

PLANT SUCCESSION ON FORMER TIDAL LANDS
IN THE NORTHEASTERN POLDER¹

BY

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The area to be discussed in this article was formed along the dikes of the former Zuidersea. In times past year after year the sea deposited its material along the shore and finally new land came into being. It is not known, however, when this took place, nor if the process was enhanced by man by means of plantations of *Schoenoplectus lacustris*, as was the case on the nearby Island of Kampen. Nowadays the area is considered to be the "hay barn" of the adjacent region and it is well established that these coastal lands have been under cultivation for several decennia.

Before the construction of the enclosing dam of the Zuidersea, these offshore lands were frequently flooded, since they were protected only against high water levels by low summer dikes. These inundations occurred mainly during winter, but occasionally also in summer when strong gale floods overflowed the area. In this way much silt was deposited, acting as a natural fertilizer. A luxuriant but predominantly saline vegetation developed, in which *Juncus gerardi* dominated to such an extent that people characterised the cover as a "heavy grass sod."

As a consequence of the enclosing of the Zuidersea the floods, which used to bring so much fertile silt, occurred no more and a gradual drop in the salt content of the soil took place. The original predominantly saline grass vegetation receded more and more and became replaced by glycophytes. Gradually the "heavy grass sod" became transformed into a "lighter" one, due to the receding of *Juncus gerardi*. The production of the grass cover decreased quantitatively; its quality, however, improved, also when we consider the after-math. Still the lower lying parts of the area remained rather strongly saline.

The strongest interference in the development of the vegetation of the area occurred after the reclamation of the Northeastern Polder. Prior to this event the water level of the IJssel Lake, formed after the enclosure of the Zuidersea, influenced the water table of the areas under discussion. The ground water table in the Northeastern Polder,

¹) The Northeastern Polder is a reclamation district in the former Zuidersea. A "polder" is an area reclaimed from the sea by the construction of a dam and subsequent pumping out of the water present between this dam and the former coast line.

however, is 15 to 19 feet beneath the level of the water in the IJssel Lake. Since the Northeastern Polder is not separated from the former coastal polders by a canal or other mass of water, the areas bordering this reclamation district suffered considerably from a substantial lowering of their water table. This phenomenon found its expression in a change in the composition and development of the grass cover. In order to ascertain this influence of the reclamation of the Northeastern Polder on the grass vegetation of the former coastal regions, the vegetation has been mapped at many localities and at frequent intervals since 1939. However, from the first botanical reconnaissances, performed before the actual reclamation of the Northeastern Polder, it appeared, that even in this period the vegetation was changing rapidly, due to the absence of silt carrying floods and a continuing desalinization. Consequently, it will not be possible to ascertain with absolute certainty the direct influences of the reclamation of the polder on the development of the vegetation.

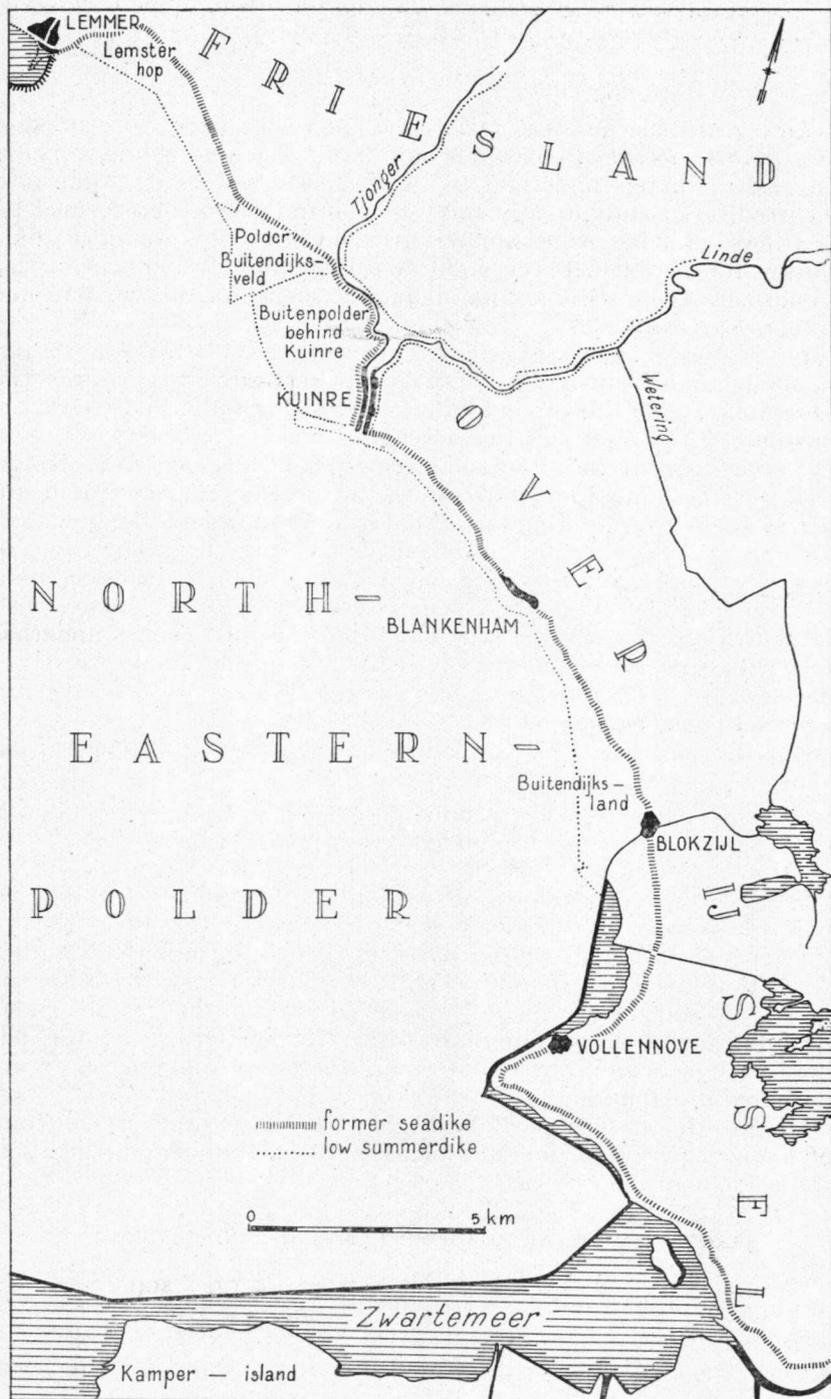
In the following paragraphs a description will be given of the changes that took place in the grass cover of the offshore polders, due to the action of the overall group of factors mentioned above.

THE LEMSTERHOP

The soil of this polder consists of clay and sandy loam, underlain by a subsoil of coarse sand. The coarse sandy layer shows its strongest development near the summer dike that used to protect the area against normal high water levels of the Zuidersea. In the region near the old sea dike peat can be found at a depth of about 2 feet; this section is also the wettest part of the polder.

Before the enclosure of the Zuidersea the grass sod of the Lemsterhop would have shown similar relationships to the vegetation of the Blokzijl Uiterdijk Polder as those that can be found between the saline offshore vegetation north of Enkhuizen and the plant cover in the Polders in that area lying more to the south. Although the vegetation of 1939 still shows a strongly saline character, a transition phase of the *Armerieto Festucetum* begins to appear, in which the grass cover is already interspersed with *Alopecurus bulbosus* and *Bromus racemosus*. It appears from the changes in the botanical composition, that these species become more abundant when the percentage of glycophytes in the vegetation increases. On the other hand an apparent decline in the predominance of these species can be noticed when *Cynosurus cristatus* and or species of the *Arrhenatheretum elatioris*-association become more prevalent. No other species characterize so strikingly this saline-glycophytic phase and consequently this phase in the succession of the vegetation is called the association of *Alopecurus bulbosus* and *Bromus racemosus*.

The constancy of this association will have to be established from more and particularly more regional material. The association is intermediate between the *Armerieto Festucetum* and the *Lolieto cynosuretum* and or, the *Arrhenatheretum elatioris*. This association can be included



Map of the former tidal lands in the Northeasternpolder.

in the *Armerion* order due to the consistent presence of *Armerion* species. *Alopecurus bulbosus* can scarcely be found in the area inland of the dikes, while *Bromus racemosus* is observed but very rarely.

POLDER BUITENDIJKS-VELD

This polder has an area of 625 acres. In 1939 a fairly pure stand of the *Armerio Festucetum* covered a low lying, wet and saline, limeless clay ridge, that is underlain by peat. This type of vegetation also occurred on a sandy area at the west point of the polder, formed by overflows carrying sandy material behind the low summer dike. During the period between 1939 and 1950 the development of this saline vegetation ran almost parallel to the succession described for the Lemsterhop area.

In 1939 the *Armerion* species occurred already rather sparsely on loamy soils underlain by peat. At that time *Carum carvi* and *Chrysanthemum leucanthemum* could be found in the grass vegetation. Prior to the enclosure of the Zuidersea the whole area must have been covered by a glycophytic grass sod. Later on large areas in the Polder Buitendijks-veld were reclaimed and only half of the region remained under a vegetation of grass. During the period from 1945 to 1950 the botanical make-up of this vegetation changed towards the association of *Alopecurus bulbosus* and *Bromus racemosus*. In this phase of the association, however much fewer *Armerion* species were present than at more moist habitats. Consequently the type has to be classified as a sub-association, with *Festuca rubra* and *Agrostis stolonifera* as differential species.

BUITENPOLDER BEHIND KUINRE

This polder covers an area of 1250 acres and is composed of a heavy clay soil, underlain by peat. In these soils lime is no longer present. Before the enclosure of the Zuidersea a strongly saline vegetation, in which *Juncus gerardi* predominated, covered the western part of this area.

In 1939 the grass vegetation was still rather saline. It could be mapped, however, as a transitional stage toward the association of *Alopecurus bulbosus* and *Bromus racemosus*. This association was rather purely developed in 1945 and 1950. Particularly *Triticum repens* spread intensively and this can be taken as an indication, that in this polder the influence of the reclamation of the Northeasterpolder was felt more strongly than in the Lemsterhop, where this same species occurs in limited distribution only.

Finally, the eastern part of this polder has been in its present state for a longer period of time and hence must have undergone desalination for many more years.

THE NARROW COASTAL AREA BETWEEN KUINRE AND BLOKZIJL

In these tidal lands much material used to be dug for the construction and upkeep of the sea dikes. Consequently this coastal area has a very irregular surface, even as far as the neighbourhood of Genemuiden.

The vegetation can be classified under the same heading as the plant cover of the Buitendijks-land. The grass vegetation is quite varied: *Juncus gerardi*, *Heleocharis palustris* and other species can be found at the lower spots and many glycophytes at the higher places. Sometimes beautiful contrasts are caused by these variations in habitat. Particularly between Blokzijl and Vollenhove, where before the mowing of the vegetation the higher spots are white due to the predominance of *Anthriscus silvestris* while later on in July and August *Heracleum sphondylium* in its turn gives these habitats a white appearance.

BUITENDIJKS-LAND

In this area two terraces, enclosing a lower region, gently slope towards the west. The soil consists of a light loam, underlain at about 1½ ft by fine sand. This sand corresponds to the sand of the coast.

Before the reclamation of the Northeastern Polder a kind of sandbank, about two miles long, was situated along the coast in the direction of Blankenham. This bank was separated from the coast by a stretch of water and it supported a vegetation in which *Scirpus maritimus* dominated and facies of *Schoenoplectus tabernaemontani* were present. At the highest spots of the sandbank saline species could be found, accompanied by *Urtica dioica*, *Bidens tripartitus*, *Epilobium angustifolium* and *Epilobium hirsutum*. The bottom of the intervening stretch of water mentioned above was a rather muddy substratum lying on sand, particularly close to the sandbank. Along the shores of this water a luxuriant vegetation of beautiful zones of *Bidens cernuus*, *Senecio paluster* and *Ranunculus sceleratus* occurred, while at the least developed spots *Typha angustifolia* formed dense stands, mixed with *Typha latifolia*. On the slopes of the sandbank, along its borders and along the coast as well, the vegetation was predominately *Pragmites communis*, mixed with *Phalaris arundinacea* and *Bidens tripartitus*. This whole pioneer vegetation showed fascinating aspects.

During the period between 1939 and 1945 the grass vegetation of the lower zone mentioned above was in a stage of transition, from the *Armerieto Festucetum* towards the association of *Bromus racemosus* and *Alopecurus bulbosus*. In 1950 the latter had changed into the *Arrhenateretum elatioris*. Moreover a strong spreading of *Rhinanthus major* could be noticed; this is a striking phenomenon in all these offshore areas. At moist habitats *Lychnis flos-cuculi* appears too. This sequence seems to be the succession on grassland that is undergoing desalinization and the agricultural care of which leaves much to be desired due to its extensiveness.

In 1939 the grass vegetation on the slope of the terrace facing the west offered a rather good picture of the association of *Bromus racemosus* and *Alopecurus bulbosus*. Before the enclosure of the Zuidersea this grass cover must have been moderately saline. Since 1945, however, the vegetation changed into a *Lolieto Cynosuretum*.

It can be deduced from the absence of *Armerion* species in 1939, that before the enclosure of the Zuidersea the grass vegetation at the

foot of the former sea dike must have contained but a few halophytes. The grass cover is rich in herbs, particularly in *Anthriscus silvestris* and *Heracleum sphondylium*. In 1945 the vegetation was rather heterogeneous but at the moment a fairly pure *Arrhenatheretum elatioris* has developed. It appears from the given description of the succession in the grass vegetation in these offshore polders, that the following succession has taken place: *Armerieto Festucetum* → association of *Alopecurus bulbosus* and *Bromus racemosus* → *Lolieto cynosuroidetum* → *Arrhenatheretum elatioris*.

CONCLUSIONS

Considering the desalinization of the Buiten polder behind Kuinre, it is striking that in 1939 this area, situated at a level of about 2 feet under N.A.P.,¹ was covered with a vegetation consisting of 50 % saline species, while at a higher altitude the Lemsterhop showed among its component species 80 % belonging to this ecological group. This is mainly due to the fact, that the Lemsterhop, not considering a single annual mowing of the grass, remained undisturbed. In the period between 1945 and 1950 the percentages of saline species mentioned above were reduced to 18 % and 20 % respectively. This decrease was due to the fact that both polders are located within the sphere of influence of the Northeastern Polder.

In the Buitendijks-land, before as well as some years after the reclamation of the Northeastern Polder, the grass vegetation growing at a level of about $\frac{1}{4}$ ft above N.A.P. showed a stronger saline influence than the vegetation growing at the foot of the former sea dike at a level of about $\frac{1}{4}$ ft beneath N.A.P. It is apparent, that the stronger saline character of the first mentioned vegetation is a result of an earlier continuous contact with the former Zuidersea.

From the saline character of the Lemsterhop, the Buiten polder behind Kuinre and the Buitendijks-land (percentages of saline species in the vegetation in 1939 80, 50, and 35 respectively and in 1950 20, 18 and 10 respectively) a decreased saline influence is evident in a southern direction. This influence is still more pronounced south of Blokzijl. due to the former influence of the river IJssel. In this area the factor "floods rich in silt" is present too. The same holds for the Kamper Island, although here at low spots some saline influence can still be noticed.

¹ N.A.P. stands for a standard waterlevel at Amsterdam, used for reference purposes.