

## **Rise of groundwater level and vegetation development in the calcareous dunes near Haarlem, The Netherlands**

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### **Abstract**

Groundwater depletion in the dunes near Haarlem has led to a decline in size and quality of wet dune slack vegetation types. The 'Masterplan Regeneratie Duinvalleien Nationaal Park Zuid-Kennemerland' offers new chances for the restoration of wet dune slacks. After six years of vegetation monitoring the results offer interesting perspectives for the future.

Keywords: Regeneration; Wet dune slacks; Monitoring; Vegetation development.

### **Introduction**

The coastal sand dunes near Haarlem comprise 3600 hectares and are part of the 'Nationaal Park Zuid-Kennemerland', managed by PWN (Water Supply Company of North-Holland), Staatsbosbeheer (State Forestry Service) and Vereniging Natuurmonumenten (Nature Conservancy).

During the past century the dunes have suffered from groundwater depletion as a result of several factors: drinking water production for the population in the region, reclamation and groundwater management of nearby polders, construction of a large canal through the dunes to the North Sea, and establishment of vegetation in formerly barren dunes. During the last decades nature managers more and more realized the deterioration of vegetations in dried-out dune slacks. The need for recovery became an important issue. In the same period new techniques of water extraction were developed. This offered possibilities for diminishing the extraction of dune water. Hydrological model-studies indicated that ending water extraction for drinking water would lead to an increase in the area of wet slacks from 35 to 300ha. It was realized that without accompanying management the rise of water levels would lead to an increase in vegetations with tall grasses and large herbs, and not to a restoration of characteristic dune slack vegetation types, because most dune slacks had formerly been used as agricultural fields. A plan, called the 'Masterplan Regeneratie Duinvalleien Zuid-Kennemerland' (Jaspers en Korstanje, 1999), was initiated to recover the characteristic ecosystems of dune lakes and wet dune slacks. In this plan several measures were

proposed such as low-density grazing with cattle and horses and yearly mowing. In some dune slacks vegetation structures such as grasslands, shrubs and woods were removed completely, including the nutrient-rich top soil layer, in other cutting sods was carried out up to the mineral sands. To attain a good judgment in the autonomous development of the dune slacks no management measures have been performed in some slacks.

New techniques of drinking water production from surface water have cleared the way for reducing the extraction of groundwater in the dunes from 14 up to 6,5 million cubic meters in 1998. In 2002 the extraction of groundwater was ended completely. As a result water levels have risen to about one meter and in some cases even more.

## Research and results

In 1998 a research program was started to monitor vegetation developments in about 30 different dune slacks. The research was performed on the basis of fixed lines of permanent squares representing wet-dry gradients, or with so-called Tansley relevés. Each year one third of the plots were investigated. Preliminary analysis after 7 years of monitoring reveals various effects on the vegetation of dune slacks. In 2004 many dune slacks show development towards moist or even water vegetation types. In a few dune slacks the groundwater table didn't rise enough to enter the root zone, so no change in vegetation took place. At the time of writing, analysis is still under way (Kruijsen, in prep.). Therefore just some typical examples are presented here.

The dune slack 'Klein Olmen' showed a vegetation characteristic of dry calcareous grasslands belonging to *Taraxaco – Galietum* and *Festuco – Galietum*. Rising water levels just reached the root zone, causing the appearance and spread of some species confined to humid soils within these vegetation types. For the time being it appears that in this case there is no difference between dune slacks with or without a mowing régime. One of the first new settling species, *Agrostis stolonifera*, is a good example of this development.

When the water table rises well into the root zone of grasslands and shrubs, as in the dune slacks 'Langerak' and 'Kleine Zijp', these vegetations turn into 'roughs'. Plant species confined to nitrogen-rich soils establish themselves or increase in coverage, like *Urtica dioica*, *Eupatorium cannabinum*, *Lycopus europeus*, *Carex hirta*, *Galium aparine* and *Holcus lanatus*. This is certainly the case when no accompanying management is being employed. A strong rise in water levels in *Hippophae*-shrub causes dying of *Hippophae rhamnoides*.

In dune slacks where measures like cutting sods and removal of topsoil have been employed we see the development of several moist vegetation types. In dune slack 'Houtglop', where the existing vegetation was removed as well as the top soil down to the mineral sands, the water level rose over two meters. During winter the dune slack is now inundated for about half its surface. One of the most valuable vegetation types of wet dune slacks, the *Junco baltici – Schoenetum nigricantis* is beginning to emerge, as shown by the establishment or increase of characteristic species like *Schoenus nigricans*, *Epipactis palustris*, *Parnassia palustris*, *Linum catharticum*, *Gentianella amarella* and

*Bryum pseudotriquetrum*. In dune slacks where comparable measures have been undertaken but which have become less wet than 'Houtglop' we see the development of another valuable but more pioneer vegetation type, the *Centaurio – Saginetum*, on the bare moist sands. Here pioneer species like *Centaureum littorale*, *Sagina nodosa*, *Gnaphalium luteo-album*, *Bryum warneum*, *B. algovicum* and *Didymodon tophaceus* are establishing. Dune slack 'Groot Olmen' is an example of this development.

## Conclusions

Restoration of water levels in the 'Nationaal Park Zuid-Kennemerland' near Haarlem has lead to re-establishment or increase of several moist and wet vegetation types in the dune slacks. Without further management restoration of water levels leads to 'rough' vegetation types with tall grasses and herbs. Most dune slack vegetations are still in development.

## Suggestions

Although water levels are stabilizing since 2001 many vegetations in the dune slacks are still 'on the move'. Continuation of the monitoring is therefore useful. In some cases adjustment of the management régime has been advised.

## References

- Jaspers C.J. en P. Korstanje. 1999. Masterplan Regeneratie Duinvalleien Nationaal Park Zuid-Kennemerland. Grontmij Advies en Techniek bv, Houten, Nederland. By order of Vereniging Natuurmonumenten, N.V. PWN and Staatsbosbeheer.
- Kruijsen B.W.J.M. (in prep.). Ontwikkelingen in duinvalleivegetaties in de Kennemerduinen en Kraansvlak in de periode 1998-2004. Report Ecologisch Adviesbureau B.Kruijsen, Santpoort-Noord, The Netherlands, [www.natuuradvies.nl](http://www.natuuradvies.nl).