

Development of Salt Marsh Vegetation in the Leybucht from 1948 to 1996

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With 2 Text-Figures and 1 Table

Abstract

[ARENS, S. & HEIBER, W. (1999): Development of salt marsh vegetation in the Leybucht from 1948 to 1996. – *Senckenbergiana marit.*, 29 (Suppl.): 7–11, 2 figs., 1 tab.; Frankfurt a. M.]

The mainland salt marsh vegetation of the whole Leybucht area (Lower Saxonian Wadden Sea, Northwest Germany) was recorded in 1995/96 by mapping in a 1:2500 scale. In addition the boundary of the vegetation was registered in 1996. First results of this study have been compared with previous mappings of the vegetation. A considerable increase in surface area and a rapid succession of salt marsh vegetation are noted. These changes are mainly put down the high sedimentation rate as well as to human interference.

Kurzfassung

[ARENS, S. & HEIBER, W. (1999): Entwicklung der Salzwiesenvegetation in der Leybucht von 1948 bis 1996. – *Senckenbergiana marit.*, 29 (Suppl.): 7–11, 2 Abb., 1 Tab.; Frankfurt a. M.]

In den Jahren 1995/96 wurden die Festlandssalzwiesen der gesamten Leybucht (Niedersächsisches Wattenmeer, Nordwestdeutschland) im Maßstab 1:2500 vegetationskundlich erfaßt. Ebenfalls wurde die Bewuchsgrenze der Vegetation 1996 eingemessen. Erste Ergebnisse dieser Untersuchungen wurden mit früheren Vegetationskartierungen, die seit 1948 in unregelmäßigen Abständen durchgeführt wurden, verglichen. Es wurden eine erhebliche Zunahme der Salzwiesenfläche sowie ein rasches Fortschreiten der Sukzession festgestellt. Diese Veränderungen sind vor allem auf die hohe Sedimentationsrate sowie auf anthropogene Einflüsse zurückzuführen. Die Untersuchungen sind Teil der Erhebungen, die seit 1982 von der Forschungsstelle Küste im Auftrag des Staatlichen Amtes für Wasser und Abfall, Aurich durchgeführt werden. Sie stehen im Zusammenhang mit der Baumaßnahme „Küstenschutz Leybucht“, hier insbesondere zum Bauprojekt „Leyhörn“.

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Introduction

During the last centuries large parts of the Leybucht (Fig. 1) were embanked. In 1950 the construction of the sea dike „Störtebekerdeich“ and in 1958 of the summer dike of the Hauener Hooge were completed. Since 1985 about 740 ha of salt marshes, summerpolder marshes and tidal flats of the Leybucht have been embanked in order to create a water reservoir for inland drainage and a new deep channel for the fishing cutters of the village Greetsiel. This construction measure is named „Leyhörn“. Furthermore, since 1991 the Störtebekerdeich has been renewed, raised and widened. As a measure of compensation the summer dike of the Hauener Hooge was opened in October 1994 to increase the influence of sea water on 80 ha grassland in this part of the Leybucht.

In former years most of the salt marshes were heavily grazed (2 cattle ha⁻¹). Presently the salt marshes are either not pastured or extensively used. It is the aim of the National Park Administration, to cease agricultural use of the salt marshes completely until 2000.

It is expected that these measures have had an effect on salt marsh development. Below, some aspects of this develop-

ment since 1948 are shown. To get informations about the salt marsh vegetation of the Leybucht the results of the records in 1995/96 were supplemented by data obtained from previous investigations. The whole Leybucht has been recorded by LINKE in 1948 (FORSCHUNGSSTELLE INSEL- U. KÜSTENSCHUTZ, Norderney 1973), 1952 (KRAUSE 1953), 1959 (MÜLLER 1960), 1977 (GROSS 1977), 1985 (ROOK 1986) and 1991 (NATIONAL-PARKVERWALTUNG NIEDERSÄCHSISCHES WATTENMEER 1994). The Mittelplate, a part of the Leybucht, has been studied in 1984 (SCHERFOSE 1984) and in 1992 (MARTZFELD-HARTMANN 1994). In the south-eastern part of the Leybucht a grazing experiment was carried out, first results of this study are based on sampling of the vegetation in 1980 and 1988 (ANDRESEN et al. 1990).

This study is a part of the investigations which have been carried out by the Forschungsstelle Küste since 1982 in context to the construction project „Küstenschutz Leybucht“, in particular with the construction of the „Leyhörn“ (in commission of Staatliches Amt für Wasser und Abfall, Aurich).

Materials and Methods

In September 1996, the boundary of the vegetation of the Leybucht was determined using a Differential Global Positioning System (DGPS). The seaward boundary was defined as a value of 0.1 plants m⁻¹.

The salt marsh vegetation of the entire Leybucht area was mapped in July and August 1995/96 in a 1:2500 scale. The

vegetation types mainly correspond with the typology used in the vegetation map of 1992 (MARTZFELD-HARTMANN 1994), based on the classification by VON GLAHN et al. 1989. First results of mapping are compared with previous vegetation mappings.

Results

According to Fig. 1 the location of the outer boundary in the Leybucht has considerably moved seawards from 1948 to 1996.

The increase of salt marsh area since 1948, including the pioneer vegetation (*Salicornietum* and *Spartinetum*), is summarized in Tab. 1. However, the interpretation of historical changes has to be performed with caution due to the different individual ways the vegetation border was plotted in the previous mappings.

Besides the vegetation boundary having moved seawards the salt marsh communities have changed in composition or increased in area. In 1977 for example, the lower salt marsh (*Puccinellietum maritimae*, without *Festuca rubra*) was still dominant. Except for the Buscher Heller, only small areas were colonized by higher salt marsh communities (*Puccinellietum*

maritimae, with *Festuca rubra* and *Armerio-Festucetum *litoralis* with *Puccinellia maritima*).

Until 1985 the variant with *Festuca rubra* of the *Puccinellietum maritimae* increased in particular. From 1985 until 1996 the vegetation of the higher salt marsh has spread out (*Armerio-Festucetum *litoralis*, *Agropyretum litoralis*) and presently covers a considerable share of the whole salt marsh area.

In the Hauener Hooge-area, which was embanked in 1958, the *Lolio-Cynosuretum* dominated until 1994. In 1993 grazing finished. The summer dike of the remaining area of the former summerpolder (about 80 ha, Fig. 2) was opened in October 1994. Within two years the grassland vegetation rapidly decreased whereas the salt marsh vegetation increased. Obviously *Aster tripolium* appeared in great numbers just one year after opening the dike.

Discussion

During the last 50 years the vegetation mappings of the whole Leybucht were repeated. Since these studies show considerable differences in their methods, the interpretation of the historical data and the comparison with our results is difficult. Nevertheless, in contrast to other salt marshes at the mainland coast of Lower Saxony, the development of the vegetation of the Leybucht is particularly well documented.

The salt marsh vegetation of the Leybucht has shown a conspicuous development since 1948. A considerable increase of salt marsh area as well as a rapid progress in succession has been observed. The previous expansion of the salt marsh area can mainly be attributed to land reclamation techniques. During the last 15 years coastal protection measures obviously supported the local expansion of the salt marshes. These measures comprised dumping of dredged material from the shipping channels of the "Greetsieler Außentief" and the "Norder Außentief" at sedimentation fields of the Hauener Hooge and the Buscher Heller in 1980 - 1985, the construction of the new dike crossing the "Greetsieler Außentief" (finished in 1991) and the building of the Leyhörn from 1988 to 1991. It has to be investigated whether these projects might have implications on the sedimentation rate and therefore on

the succession of the vegetation of the Leybucht as a whole. Also further removal of sand on a large scale as well as dumping of dredged material in and around the Leybucht may have influenced the development.

Furthermore grazing is considered to be an important factor which determines the sedimentation rate and species composition of the salt marsh vegetation. In higher salt marshes of the Leybucht the cessation of grazing supported the *Agropyretum litoralis*. This was already noted by ANDRESEN et al. 1990 in ungrazed areas of the south-eastern part of the Leybucht. Our investigations suggest that, if the grazing of the higher salt marshes in the Leybucht will be ceased in the future, it is to be expected that this phenomenon might become even more relevant.

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References

- ANDRESEN, H. & BAKKER, J. P. & BRONGERS, M. & HEYDEMANN, B. & IRMLER, U. (1990): Long-term changes of salt marsh communities by cattle grazing. – *Vegetatio*, **89**: 137-148.
- FORSCHUNGSSTELLE INSEL- UND KÜSTENSCHUTZ, NORDERNEY (1973): Zur Ausbreitung und Gesellschaftsbildung von *Spartina townsendii* an der ostfriesischen Küste. – *Jber. Forschungsstelle Insel- u. Küstenschutz Norderney* 1972, **24**: 219-240.
- GLAHN, H. VON & DAHMEN, R. & LEMM, R. VON & WOLFF, D. (1989): Vegetationssystematische Untersuchungen und großmaßstäbliche Vegetationskartierung in den Außengroden der niedersächsischen Nordseeküste. – *Drosera*, **89** (1/2): 145-168.
- GROSS, G. (1977): Die Pflanzengesellschaften der Leybucht als vegetationskundlicher Beitrag zur Landschaftsdynamik des Ostfriesischen Küstenraumes. – (unpublished).
- KRAUSE, H. R. (1953): Bericht über den Stand der natürlichen Verlandung in der Ley-Bucht und auf der Hauener Hooge. – *Jber. Forschungsstelle Norderney* 1952, **5**: 85-95.
- MARTZFELD-HARTMANN, A. (1994): Die Pflanzengesellschaften der Mittelplate (Leybucht). Vegetationskundliche Untersuchungen 1992. – (unpublished).
- MICHAELIS, H. (1984): Studien zur ökologischen Fortentwicklung der Leybucht und zur Auswirkung des geplanten Bauvorhabens Leyhörn. – *Jber. Forschungsstelle Insel- u. Küstenschutz Norderney* 1983, **35**: 135-161.
- MÜLLER, C. D. (1960): Fauna und Sediment in der Leybucht. Biologisch-bodenkundliche Wattuntersuchung mit Stellungnahme zur Landgewinnung. – *Jber. Forschungsstelle Insel- u. Küstenschutz Norderney* 1959, **11**: 39-178.
- NATIONALPARKVERWALTUNG NIEDERSÄCHSISCHES WATTENMEER [Ed.] (1994): Biotoptypenkartierung terrestrischer Bereiche des Nationalparks Nieders. Wattenmeer auf der Basis der CIR-Luftbilder von August 1991. – (unpublished).
- ROOK, B. (1986): Landschaftsökologische Untersuchungen eines anthropogen gestörten amphibischen Lebensraumes am Beispiel der Salzwiesen und der Verlandungszone im Bereich der Leybucht/Ostfriesland. – (unpublished).
- SCHERFOSE, V. (1984): Vegetations- und Standortverhältnisse von Teilen der Leybucht - Mittelplate. – (unpublished).

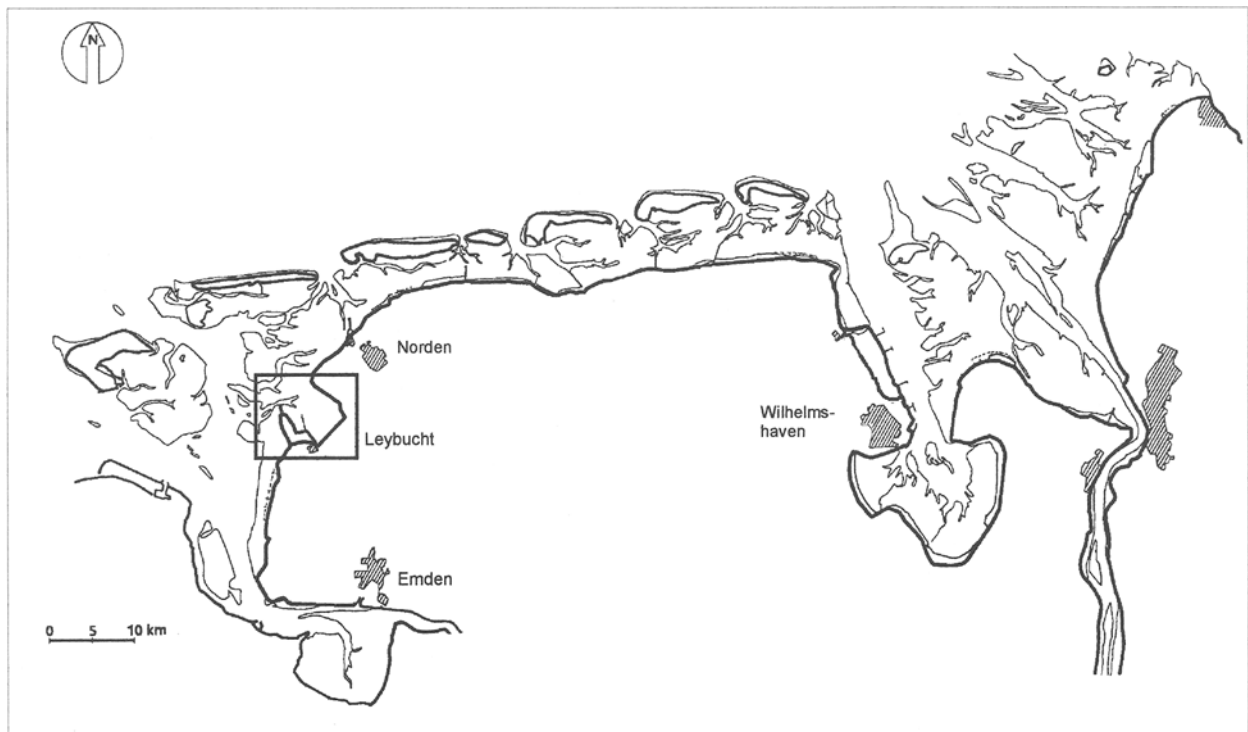


Fig. 1. Map of the coastline of Lower Saxony, showing the location of the Leybucht.

Table 1. Modification of salt marsh areal coverage in the Leybucht in the period 1948-1996. – *) All surface areas until 1983 refer to the border of the Leybucht in 1983 (not including the summerpolder Hauener Hooge). However, the total of 1996 is comprising only those areas situated seawards the new dikes and thus giving a more realistic computation of the present surface area (the summerpolder area of the Hauener Hooge is not included, too). Since 1983 approximately 100 ha of salt marshes and pioneer vegetation have been embanked. In the data from 1996 these embanked areas are not included. – **) MICHAELIS (1984).

year	Surface area*)
1948	400 ha**)
1952	467 ha**)
1959	628 ha**)
1977	851 ha**)
1983	921 ha**)
1996	1169 ha

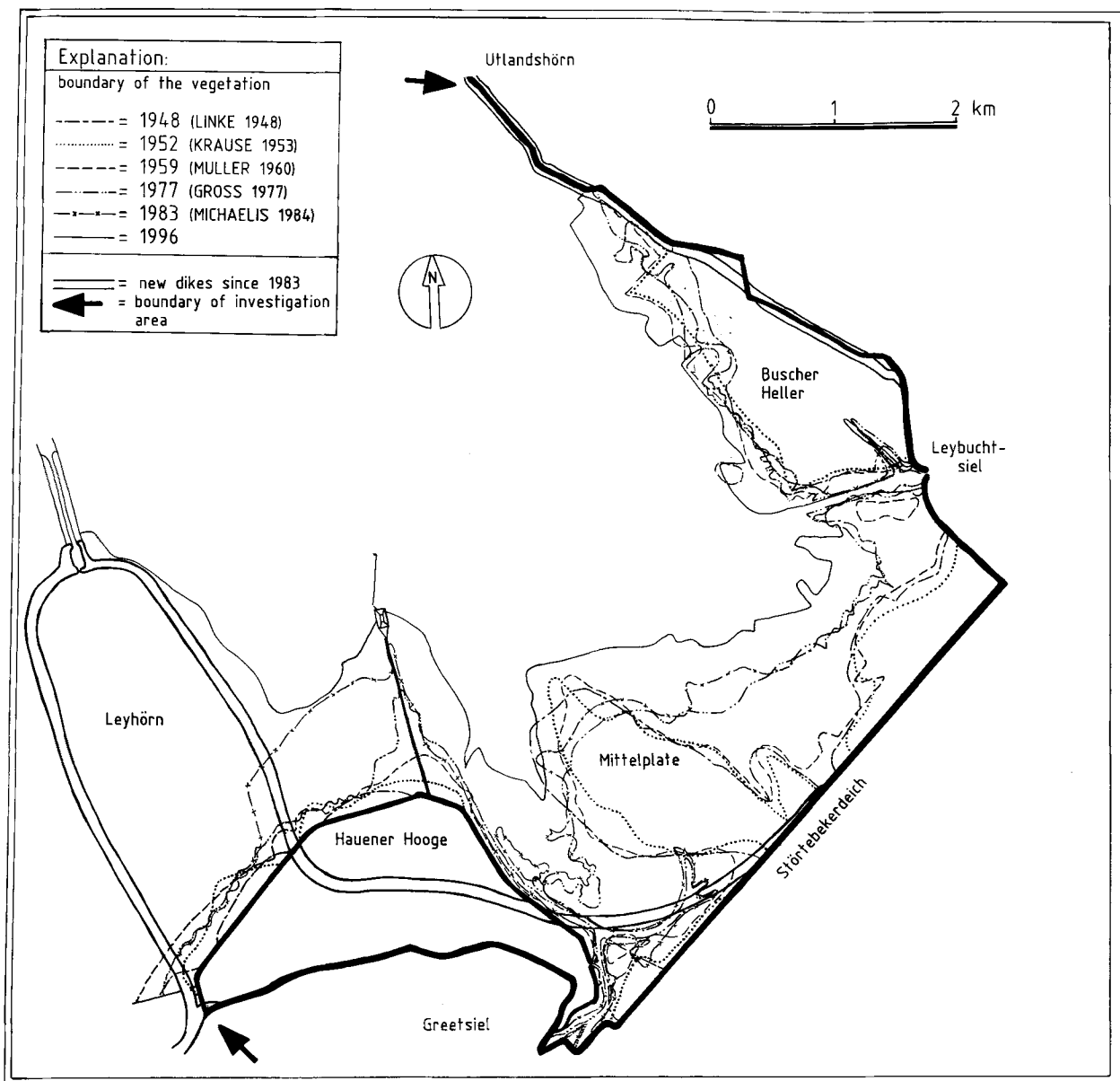


Fig. 2. Modification of the vegetation boundaries in the Leybucht in the period 1948-1996.