

## Dune Slacks

Jörg Petersen, Institute of  
Geobotany, University of  
Hannover, FRG

# Dune Slack Vegetation of the Wadden Sea Islands

## Ecology, Phytosociology, Nature Conservation and Management



The eastern part of  
Borkum: a salt marsh,  
dune and dune-slack area  
with high natural dynamic  
(Photo: Jörg Petersen).

In a research project funded by grants from the State Lower Saxony and the Reinhold-Tüxen-Society, the five West Frisian islands, Texel, Vlieland, Terschelling, Ameland and Schiermonnikoog, the seven East Frisian islands, Borkum, Juist, Norderney, Baltrum, Langeoog, Spiekeroog and Wangerooge, the three North Frisian islands Föhr, Amrum and Sylt, and the Danish islands, Rømø and Fanø, were investigated during 1994–1999 with respect to the ecology and phytosociology of the dune-slack vegetation. On the basis of the results of these investigations, the problems of nature conservation and management of the dune-slack ecosystems are addressed at both local levels and within the overall Wadden Sea region (s. Tab. 1).

The vegetation of dune slacks was extensively sampled and, on the basis of tabular comparison of a comprehensive data set (2775 relevés), the vegetation has been classified according to Braun-Blanquet methodology within thirty vegetation units. These units have been assigned to the following classes: *Littorelletea uniflorae*, *Isoëto-Nanojun-cetea*, *Saginetea maritimae*, *Scheuchzerio-Caricetea nigrae*, *Calluno-Ulicetea* and *Oxycocco-Sphagnetea*.

On the basis of the extensive investigations that were carried out, summary vegetation parameters and ecological characteristics were assigned to each vegetation unit. Moreover, ecological comparisons

of the various vegetation units were made using life-form and phreatophyte characteristics, and ecograms (*Ökogramme*). The correlation that exists between the various parameters was established and the implications of this correlation is considered. Furthermore, it is demonstrated that there is positive linear correlation between the number of vegetation units within a hygroserie and the total dune area of the particular island.

Succession patterns in the plant communities of the moist dune slacks are summarized and graphically presented. One example of a typical succession, involving progression from pioneer vegetation on strongly base-rich substrate to wet, heath vegetation on base-poor, acid substrate, is discussed in detail.

Dot vegetation maps, using a grid size of 1 x 1 km, have been prepared that show the distribution of the various communities in each of the seventeen islands. These maps are of particular value in that they provide a reliable basis for monitoring future changes in the plant cover of the Wadden Sea islands.

Based on the results of this investigation, the composition and the geographical extent of the individual hygroseres on each of the islands are comprehensively described. As well as plant communities that are present on virtually all islands, there are also communities that occur only in particular groups of islands, e.g. the West and East Frisian islands, as distinct from the North Frisian and Danish islands. Thus, several communities have quite distinctive distribution patterns in the Wadden Sea islands.

Dot vegetation maps of the communities on Terschelling, as recorded in the period 1937 – 1947 and in the course of the present investigations, are compared. This enables vegetation changes over a 50-year interval to be documented. The number of occurrences of the various vegetation units increased or, in some instances, remained constant. This is attributed to natural processes of succession, creation of new habitats as a result of an increase in island size, as well as the effects of active nature-management practices.

	West Frisian islands					East Frisian islands							North Frisian islands			Danish islands	
Islands (*)	Te	VI	Tr	Ae	Sc	Bo	Ju	No	Ba	La	Sp	Wa	Fö	Am	Sy	Rø	Fa
Area (km <sup>2</sup> )	162	33	116	57	46	34	13	25	6	20	21	8	84	22	101	100	56
Total dune area (km <sup>2</sup> )	34	23	35	23	22	12	5	10	3	7	5	3	1	10	54	60	40
Number of Vegetation units	17	11	23	11	13	12	8	12	7	12	4	9	7	13	14	23	18
Acidity of the dune-slack soil	Calcareous and acid												Acid			Acid+calcareous	
Min. pH (H <sub>2</sub> O) / hygroserie	3.7	3.8	3.7	4.6	5.0	4.4	6.0	4.6	5.4	4.2	6.0	4.5	3.9	3.9	3.7	4.0	3.8
Max. pH (H <sub>2</sub> O) / hygroserie	9.0	7.9	8.1	7.2	7.9	8.5	7.4	8.4	7.5	8.5	6.4	7.2	5.5	7.1	6.3	6.5	7.8
Mean pH (H <sub>2</sub> O) / hygroserie	6.7	6.0	5.8	6.0	6.2	6.8	6.3	5.8	6.2	5.9	6.1	5.9	4.7	5.1	4.8	5.1	5.1
Relative freq. of wet dune slacks	Frequent					Very rare							Rare			Frequent	
Max. average moisture values / hygroserie (**)	10.3	9.7	11.0	10.4	10.3	9.9	8.5	8.8	8.5	8.6	8.0	9.9	8.7	10.0	9.7	12.0	10.8
Mean average moisture values / hygroserie (**)	8.2	7.6	8.0	7.8	7.9	7.5	7.1	7.1	6.5	6.8	5.4	7.7	7.8	7.7	7.8	8.3	8.2
Aspects of development	Pleistocene island		Barrier islands (Holocene)										Pleistocene (Geestkern) islands			Barrier islands (Holocene)	
Position of islands (and dune slacks)	West-east												North-south				
Climate	– Average annual temperature ca. 9°C – Lower average no. of frost days than on the North Frisian and Danish islands												– Average annual temperature ca. 8°C				
Biogeographical aspects	Subatlantic-mediterranean elements: – <i>Echinodorus ranunculoides</i> – <i>Carex punctata</i> – <i>Cicendia filiformis</i> – <i>Anagallis tenella</i>												Boreal elements: – <i>Oxycoccus palustris</i> – <i>Vaccinium uliginosum</i> – <i>Rhynchospora alba</i>				
Nature conservation	Frequently active conservation measures, e.g. cutting of plaggen, grazing a. mowing; also passive conservation measures.					Passive conservation measures. Premise: optimal "no human influence", i.e. nature should be left alone.							Passive conservation measures; some active conservation measures (grazing).				
(*): Te = Texel, VI = Vlieland, Tr = Terschelling, Ae = Ameland, Sc = Schiermonnikoog, Bo = Borkum, Ju = Juist, No = Norderney, Ba = Baltrum, La = Langeoog, Sp = Spiekeroog, Wa = Wangerooge, Am = Amrum, Sy = Sylt, Rø = Rømø and Fa = Fanø. (**): moisture values (Feuchtezahl) from Ellenberg et al. (1992)																	

Cutting of plaggen, grazing and mowing are accepted methods of nature conservation today. They have a positive effect on many vegetation units of the hygroserie or may even be a prerequisite for their continuing occurrence. From the viewpoint of conservation and biodiversity, the abandonment of these historical forms of land use, in all but the West Frisian islands, is regrettable. The dune-slack ecosystems are also endangered as a result of human-induced restrictions on the action of wind and sea – often necessary from the human viewpoint – and also the lowering of water tables which is often connected with increase in tourism.

In order to preserve the plant communities of moist dune slacks, which are the most endangered of coastal vegetations, a combination of active and passive conservation measures is necessary and, additionally, it is important to introduce specific measures to facilitate natural dynamic succession. Measures, other than succession alone uninfluenced

by human intervention as favored by some conservationists, must be taken with a view to conserving the dune-slack communities with their high species diversity. Otherwise, in the long term, these communities will be largely displaced by species-poor, shrub communities with birch and willows as dominants and hence the biodiversity of the dune slacks will be greatly reduced.

## References

Petersen, J., 1999. Die Dünenvegetation der Wattenmeer-Inseln in der südlichen Nordsee. Eine pflanzensoziologische und ökologische Vergleichsuntersuchung unter Berücksichtigung von Nutzung und Naturschutz. Husum Druck- und Verlagsgesellschaft, Husum, pp. 205.

Dr. Jörg Petersen

Institut für Geobotanik  
der Universität Hannover  
Nienburger Str. 17  
D 30167 Hannover  
Petersen@mbx.geobotanik.uni-hannover.de

Table 1  
Overview of main features  
of the hygroseres on the  
Wadden Sea islands.