The drowned Land of Saeftinghe of severe ecological importance for the migration of birds

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Abstract

In this research we tried to find out the ecological importance of the "Land of Saeftinghe" for migrating birds. The research is divided into several smaller or sub researches. The investigated area is a vast salt marshland with a special environment ideal for breeding grounds, resting places and food sources. Our focus was on what makes the habitat of Saeftinghe different from other Dutch coast areas and resting places who are also inhabited with the migratory birds. We did this by examining the birdlife, epifauna, flora, stratification and sand and silt ratio of Saeftinghe area. We concluded that if the Land of Saeftinghe were to be lost to rapidly negative changes, it would be dire for the residing species and the migration of birds, which illustrate the ecological importance of Saeftinghe.
Keywords: migrating birds, Land of Saeftinghe, flora, fauna, stratification

Introduction

'The Drowned land of Saeftinghe' is one of the most important and largest salt marshes of the Netherlands with its acreage of 3600 hectares. It's located on the edge of the estuary Westerschelde resulting in brackish water, as salty water from the North Sea mixes with the fresh water from the river Schelde in the salt marsh channels of Saefthinge. It's the largest brackish water marsh of West Europe, making it a special location with its unusual plants and animals due to its unique environment.
The Land of Saeftinghe used to be a town however in the late medieval times the government decided to stop their involvement by returning claimed land to nature. This is in the disadvantage for the local farmers as their property disappears and thus their profit and business as well.
Saeftinghe is part of the Dutch coastal area. The Dutch seashore has a big international reputation and has global significance for the migration of birds with its favourable location for various species of birds to breed or to live during wintertime. European uncommon species like the common spoonbill (*Platalea leucorodia*) and species from the Dutch '*Red List of birds*' like the short-eared owl (*Asio flammeus*), the little stern (*Sternula albifrons*) and the Kentish plover (*Charadrius alexandrinus*) use the Dutch seashore for breeding. The Dutch seashore is an indispensable stop for the millions of birds that are migrating on the great East Atlantic flyway. This migration route goes from Siberia through West-Europe to Africa, which is why Dutch coastal areas like the Wadden Sea, the Westerschelde and the North Sea beach are of vital importance for birds on this route. The land of Saeftinghe is an ideal location for birds to breed or to forage as reed beds are situated all over Saeftinghe.
Further is the presence of shellfish highly important for the birds that inhabiting Saeftinghe, for without the presence of all these shellfish the population of birds would be strongly reduced by the lack of food available. Over the years there have been over 200 birds species spotted as they use the Land of Saeftinghe as food source, breeding ground and resting place.
Yet whether they'll be able to remain doing so is questionable as Saeftinghe is located near the Belgium border where nuclear plants are at risk due safety reason and terrorist activity. This paper researches what the ecologic importance of the Drowned land of Saeftinghe for the annual migration of birds is.

Materials and methods

ANALYSE OF BIRDLIFE
To watch, count and determine the birds we spotted we used the following objects; binoculars to count and to look closer to the birds which are further away, bird guides to search for the name and species of the birds based on their features and writing materials to write down our findings. We used various research locations such as bird lookouts, open fields and the locations where we conducted our other researches. At the place of our research spot we used the 360-degrees-method and rotated slowly 360 degrees to count and watch to get the most accurate and reliable portrayal of the spotted bird species. When we located a bird, with or without a binocular, we searched the bird guide for

birds that resembled the one we had seen to find out which kind of species the bird was, paying extra attention to the beak, colour and size of the bird. As the birds fly, eat or breed in chaotic order, we had to work as quickly as possible and had to estimate some amounts of birds to write down our findings as accurately as we could.

EPIFAUNA

We wanted to find out what species are living in the soil of the land of Saeftinghe and in what numbers. We searched in both the aerobic alpha layer and in the anaerobic beta layer of the soil.

Our research locations were positioned around the intertidal zone and the tide line of the mudflats where we set out a sampling site of 50x50 cm. Once the sample was set, we used a small shovel to dig up the organism and a sieve to separate them from the soil of the alpha-layer. In addition we used a large flat tray filled with water to count the species and to determine them with a field guide before writing them down on a spreadsheet. For the beta layer we used the same materials and methods, only instead of a small shovel we used a bigger one to dig deeper and a ruler to find out at what depth the beta layer began. After noting down the name and the quantity of the species on the spreadsheet, we released the animals back into nature.

SAEFTINGHE FLORA

We wanted to find out which species of plants are present at the Land of Saeftinghe, which is related to the soil and fauna of the area. We chose 3 different sites as our research locations; the first area was located near or in the water, the second area was a few feet away from the water and the third area was on the flat shore a few meters away from the water. We inspected and collected every species of plants that we could find in refrigerator bags for preservation and counted or estimated the amount of the different plants by setting out a border of 1 x 1 m. We indentified the found species by the use of a field guide and by taking them home for further inspection when we couldn't identify it immediately with the field guide.

STRATIFICATION

We started with taking soil profiles to determine the stratification of the researched locations. The locations vary into the top of the hill that the high tide defiantly reaches, to the middle that the high tide most certainly reaches and to the bottom where water from the low tide is still present. The tidal range of Saeftinghe is approximately 4,8 meters under normal conditions however the tidal range can raise up to 7 meters in spring tide.

In every location we started with digging a hole in the soil with a soil-drill and laying the dug up soil into the surface of a cut in half PVC tube with the alpha-layer at the top and the beta-layer at the bottom and noting down our findings of the depth of each layer through photographs.

SAND AND SILT RATIO

To determine what the silt-sand ratio is, we took various soil profiles from different locations on the ground of 'het land van Saeftinghe'. This ratio is an important factor to the habitat of the organism that live in the vast marshland of Saeftinghe and it gives us a profile of the soil texture.

To measure the silt-sand ratio we started with filling a measuring glass to three quarters with seawater. We then proceeded with pressing a container upside down into the soil and digging it out with a shovel. Cutting a vertical part out of the just taken ground sample and putting it into the measuring glass. After stirring the sample for a while for equal distribution of the sand and silt with a lath, we stopped and wrote immediately down how much centilitre sand was gathered at the bottom of the measuring glass. After waiting for the water to become clear after stirring, we wrote down how much centilitre silt was gathered on top of the sand.

Equations used to determine the ratios =

Sand ratio = 100 x sand / (sand + silt)

Silt ratio = 100 x slit / (sand + silt)

Results

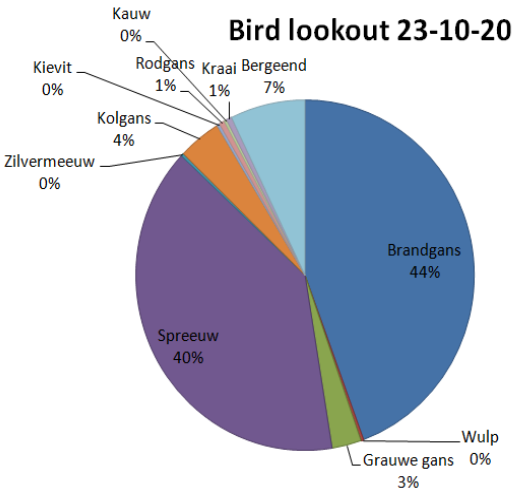
BIRDLIFE

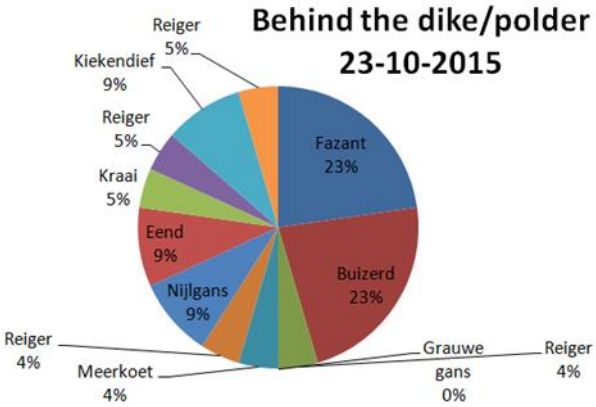
We have spotted a lot of geese. This specie used to be a migrating bird species but nowadays they seem to linger more in the area of Saeftinghe for the favourable living conditions such as small islands, marsh and reed beds. Despite the good living conditions, the amount of geese has decreased as a result of humans quitting to feed them at the polders. The high amount of geese also attracts birds of prey, most commonly the Bruine Kiekendief and Blauwe Kiekendief, in winter. We have spotted a few of them.

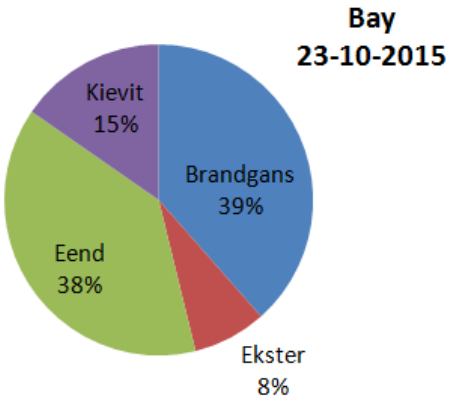
We have also seen large groups of flying Spreeuwen (*Starlings; Sturnus vulgaris*). This species nest in trees but collect their nourishment, insects and their larvea from fields, meadows and of the Land van Saeftinghe.

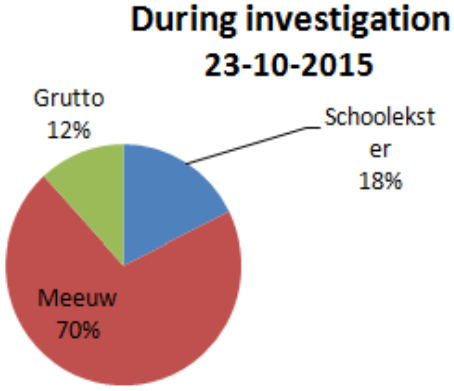
Besides the high quantity of geese, we have seen a lesser amount of Kievits (Lapwings; *Vanellus vanellus)*. The food source of this bird specie consists of all sorts of invertebrates found mostly in the vegetation on the ground. Open areas with a rich soil fauna are an ideal habitat for the Kievit and they

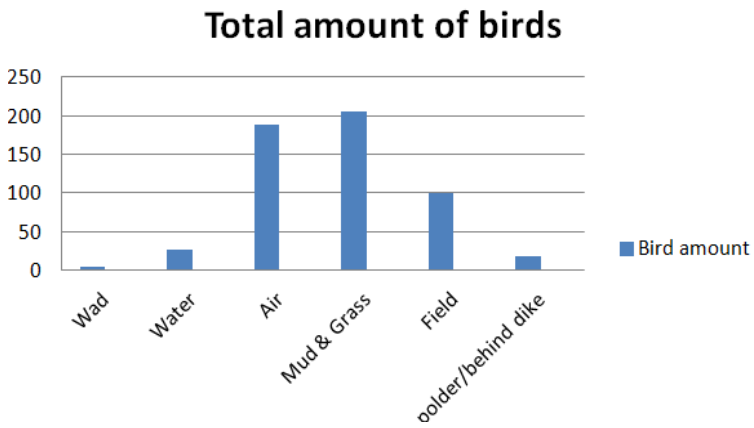
make their nest of a small bowl of grass. The Land van Saeftinghe is therefore perfect for the Kievit, which is why we saw this bird regularly.











EPIFAUNA

First location

Measuring spot 1	Alpha layer	Beta layer	Both layers
Spisula subtruncata	X		
Mya arenaria			X
Scrobi cularia plana		X	
Kurtiella bidentata			X
Ordinary beach crab	X		
Hydrobia ulvae	X		
Nereis virens			X
Arenicola marina			X

Our first measuring place was located below the high tide line, where we found a high amount of *Spisula subtruncata* and *Bivalve mollusks* in the alpha layer. The *Bivalve mollusks* bury themselves into the soil and serve as food for different fish like plaice. We also found oysters in the alpha layer.

The majority of shells we found belonged to the species *mya arenari*. The *mya arenari* live in sandy habitats just below the intertidal zone and are resistant to a strong reduction of salt ratio, which explains why we found such a high amount at our first measuring place. We also located some *mya arenari* in the beta layer but those came in a bigger size in comparison to the ones found in the alpha layer. Curlews and oystercatchers often eat young mya arenari's.

Both in the alpha and in the beta layer we found the species *Scrobicularia plana*. The *Scrobicularia plana* uses two tubes in order to get food and water. These tubes give good access to the species for a variety of

fish and birds. Another species we found a lot is the *Kurtiella bidentata.* This species lives buried in fine sand and mud bottoms. They are very sensitive to oil pollution which indicates that the Land of Saeftinghe isn't polluted by oil, otherwise we wouldn't have found so many.

In the alpha layer we also found the remains of an ordinary beach crab. The common beach crab eats *bivalve mollusks* and gets eaten by both fish and birds. The common beach crab can withstand low salinities, which is why he is able to survive in the brackish water of Saeftinghe.

Another species we found frequently is the laver spire shell (*Hydrobia ulvae*). When the laver spire shells graze, they leave distinctive cross tracks behind, which we often encountered tracks. This indicates that the laver spire shell is a common species of Saeftinghe and plays an important role in its ecosystem as the laver spire shell serves as food for migrating birds and fish.

We also discovered a high quantity of *Nereis virens*. The annelid worm species bury themselves in wet sand and mud and they are good swimmers, which's why we found them close to the water. We saw a lot of distinctive patterns in damp sand, which indicate the presence of lugworms (*Arenicola marina*). So to check if our observation was correct, we dug further and found indeed the lugworms buried in their U-shaped burrow in the sand. Various species of birds eat lugworms and at high tide fish also eat the lugworms.

Second location

Measuring spot 2	Alpha layer	Beta layer	Both layers
Nereis virens			X
Macoma balthica	X		
Cerastoderma edula	X		
Scrobicularia plana		X	
Mya arenaria			X

Our second measuring place was located at the tide line of the mudflats. Here we also found *nereis virens* in both layers but in a lower quantity than we did under the intertidal zone. In the sand we found *macoma balthicas* in the alpha layer, which is a small saltwater clam, they burry themselves in mud and sand plates high in the intertidal zone and can resist a very low salt ratio. This is why we couldn't find them in a lower region in the intertidal zone. Different crabs and shrimps eat the eggs of the *malcoma balthica*. The alpha layer also contained common cockles (*Cerastoderma edule*).

Both at the first measuring spot and the second measuring spot we located many organism of the species *scrobicularia plana*. This specie prefers to live high in the intertidal zone, which is why we found a higher amount of them at our second measuring spot in the beta-layer. We also found *mya arenaria* in the beta-layer but in a lower number than we did at our first measuring place, as they prefer to live below the intertidal zone. During our survey we came across a lot of shells belonging to the species *spisula solida*, *spisula elliptica*, *angulus tenius* and *spisula subtruncata.*

SAEFTHING FLORA

First location

Near the water we found a high amount of *Tripolium pannonicum*. These plants live in areas that are under the influence of the tide. *Tripolium pannonicum* provides food for over 20 species of insects and numerous animal species such as the brent geese (*Branta bernicla*). Its seeds are a food source for many birds such as sparrows (*Passeridae*) and finches (*Fringillidae*). The plant can't live in pure salt water and thus it needs fresh water in order to survive. Next to the water and in the water we found a high number of *Bolboschoenus maritimus*, which tubers are an important food source for the wintering greylag gooses (*Anser anser*).

Second location

On the flat shore we found a high amount of *Elytrigia atheric*. This plant can be found at sunny, open areas on dry or moist soil. There was also a high quantity of *Phragmites australis* near the water as the plant grows in the water or nearby water in fresh to brackish soil. The *Phragmites australis* is very important for various species from the '*Red List of birds* ' such as *Panurus biarmicus*, *Luscinia svecica*, *Acrocephalus schoenobaenus* and the *Circus aeruginosus* since they need it for their breeding area's. Further we found a high amount of *Limonium vulgare*, as these plants prefer to live in sunny areas with silty soil. On the shore we found also *Elytrigia juncea*. This plant is salt tolerant and can only live at a location where the soil moisture has a salinity of 2%.

Third location

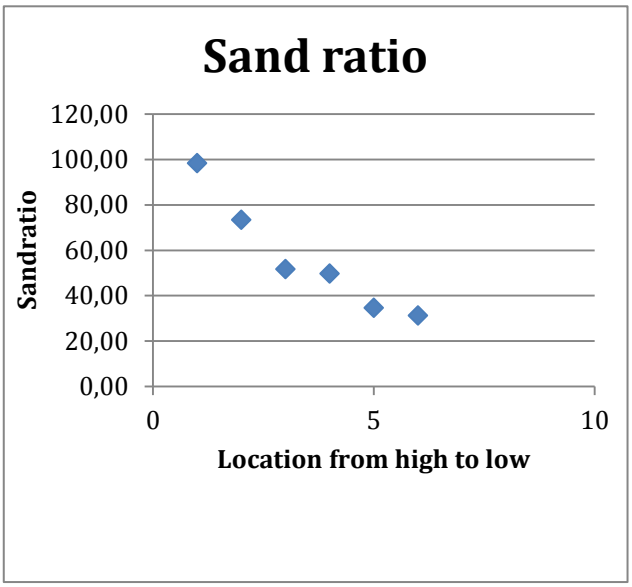
A plant we found on the flat shore was the Sea milkwort (*Glaux maritime*) and the *Puccinellia maritime*. The *Puccinellia maritime* is very nutritious as it is rich of protein and it is eaten by the brent geese (*Branta bernicla*), the barnacle goose (*Branta leucopsis*) and the eurasian wigeon (*Anas penelope*).

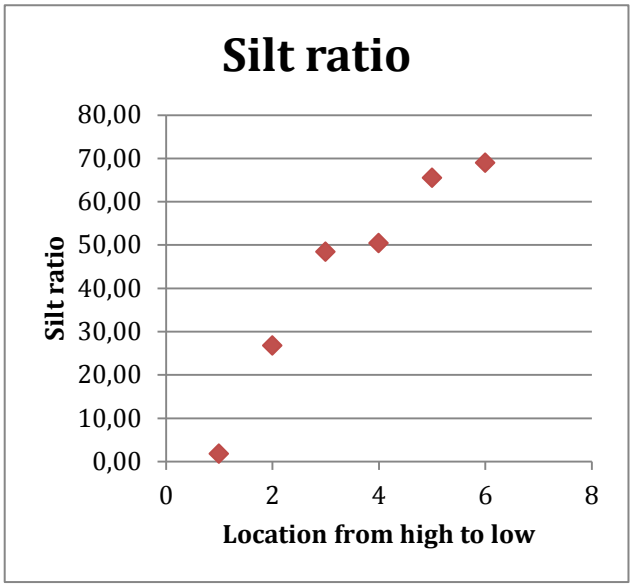
There was a lot of grass (*Poaceae*) surrounding all of our research areas.

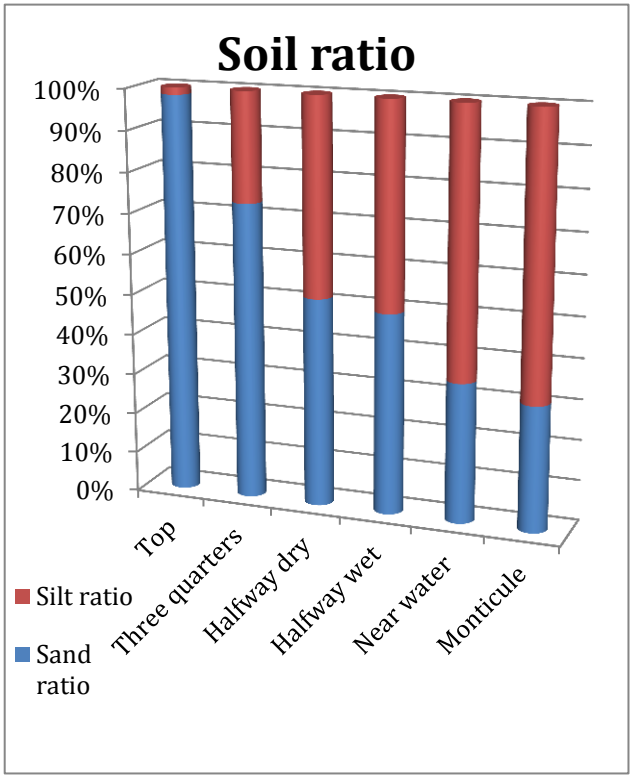
STRATIFICATION

SAND AND SILT RATIO

Sample	Sand (in cL)	Silt (in cL)	Sand ratio	Silt ratio	Location
1	11,2	0,20	98,25	1,75	On top of hill
2	11,0	4,00	73,33	26,67	Three quarters on the hill
3	11,2	10,5	51,61	48,38	Halfway the hill on dry soil
4	13,1	13,3	49,62	50,37	Halfway the hill on wet soil
5	9,40	17,8	34,56	65,44	Near the water
6	18,1	40,2	31,05	68,95	Monticule by water







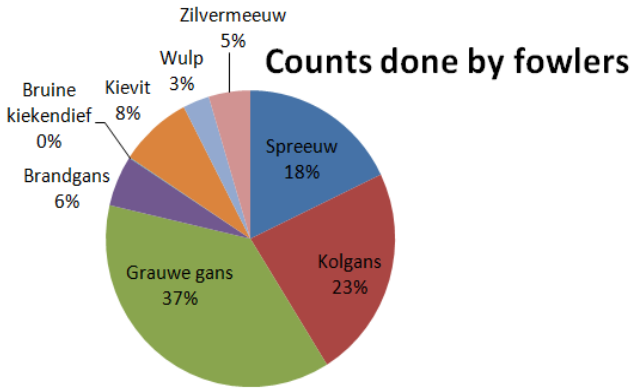
Discussion

BIRDLIFE

From our results we found that the species of birds differ by time and place. The 'Total amount of birds' bar graph shows the amount of the spotted birds spread out over 6 areas. From the bar graph can be concluded that birds are mostly present in the places where the birds get their nutrition, the grass and at wet and muddy land, and in the air where they migrate.

The species of birds most present in the habitat of the Land of the Saeftinghe were the Brandgans (*Branta leucopsis*), Grauwe gans (*Anser anser*),

Spreeuw (*Starling; Sturnus vulgaris*) and the Kievit (Lapwing; *Vanellus vanellus*). According to all the birds which are spotted and counted by fowlers at the low-water counting on October 18th 2015, the Brandgans (*Branta leucopsis*), the Grauwe gans (*Anser anser*), the Spreeuw (Starling*; Sturnus vulgaris*, the Kievit (Lapwing; *Vanellus vanellus*and the Kolgans (*Anser albifrons,*) were in the majority. These findings match the results of our research.



EPIFAUNA

From our results we found that every bottom dweller plays a big part in the ecosystem of Saeftinghe. They all serve as food for the bigger species and thus play an important part in the nutrient cycle of Saeftinghe. The bottom animals we found are indispensable for the ecosystem. We also came to the surprising discovery that the area where we did our research wasn't polluted by oil as we found a high amount of *Kurtiella bidentata*. This makes Saeftinghe unique since there aren't many nature reserves that are still untouched by pollution. We found a bigger quantity species in the alpha-layer in comparison to the beta-layer, as the alpha-layer is aerobic while the beta-layer is not resulting that less species can thrive there.

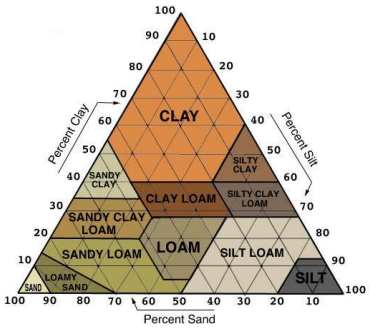
SAEFTINGHE FLORA

We came to the conclusion that all the plants we found were adapted to the high salt ratio of the area. Common plants at Saeftinghe are *Tripolium pannonicum, Bolboschoenus maritimus* and the *Puccinellia maritime* and they are an essential food source for migrating birds. The Land of Saeftinghe has thus plenty of food for migrating birds as we didn't only find many of these plants at our research areas but also at other locations in Saeftinghe. The high amount of *Phragmites australis* makes Saeftinghe an ideal area for birds to breed.

For the following researches we recommend to make the sampling site bigger than 1 x 1 m as this measurement didn't work perfectly for us to count the quantity. We had to resort to make an estimation of a larger sampling site resulting in less accuracy in terms of quantity.

STRATIFICATION IN TERMS OF SAND AND SILT RATIO

From the results can be concluded that the alpha-layer is the upper and the aerobic layer of the soil, resulting in a lighter colour in comparison to the beta-layer, the lower and the anaerobic layer of the soil, which has a darker colour. This has to do with the fact that the beta layer comes from a lower point in the marshland, where the soil pores are filled with water from the tides for a long period of time, preventing oxygen from entering the soil. The lack of oxygen increases the process of decomposition resulting in the increase of the forming of organic material. How closer the presence of water is by the sample, how more anaerobic the soil is, how lower the concentration of oxygen, how higher the concentration of organic material and thus how darker the soil colour. Further out of the soil ratio can be concluded that how closer the sample is taken by the water, how more water is still present in the soil, how higher the silt ratio and how lower the sand ratio. Not only take other mechanic and chemical processes place in the alpha-layer comparison to the beta layer but also the species of living organism differ from each other. From the findings found in above stated conclusions and out of the fact that silt is the colour of the beta-layer, we can conclude that the beta-layer is mostly consisted of silt and the alpha-layer out of silt loam. The relation between the alpha-layer and the beta-layer and the type soil would have been more exact if we had linked the alpha and beta-layer ratio to the location of the soil samples. Furthermore it would be advisable to research the clay ratio and salt ratio in addition to the silt and sand ratio. That way there's a more accurate portrayal of the soil consistency of the soil. We recommend to do so in the further following researches.



RESEARCH QUESTION

In conclusion, the Land of Saeftinghe is of significant importance to bird migration. If sudden destructive changes were to take place, the consequences would be disastrous from an ecological perspective. A huge feeding source, breeding ground and nesting places would be destroyed. The most common species in the habitat of the Land of Saeftinghe such as the Brandgans (*Branta leucopsis*), the Grauwe gans (*Anser anser*), the Spreeuw (Starling*; Sturnus*

vulgaris), the Kievit (Lapwing; *Vanellus vanellus)* and bird species from the Dutch *'Red List of birds'* would be wiped out along with plants such as the *Tripolium pannonicum, the Bolboschoenus maritimus* and the *Puccinellia maritime*, all of them are an essential food source for migrating birds. The loss of the Land of Saeftinghe would mean that a big part of the nutrition cycle of migrating birds would be lost as the high amount of multiply species of common dweller in Saeftinghe would be wiped out.

In addition to the loss of a high amount of *Phragmites australis,* which makes Saeftinghe an ideal area for birds to breed. Without the land of Saeftinghe a lot of birds would have to find other areas for their nesting ground, migrating birds will have to search for other areas to rest and recuperate from their long journey and endangered or rare species would be lost to ecology.

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