water. During high tide, these objects had settled on the salt marshes, which is why we found them there. It is possible that this pollution is directly linked to human acts. Maybe someone accidentally, or deliberately, dropped a plastic object and didn't notice it. No unnatural products were found on the mud banks. Probably explained by the fact that this is the aftermath of the sea and those objects were taken to the open sea.

Overall conclusion

We can say with relative certainty that all the experiments where influenced by the tide one way or another, this confirms our hypothesis: The tide has an effect on the soil composition, the soil composition will affect the vegetation, the vegetation will have its effect on which benthos will live there and the benthos will eventually have an effect on the different bird species. So tides will lead to a chain reaction.

Discussion

After having done all the research, we discovered some inaccuracies and small problems. The differences between high and low tide were less clear, which caused some uncertainties. The tides should be taken into account more. The experiments have to be done when the water is at the highest- and lowest level. It might be a good idea to change our observance locations. In this way the differences that the tides bring better are more evident.

To keep the outside variables as low as possible, it is better to perform each experiment twice. For example, we can do the experiments at high tide in the morning and the evening or even on two different days in the morning. Also, more measurements will reduce the variability. The number of assessments per group can easily be doubled

In this research, we mostly did our research in the public area of the nature reserve. If we could get an arrangement with 'het Zeeuwse Landschap', we could do our research in the non-public areas. In this way the perceptible influence of human activity will be decreased.

As soon as this research has been conducted a few years in a row the students will get a chance to compare their findings with previous years. In this way the changes happening over a course of many years can be observed clearly. Having all this data creates the possibility to really see how the ecosystem of 'the Drowned Land of Saeftinghe works.

Acknowledgement

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Attachments

Birds species list

Latin	Dutch	English
Acrocephalus arundinaceus	Grote karekiet	Great reed warbler
Acrocephalus schoenobaenus	Rietzanger	Sedge warbler
Alauda arvensis	Veldleeuwerik	Sky lark
Alopochen aegyptiacus	Nijlgans	Egyptian goose
Anas acuta	Pijlstaart	Northern pintail
Anas clypeata	Slobeend	Northern shoveler
Anas crecca	Wintertaling	Common teal
Anas penelope	Smient	Eurasian wigeon
Anas platyrhynchos	Wilde eend	Mallard
Anas querquedula	Zomertaling	Garganey
Anas strepera	Krakeend	Gadwall
Anser albifrons	Kolgans	White-fronted goose
Anser anser	Grauwe gans	Greylag goose
Ardea purpurea	Purperreiger	Purple heron
Arenaria interpres	Steenloper	Turnstone
Aythya fuligula	Kuifeend	Tufted duck
Botaurus stellaris	Roerdomp	Eurasian bittern
Branta canadensis	Canadese gans	Canadese goose
Branta leucopsis	Brandgans	Barnacle goose
Brante bernicla	Rotgans	Brent goose
Calidris alba	Drieteenstrandloper	Sanderling
Calidris alpina	Bonte strandloper	Dunlin
Calidris canutus	Kanoet	Red knot
Charadrius alexandrinus	Strandplevier	Kentish plover
Charadrius hiaticula	Bontbekplevier	Great ringed plover
Chlidonias niger	Zwarte stern	Black tern
Circus aeruginosus	Bruine kiekendief	Marsh harrier
Columba oenas	Holeduif	Stock dove
Columba palumbus	Houtduif	Wood pigeon
Crex crex	Kwartelkoning	Corn crake
Cygnus olor	Knobbelzwaan	Mute swan
Egretta garzetta	Kleine zilverreiger	Little egret
Fulica atra	Meerkoet	Common coot
Haematopus ostralegus	Scholekster	Oystercatcher

Latin	Dutch	English
Haliaeetus albicilla	Zeearend	White-tailed eagle
Ixobrychus minutus	Woudaapje	Little bittern
Larus argentatus	Zilvermeeuw	Herring gull
Larus fuscus	Kleine mantelmeeuw	Lesser black-backed gull
Larus melanocephalus	Zwartkopmeeuw	Mediterranean gull
Larus ridibundus	Kokmeeuw	Black-headed gull
Limosa lapponica	Rosse grutto	Bar-tailed godwit
Limosa limosa	Grutto	Black-tailed godwit
Locustella luscinioides	Snor	Savi's Warbler
Luscinia svecica	Blauwborst	Bluethroat
Melanitta nigra	Zwarte Zee-eend	Common scoter
Mergus serrator	Middelste zaagbek	Red-breasted merganser
Numenius arquata	Wulp	Curlew
Palco peregrinus	Slechtvalk	Peregrine
Panurus biarmicus	Baardman	Bearded reedling
Phalacrocorax carbo	Aalscholver	Great Cormorant
Platalea leucorodia	Lepelaar	Eurasian spoonbill
Pluvialis apricaria	goudplevier	European golden plover
Pluvialis squatarola	Zilverplevier	Grey plover
Podiceps cristatus	Fuut	Great crested grebe
Porzana porzana	Porseleinhoen	Spotted crake
Recurvirostra avosetta	Kluut	Pied Avocet
Saxicola rubetra	Paap	Whinchat
Somateria mollissima	Eider	Common eider
Sterna albifrons	Dwergstern	Little tern
Sterna hirundo	Visdief	Common tern
Sterna sandvicensis	Grote stern	Sandwich tern
Tachybaptus ruficollis	Dodaars	Little grebe
Tadorna tadorna	Bergeend	Common shelduck
Tringa erythropus	Zwarte ruiter	Spotted redshank
Tringa nebularia	Groenpootruiter	Common greenshank
Tringa totanus	Tureluur	Common redshank
Vanellus vanellus	Kievit	Nothern lapwing

Plants species list

Latijn	Nederlands	Engels
Agrostis stolonifera	Fioringras	Fiorin/Creeping Bent
Armeria maritima	Engels Gras	Thrift
Aster tripolium	Zulte	Sea aster
Atriplex pedunculata	Gesteelde Zoutmelde	Stalked Orache
Atriplex portulacoides	Gewone zoutmelde	Sea purslane
Bolboschoenus maritimus	Zeebies/Heen	Sea Clubrush
Elytrigia atherica	Strandkweek/Zeekweek	Sea Couch
Festuca rubra	Rood Zwenkgras	Red Fescue
Glaux maritima	Melkkruid	Sea milkwort
Limonium vulgare	Lamsoor	Common Sea-lavender

Latijn	Nederlands	Engels
Plantago maritima	Zeeweegbree	Sea plantain
Puccinellia maritima	Gewoon Kweldergras	Common Saltmarsh-Grass
Salicornia europaea	Kortarige Zeekraal	Common Glasswort
Salicornia procumbens	Langarige Zeekraal	Long-Spiked Glasswort
Spartina anglica	Engels Slijkgras	Townsend's Cord-Grass
Spergularia media	Gerande Schijnspurrie	Greater Sea-spurrey
Suaeda maritima	Klein Schorrenkruid	Annual Seablite
Triglochin maritima	Schorrenzoutgras	Sea arrowgrass
Zostera marina	Groot Zeegras	Common Eelgrass
Zostera noltei	Klein Zeegras	Dwarf Eelgrass

Other animals

Latijn	Nederlands	Engels
Alitta virens	Zeeduizendpoot	King Ragworm
Arenicola marina	Wadpier	Lugworm
Assiminea grayana	Gray's kustslakje	Dun sentinel
Batoidea sp.	Roggen	Rays
Capreolus capreolus	Ree	European roe deer
Cerastoderma edule	Kokkel	Common cockle
Corophium volutator	Slijkgarnaal	Mud shrimp/Corophium
Ensis siliqua	Groot tafelmesheft	Pod razor
Gadus morhua	Kabeljauw	Atlantic cod
Halichoerus grypus	Grijze zeehond	Grey seal
Hediste diversicolor	Veelkleurige zeeduizendpoot	Ragworm
Hydrobia ulvae	Wadslakje	Laver spire shell
Lepus europaeus	Haas	European hare

Latijn	Nederlands	Engels
Littorina littorea	Gewone alikruik	Common periwinkle
Macoma balthica	Nonnetje	Baltic macoma/Baltic clam
Mustela erminea	Hermelijn	Stoat/short-tailed weasel
Mustela putorius	Bunzing	European polecat
Mytilus edulis	Mossel	Mussel
Ondatra zibethicus	Muskusrat	Muskrat
Oryctolagus cuniculus	Konijn	European rabbit
Phoca vitulina	Gewone zeehond	Harbor seal
Phocoena phocoena	Bruinvis	Harbour porpoise
Rattus norvegicus	Bruine rat	Brown rat
Scrobicularia plana	Platte Slijkgaper	Peppery Furrow shell
Vulpes vulpes	Vos	Red fox

Amount of bird species

Bird species	**Birds at high tide**		**Birds at low tide**	
	Salt marshes	Mud banks	Salt marshes	Mud banks
Black-headed gull/ Larus ridibundus	26			19
Common shellduck / tadorna tadorna	18			15
Lapwing / vanellinea		1	1	
Curlew / Numenius				1
Red knot / Calidris canutus				1
Oystercatcher / Haematopodidae	2		1	
Spoonbill / Plataleinae		2		1
Crow / Corvus	2		1	
Canadese goose / Branta canadensis			5	
Greylag goose / Anser anser			3	
Common redshank / Tringa totanus	7			5
Mallard / Anas platyrhynchos		1		3
Great white heron / Ardea alba	1			
Yellow wagtail / Motacilla flava	2			
Sedge warbler / Acrocephalus	1			