VEGETATIONAL HISTORY OF THE COASTAL DUNES IN THE WESTERN NETHERLANDS

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SUMMARY

The two main dune systems in the area between Hoek van Holland and Bergen are described: Older Dunes and Younger Dunes. The vegetational history of the Older Dunes is described

with the help of pollen-analytical and archaeological data. The formation of the Younger Dunes, starting 1200 A.D., is brought into connection with preceding human interference in the vegetation. The vegetation of these Younger Dunes is described on the basis of pollen-analytical and archaeological founds.

1. INTRODUCTION

In the last few years geological, pollen-analytical and archaeological investigations have been carried out in the dunes between Hoek van Holland and Bergen (*fig. 1*). This investigation, carried out as a joint venture by workers of the Geological Survey of the Netherlands and the State Service for Archaeological Investigations in the Netherlands, has yielded several interesting results, which will shortly be published in full detail (JELGERSMA *et al.* 1970).

Up to now only the calcareous dunes, between Hoek van Holland and Velsen have been studied using pollen analysis, whereas no such data are yet available from the non-calcareous dunes near Bergen-Schoorl.

In this area two dune systems occur (JESWIET 1913; VAN BAREN 1913):

a. Older Dunes – low ridges more or less parallel to the coast;
b. Younger Dunes – higher, showing parabolic shape.

The Older Dunes overlie beach sands. In the western part of the area they are covered in turn by Younger Dunes.

The following summarizes the main results of the geological investigations:

1. beach deposits mainly date from between 3000 and 2000 B.C.; three or four inlets, estuaries of main river branches, remained open during later stages;
2. during formation of the Older Dunes periods of dune sand deposition alternated with phases of inactivity, indicated by soils and peat horizons (*fig. 2*);
3. the archaeological and radio-carbon dates indicate that these alternations occurred synchronously in various parts of the area;
4. the formation of Older Dunes as such was essentially completed at about O A.D. and was followed by a long period of nondeposition until about 1200 A.D. Only in the extreme west, near the coast, did some dune building take place during this period. During the inactive phase a podsolic forest soil was formed in many places;
5. overblowing by Younger Dune sand began at about 1200 A.D. and maximum sand drift was in the 15th and 16th centuries A.D.

2. VEGETATIONAL HISTORY OF OLDER DUNES

Pollen diagrams from various places (The Hague, Zandvoort, Velsen) are available, mainly from the first half of the Subatlantic between about 1000 B.C. and O A.D. (BOERBOOM & ZAGWIJN 1966; JELGERSMA *c.s.* 1970). During phases of active dune formation an increase of herbaceous pollen occurs in the pollen diagrams, whereas in inactive phases an increase of dune shrub and tree pollen is found (*fig. 3*). *Juniperus* was important in the dune scrub, especially in the period between about 1000 and 500 B.C. Successions of *Hippophaë* followed by *Juniperus* are found during transition from wind drifting phases to

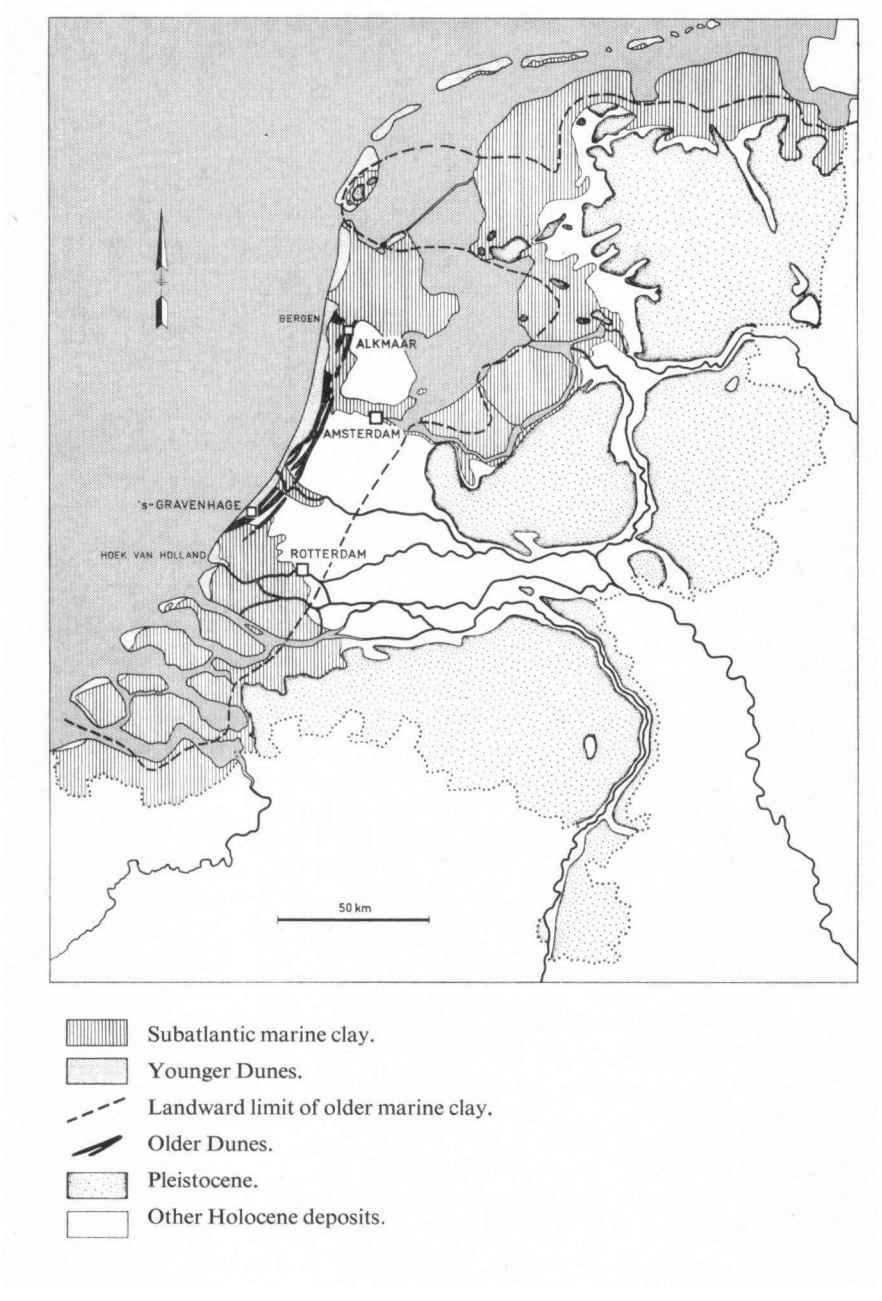

Fig. 1. Map of the Netherlands, showing Holocene en Pleistocene beds at the surface and main occurrence of Older and Younger Dunes.

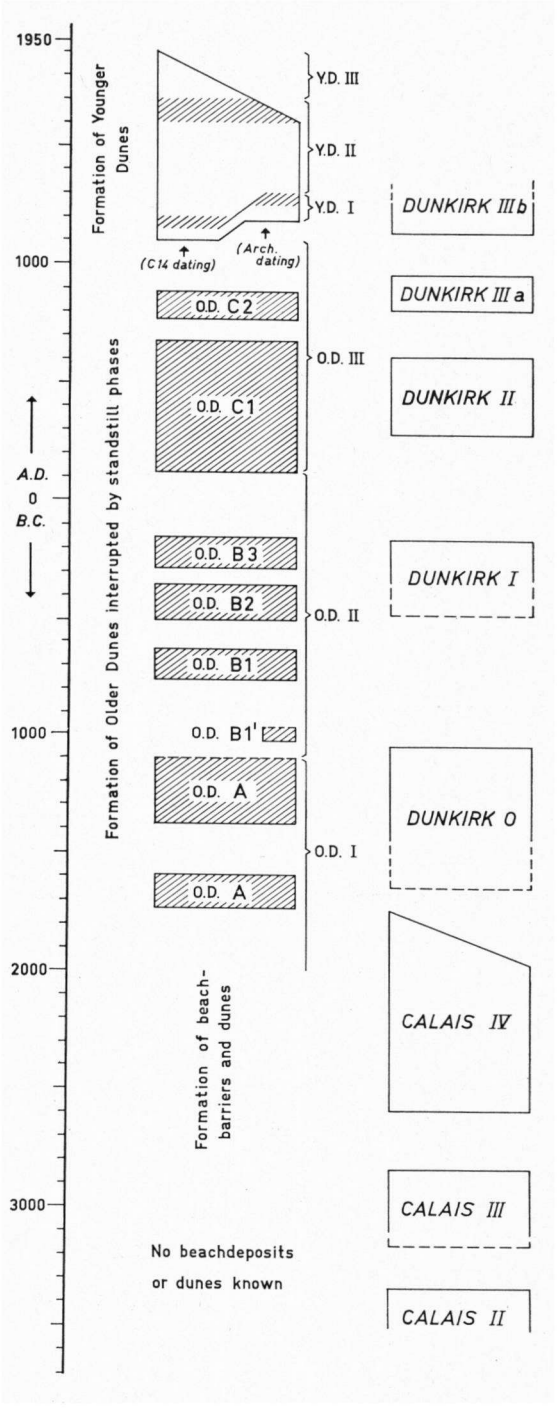

Fig. 2. Scheme, showing alternation of inactive phases and sand-drift periods in dune area as compared with transgression phases in the marine deposits during the later part of the Holocene. (hatched areas = inactive phases in the dune area with numerical symbols; O.D. = Older Dunes; Y.D. = Younger Dunes; right hand column = major transgression periods).

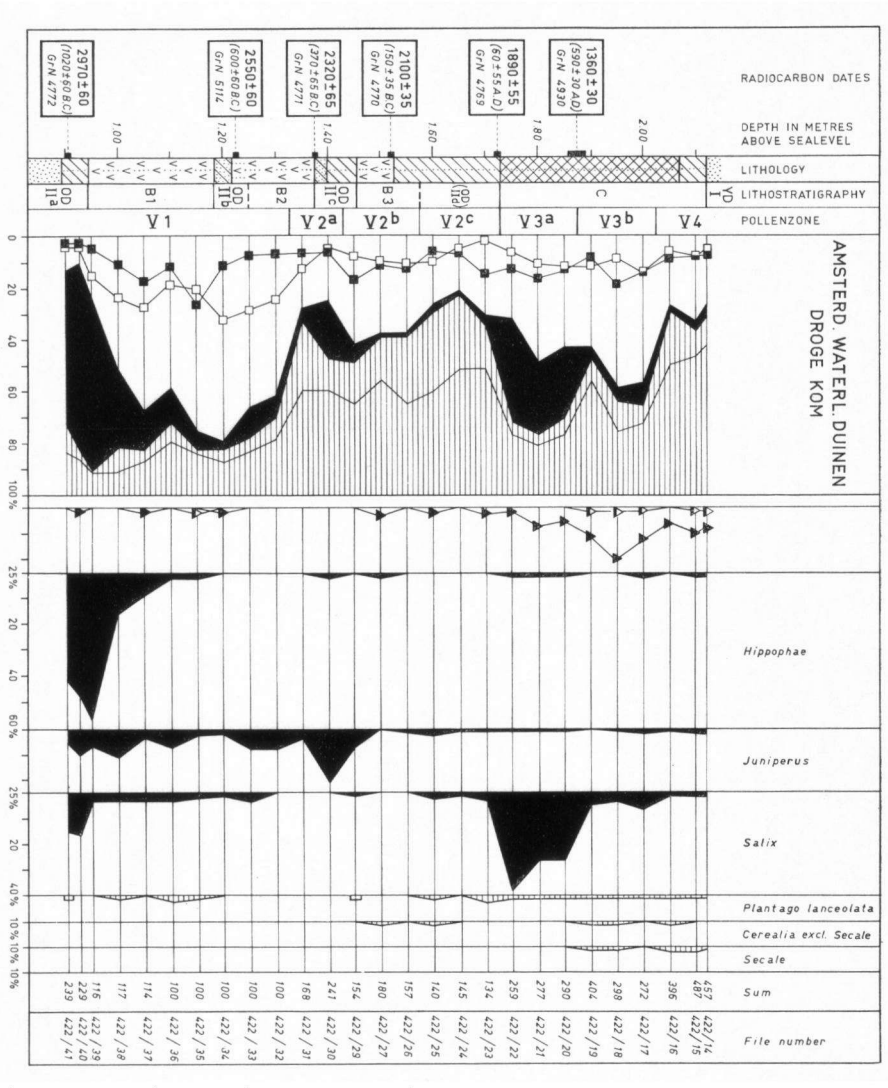

Fig. 3. Pollen diagram of a section east of Zandvoort. Pollen zones V 1 etc = local zones of subatlantic in coastal dune area. For lithostratigraphic symbols compare with *fig.* 2. Legend *fig.* 4.

inactive phases (influence of leaching of the soil). It should be noted that in this area the Older Dune sand is primarily calcareous, though perhaps less so than the Younger Dune sand. In several cases pollen grains of genera characteristic for dune-slack vegetations, like Centaurium, Sagina and Epipactis, have been found.

It has been shown that in the eastern part of the Older Dune system, the age

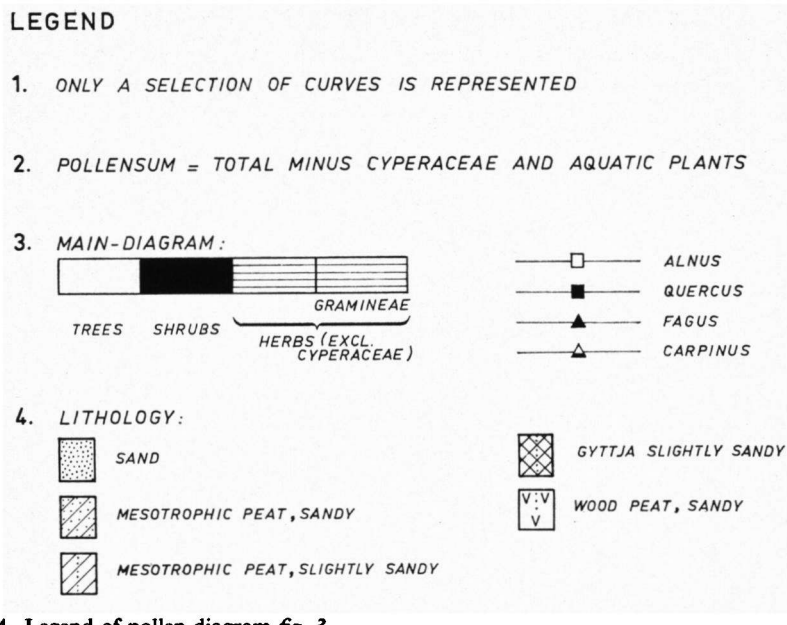

Fig. 4. Legend of pollen diagram *fig. 3.*

of inactive horizons and drift sand beds is generally older than near the coast. Evidently the dunes were progressively stabilized by vegetation from east to west. In the present coastal area open vegetation was dominant for the longest time. Indications of denser vegetation in areas near former estuaries have been found. In the pre-roman Iron Age the influence of man on vegetation in the dune area must have been important, as many settlements have been found. Nevertheless it seems that the alternation of inactive phases and overblowing is not directly linked with intensity of farming. It seems that in this region man settled in areas with open vegetation, where overblowing by sand was slight. Probably the dune vegetation was kept open by grazing. In this connection the relatively high frequency of Plantago lanceolata which is still important in certain dune pastures, must be quoted. It might be that such vegetations, formerly as well as at present, have been strongly influenced by grazing.

It is remarkable that inactive phases occurred at the same time as some well-known phases of transgression in the coastal area. Of course a rise in groundwater table in the dune area could be considered as a direct cause of such a transgression. This is improbable, however, as the peat horizons of the inactive phases occur many meters above the sealevel of that time, according to the curve published by JELGERSMA (1961). Climatic change is a more likely common

factor, leading to transgressions on one hand and to a rise in the water-table in the dune area on the other hand. The alternations between inactive phases and sand-drifting as well as the corresponding changes in vegetation, in our opinion reflect changes in precipitation (wet and dry phases). Human influence was certainly an agent causing sand-drifting, as we will presently see, but it is hard to understand how this factor could account for the cyclic rises observed in the groundwater-table.

3. THE PERIOD BETWEEN 0 A.D. AND 1200 A.D.

Between the Older and Younger Dunes a well developed podsolic soil is very often found which in former low-lying places merges into a peat bed.

According to radio-carbon dates and archaeological finds this soil reflects an interruption in dune building lasting about 1200 years since Roman times. Only in some sections near the present coast was proof found of interruption of this prolonged inactivity by dune formation during the 8th century A.D.

Especially in the area between Katwijk en Velsen (*fig. 5*) the podsolic soil is found well developed. The pollen diagrams in this area indicate the formation of forests rich in beech, with a peak between 800 and 1000 A.D., as far west as the present coast line. Of course it is quite possible that the actual coast line of those times was further to the west as it is known that since medieval times the coast of Holland has receded on many places. In this forest, besides beech, both oak and birch occurred in lower places, as is testified by, for example the finds of many well preserved trunks and logs. These show clear traces of cuttings and burning, indicating cutting of the forest. Radiocarbon dating, as well as archaeological finds, date this event in the 12th century A.D. Shortly after this, at about 1200 A.D., the area was overblown by Younger Dunes and, evidently as a result of man's remount, of the protective forest.

It is interesting to note that according to historical data (DE COCK 1965), in this very area a boundary forest (the "Haarlemmerhout"), existed in Carolingian times. It marked the boundary between the old regions of "Kennemerland" and "Rijnland" and the forest was spared to form a zone of defence. This boundary forest was cut down during the 11th or 12th century as is indicated by several toponyms ending with "-rode" (DE COCK 1965) (*fig. 5*). An interesting feature is the name "Boekenrode" – indicating the cutting of beech forest. The parallels of these historical data and the observations in the field are striking indeed.

North of Velsen the pollen diagrams likewise indicate a tendency of the vegetation to reafforestation after Roman times. In contrast to the area discussed, however, they show that the forest was cut down at an earlier stage, at about 700 A.D. In this area no well developed beech phase has been found. It should be remarked in this connection that at Velsen one of the earliest Christian churches in the area was founded by Willibrord in the 8th century.

Evidently the rather rich soils of the dune landscape offered potential areas for beech forest, provided that man did not interrupt the development of the natural forest.

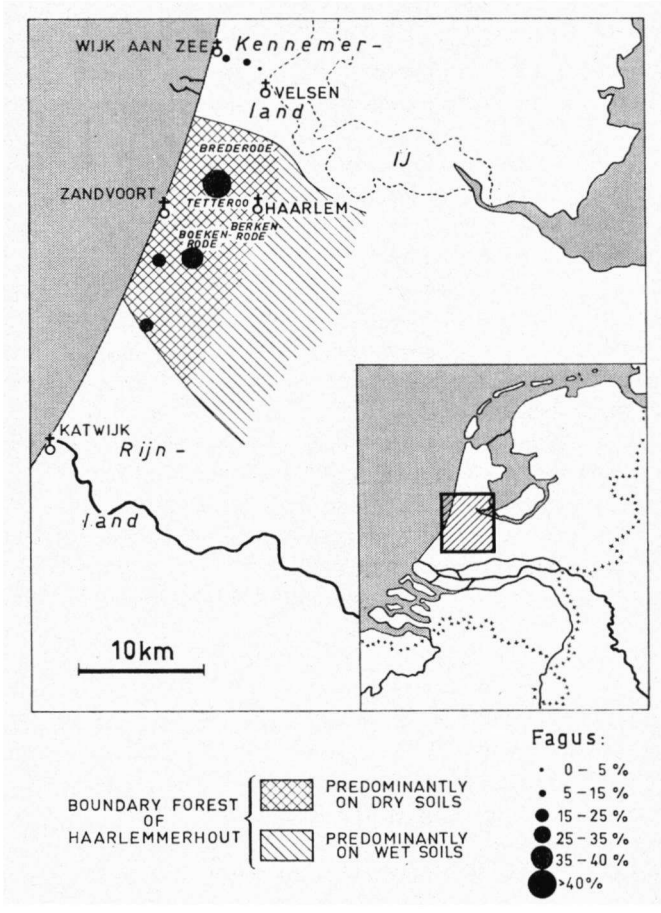

Fig. 5. Map of area between Velsen and Katwijk, showing maximum percentages of Fagus pollen during period 0–1000 A.D. (calculated according to tree-pollen sum) and area of former Haarlemmerhout and toponyms ending in -rode (according to De Cock 1965).

4. THE VEGETATION OF THE YOUNGER DUNES

Only a few of the soils and dune-slack horizons found in the Younger Dune sand, that is those dating from about the 13th to the 14 th century A.D., have been investigated by means of pollen analysis. The vegetation was very open and herbaceous, dune scrub being in the minority. *Juniperus* is lacking. The percentages of herbs in the pollen diagrams are very high (mainly Asteraceae-Liguliflorae, Cyperaceae, Poaceae), and are comparble to those in pollen diagrams of toundra-phases of the last Glacial. Historical sources as well as field-data furthermore indicate large scale sand-drift during the 15th and 16th centuries A.D., and vegetation probably was extremely scanty at those times.

5 RECORDS OF SOME INTERESTING PLANTS

Perhaps the present and former distribution of some genera of the dune scrub vegetation is connected with the situation of former river outlets in the beach-barriers.

Berberis is now common in some dune areas especially that of Voorne. In a fossil state it has been found in deposits dating from a few centuries B.C. in the area south of the Hague, that is in the vicinity of the former Helinium outlet, of which Voorne also formed a part.

Euonymus is at present common in the dunes near Haarlem and Velsen. Fossil finds, both in the Older as well in the Younger Dunes have been made in the same area, namely south of the inlet near Bergen-Egmond.

Ligustrum has been found by pollen-analysis in beds from the Older Dunes as well as from the Younger Dunes.

Hippophaë was common in the coastal dune area from subboreal times onward.

Juniperus was common in the calcareous Older Dune landscape.

It is interesting to note that the present areas of (relatively) abundant distribution of genera like *Berberis* and *Euonymus*, must have already been centres of occurrence in Older Dune times. These plants have only a small pollen production and single pollen grains probably indicate a rather plentiful distribution.

6. GENERAL CONCLUSIONS

The vegetational history of the calcareous coastal dunes shows a rapidly changing picture: now open, then closed again. Relatively small changes in geological and pedological conditions had a strong influence, especially changes in sand supply and moisture. This is in strong contrast to the holocene history of the inland forested areas. There only few changes can be observed and long periods occurred, during which the composition of forest hardly changed, except when man exerted his influence (agriculture, pasturing).

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