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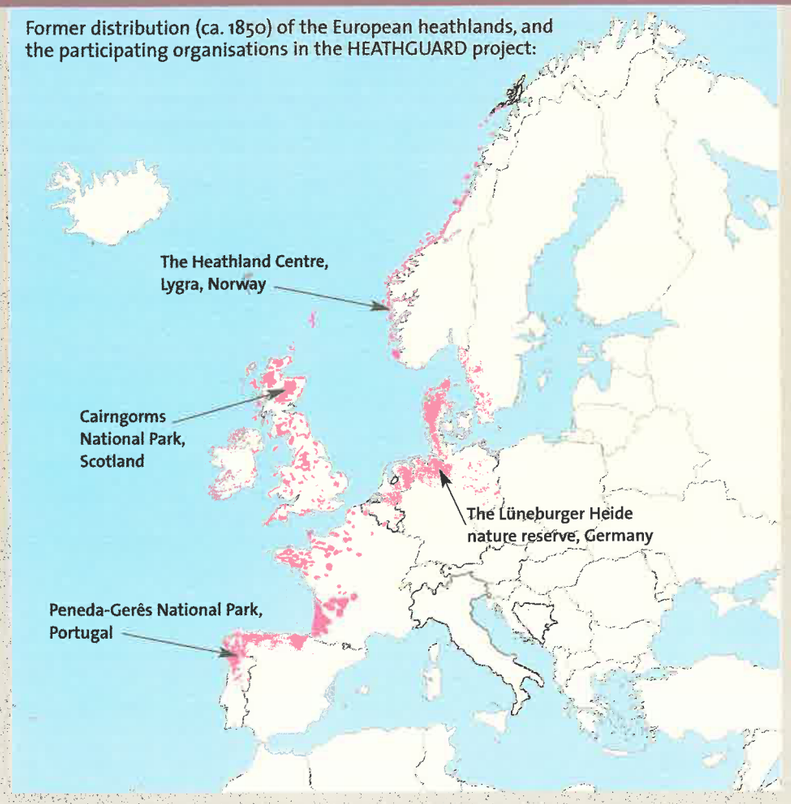

Heathlands are present in most European countries facing the Atlantic, and they constitute a common cultural landscape unique for Europe. Safeguarding the Heathlands of Europe (HEATHGUARD), has been a one year European Heritage Laboratories project financed by the EU commision Culture 2000 Framework Programme in Support of Culture. The object of the project has been to compare conservation methods and landscape management practice of heathlands in different regions of Europe.

In four reports, one from each partner, descriptions are given of landscape development, traditional land use systems and the importance of heathlands to regional heritage, identity and biodiversity. In a fifth report the experiences of the partners from heathland conservation and management are compared and evaluated, in order to propose recommendations for the future preservation of the remnents from this common European cultural heritage.

Tobias Keienburg & Johannes Prüter

Safeguarding the Heathlands of Europe

Conservation and management of central European lowland heathlands

Case study: Lüneburger Heide nature reserve, North-West Germany

Education and Culture
Culture 2000

European Heritage Laboratories
HEATHGUARD

NNA
Alfred Toepfer Akademie
für Naturschutz

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This document does not necessarily represent the Commission's official position.

Education and Culture

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The HEATHGUARD Project: Safeguarding the Heathlands of Europe
European Heritage Laboratories/CULTURE 2000 Programme of The European Union

Reports:

Conservation and management of North European coastal Heathlands
Case study: The Heathland Centre, Lygra, Western Norway

Conservation and management of North-West European upland Moorlands
Case study: Cairngorms National Park, Scotland

Conservation and management of Central European lowland Heathlands
Case study: Lüneburger Heide nature reserve, North-West Germany

Conservation and management of South-West European mountainous Heathlands
Case study: Peneda-Gerês National Park, Northern Portugal

Safeguarding the Heathlands of Europe
Conservation, management, recommendations

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TOBIAS KEIENBURG & JOHANNES PRÜTER

SAFEGUARDING THE HEATHLANDS OF EUROPE

CONSERVATION AND MANAGEMENT OF CENTRAL EUROPEAN LOWLAND HEATHLANDS

Case study: Lüneburger Heide nature reserve, North-West Germany

Table of contents

View of the Wilseder Berg – at 169.2 m the highest point in the northwest German lowlands.

JOHANNES PRÜTER

1 Summary

The heaths of the Lüneburger Heide nature reserve, lying in northwest Germany, are characteristic of the former extensively distributed heathlands of the Central European lowlands which were strongly influenced by glacial processes. In the conglomeration of diverse habitats of this landscape dominated by older moraines, be it forests, brook valleys, bogs, meadows, pastures or fields, the extant heathlands of about 5,400 ha are, from a supraregional point of view, the most striking ecosystem. In the spacious and open heathlands, with their numerous transition zones to other habitats, a high number of specifically adapted and often endangered animal and plant species can be found.

The main impact of the approximately 5,000 years old land use history of this area is the attempt by pastoral farmers to concentrate nutrients in order to to till the soil despite the lack of nutrients in the sandy soils. Initially this was done by slash-and-burn and grazing of small parts of the native forests. Afterwards, when heathlands became more and more distributed under thinned forests, these heathlands were grazed by flocks of Heidschnucken sheep, whose dung was collected and used for fertilizing small fields. In particular, rye, sand oat and buckwheat were grown. The mowing of heaths provided important additional winter fodder and litter. After the Middle Ages the heath was "plagged", meaning that the heather plants were cut together with the organic soil layer, in order to get necessary litter for the sheep sheds. In addition to the use of what is known as historical heathland farming, beekeeping was also practised on the extensive heathlands.

Relics of this land use history still exist in abundance in the landscape in the form of earthworks and architectural monuments.

During the 19th century historical heathland farming lost its economic viability. This was mainly caused by the introduction of artificial fertilizer and the import of rival products. A predominant part of the heathlands was forested, mainly with pine trees, resulting in a sharp decline of the heaths.

In order to safeguard heaths, the first land purchases in the area of the present Lüneburger Heide nature reserve were made at the outset of the 20th century by the privately organized Verein Naturschutzpark Association, which was founded in 1909. This acquisition of land continued after the designation of the area as nature reserve in 1922 and continues today. The preservation of heathlands is currently stipulated by a variety of legal regulations from the regional to the European level. At present their threat mainly consists of increased rates of nutrient input from the air and in the lack or improper application of heathland management practices. In the Lüneburger Heide nature reserve, heathlands are managed mainly by grazing with Heidschnucken sheep, mechanical management such as mowing or plaggen, and prescribed burning in winter. In their effects, these management practices orient themselves to the historical ways of heathland cultivation. The combination of different practices results in a sufficient removal of nutrients from the heaths and enables the necessary rejuvenation of heather plants. On the basis of a contractual agreement with the Bundesland Niedersachsen, the Verein Naturschutzpark Association carries out the heathland management. The costs are mainly covered by the public purse. In order to reduce costs, attempts are made to continuously optimize management practices, to open up new ways of marketing products resulting from heathland management and to integrate heathland management and extensive organic farming, which is also done by the Verein Naturschutzpark Association.

With modern approaches to sustainable land use attempts are made to safeguard the special structures and functions of this cultural landscape, which has developed over milleniums.

Not least because of the foundation of the Alfred Toepfer Academy for Nature Conservation in 1981, research, education and public relations for nature conservation have a long tradition in this area and support the development concept integrating conservation and use.

For the regional economy of this sparsely populated landscape, tourism in particular is of great importance, being aided by the nature reserve's attractiveness. But other ecological benefits of the heathlands are also being increasingly recognized and discussed with respect to their importance for the future economic development of the region.

2 Introduction

"Safeguarding the Heathlands of Europe" (HEATHGUARD), is an EU-financed project within the *"Culture 2000 Framework Programme in Support of Culture"*. It aims to compare heathland conservation methods and management practices in different regions of Europe, in order to develop recommendations for Pan-European guidelines for heathland preservation.

The Atlantic heathlands are an important part of the common European heritage. Distributed from Portugal in the south to northern Norway in the north, they constitute a belt of cultural landscapes through Western Europe. Within this enormous area, the strategies for making a living from the resources of the landscape have been more or less the same over innumerable generations. The homogeneity of heathland farming methods across Europe has produced a landscape where the similarities in land use history and management traditions far outnumber the differences there may be due to variation in geographical settings and cultural background.

Due to the development of modern agriculture, the economic output from heathland farming today is rapidly decreasing. On the other hand, heathlands receive increasing attention as valuable areas for leisure, recreation and inspiration purposes for modern people living in urbanized areas. They also contribute considerably to the common European cultural history, and they are easily understood examples of sustainable subsistence based on natural resources.

These heathlands are valuable for the maintenance of important aspects of the biological diversity of Europe. This is partly due to the occurrences of species that have specialized over a long timespan to live in this open landscape. In addition, some of the most interesting examples of ancient livestock breeds still surviving in Europe are found on the heathlands.

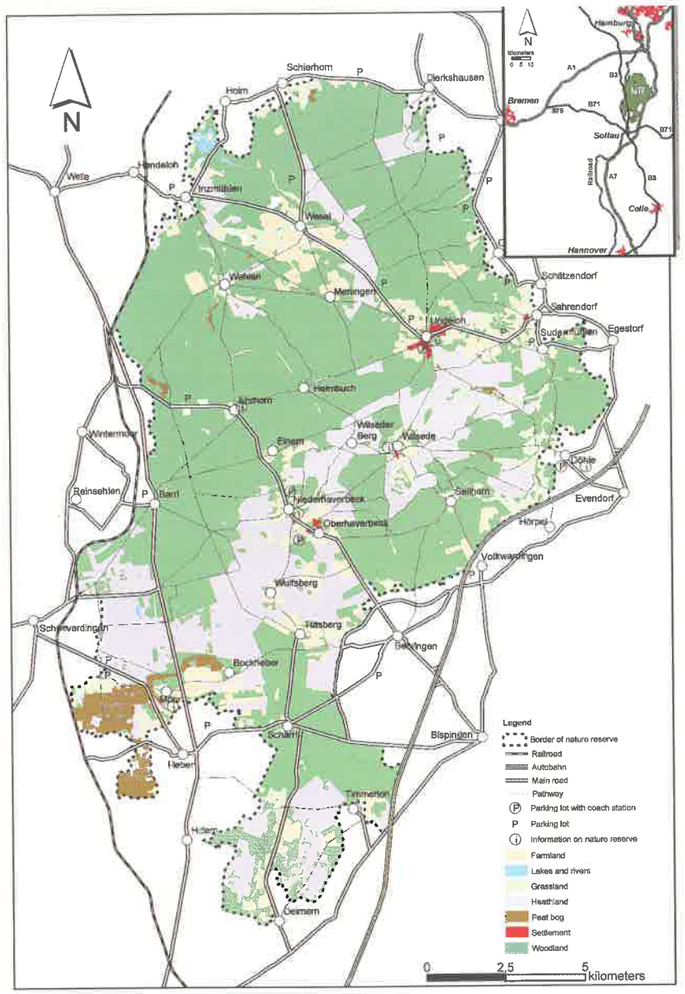
In spite of the many values attached to heathlands, it is today an endangered type of landscape. The relative importance of the varied threats differs across Europe, but taken all together, the effect is that nearly 90% of heathlands have disappeared over the last 150 years. Although these changes have been most rapid over the last 50 years, the development was foreseen much earlier, and the first safeguarding of heathlands took place early in the 20th century, e.g. in Germany. In other parts of Europe it is quite a new idea to establish protected areas of heathlands.

It is important that heathlands are preserved in different parts of Europe. The variations in climate, geology and topography create considerable variation in heathland biodiversity, and this cannot be safeguarded in one protected area alone. The many different cultural traditions, and the diverse adaptations to local natural resources, are also impossible to preserve in one location. To make sure that both the theoretical and practical knowledge behind this variety of land use practices are passed on to future generations, it is important that satisfactory heathland areas are preserved in complementary regions throughout Europe.

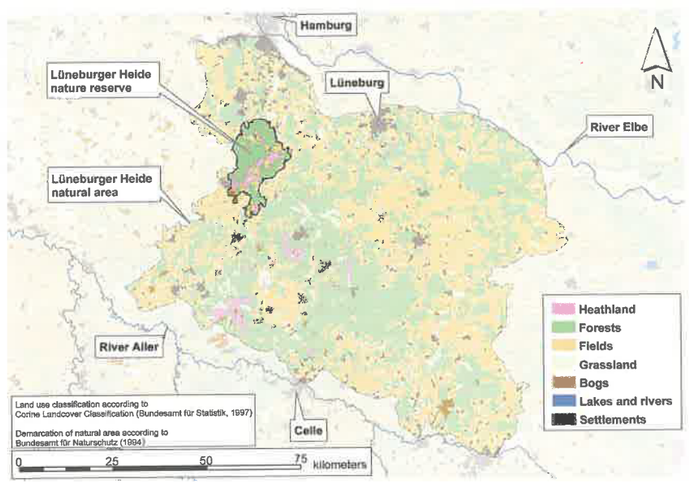
The variety of cultural traditions, management practices and resource utilizations found within the heathlands has been mapped in an earlier EU-project called Heathcult, financed through the Raphael-programme. The results were communicated through a popular booklet (Haaland 2002), an internet site (*www.nationaltrust.org.uk/heathlands*), an exhibition at the World Exhibition in Hannover 2000 and a mobile exhibition (Kaland, Kaland & Mellemstrand 2001).

The Heathguard project builds on the experiences from Heathcult. Heathcult focused on visualizing in a popular way the most important aspects of heathland nature and culture across Europe. Heathguard will compare and exchange experiences of heathland management and preservation between complementary regions of Europe. The method for doing this is to make standardized descriptive reports, one from each of the participating institutions. The present report is just such a report for the Lüneburger Heide nature reserve in northwest Germany. The other reports will be compiled by The Heathland Centre (Norway), Cairngorms National Park (Scotland), and Peneda-Gerês National Park (Portugal).

The next step will be to analyze and evaluate the different conservation strategies and management methods applied in the four areas, as described through the individual reports. This work will be presented in a fifth report, where guidelines for preservation of remaining heathland areas in Europe will also be developed.



The Lüneburger Heide nature reserve – location and land cover (map based on: ATKIS and Corine land cover, courtesy of Landesvermessung + Geobasisinformation Niedersachsen and Bundesamt für Statistik 2004).



Land cover in the Lüneburger Heide natural area (map based on Corine land cover, courtesy of Bundesamt für Statistik and Bundesamt für Naturschutz 2004).

3 Definition of the area

The Lüneburger Heide nature reserve is located in northwest Germany, approximately 150 km from the southern North Sea coast in a gradient influenced by Atlantic as well as continental climates. It represents the typical kind of Central European lowland heathlands on sandy Pleistocene sediments extending from Belgium in the west to Jutland in the north and covering the coastal region of the southern and eastern North Sea. The heathlands lying in the Lüneburger Heide nature reserve belong to the largest coherent heathlands of this region, which have developed directly from the historical cultural landscape.

The nature reserve lies inside the geologically, pedologically, climatically and phytosociologically defined natural area Lüneburger Heide, which was almost completely covered by heathlands 200 years ago. Therefore, "Lüneburger Heide" is a historical term for a large part of the northeast lowlands of the German Bundesland Niedersachsen on the one hand, and on the other it is specifically used for the extant heathlands inside of the Lüneburger Heide nature reserve.

The nature reserve today comprises an area of 23,440 ha. Dry sandy heaths and oligotrophic grasslands have a share of about 6,000 ha (26%) of this area. Furthermore, the nature reserve encloses a habitat mosaic of extensive coniferous forests (especially pine) dating back to heath afforestation in the mid-19th century, scattered ancient forests with oak and beech, brook valleys, bogs, grasslands, fields and exposed sandy soils.

As a "Special Protection Area" according to the Birds Directive and a "Special Area of Conservation" according to the Habitats Directive, the nature reserve is strictly protected by European law, because of its rare habitats and plant and animal species. Moreover, it is protected as a "nature reserve" by the strictest German legal category of protection.

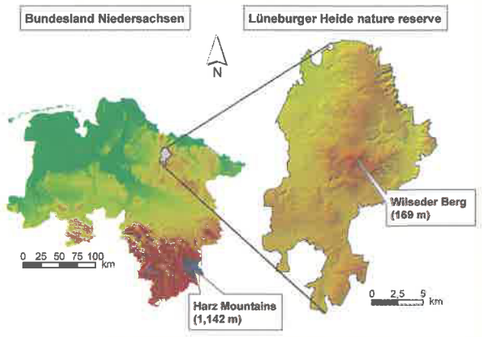
At the same time, large parts of the nature reserve were designated as a nature park at the beginning of the 20th century and are thus in part steeped in the tradition of the German nature park system, which currently covers about 25% of the total area of Germany.

Finally, the nature reserve has been awarded the European Diploma of the European Council, firstly in 1967 and every fifth year thereafter.

After their sharp decline in the 19th century, first efforts to protect heathlands started at the outset of the 20th century, leading to extensive land acquisition by a private nature conservation association ("Verein Naturschutzpark", VNP). Almost all heathland and bog areas as well as considerable areas of forests, grasslands and fields inside the nature reserve now belong to this Association.

With its designation under a police decree in 1922, the Lüneburger Heide nature reserve is one of Germany's oldest nature reserves. In order to add heathlands which had formerly been used for military training purposes, the area was enlarged under an updated decree in 1993.

There is no uniform administration of the nature reserve, which is visited by more than 2 million people per year. Sovereign duties are dealt with by the Bundesland Niedersachsen and partly by the local districts of Soltau-Fallingbostel and Harburg. The necessary heathland management is carried out independently by the Verein Naturschutzpark Association. Its financing by public means is regulated by contract. All institutions dealing with nature conservation tasks work together in a steering group whose decisions are not legally binding.



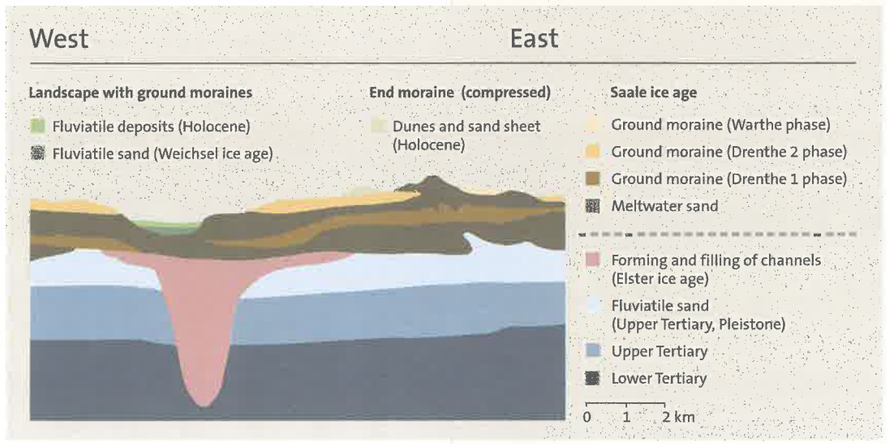
Digital height model for the Bundesland Niedersachsen. The glacially dominated landscape in the Central and northern parts of Niedersachsen reaches its greatest heights in the Lüneburger Heide nature reserve (map based on: GEOSUM, courtesy of Niedersächsisches Umweltministerium 2004).

4 Description of the area as part of the Atlantic European heathland system

4.1 Natural conditions

It is essential to consider the pedological conditions and their initial geological situation in order to understand the agricultural processes that led to the extensive development of heathlands in the Central European lowlands over recent centuries.

The present geological and hydrological conditions in the area being considered date back to glacial processes. In the course of the so-called "Elster" ice age, which influenced the climate 350,000 to 250,000 years ago, the Lüneburger Heide natural area was covered by inland ice from Scandinavia. Melt water sands and calcareous glacial till were deposited by advancing glaciers from the north. Many channels, more than 300 m deep and 1 to 2 km broad, were formed by immense amounts of draining melt water during the glaciers' retreat. Even during their emergence and then in their later development, those channels were filled with grav-



Strongly schematized geological sectional view in the area of the Lüneburger Heide nature reserve with the characteristic succession of deposits of the Pleistocene (Quartery) and of the Holocene (according to SCHWARZ in CORDES ET AL. 1997, simplified)

elled to very fine sands before they were closed by a cover of clay. Today, they are important groundwater layers (aquifers). The sediments of this period, however, have no current influence on the present relief, as they are hidden below the sediment layers of the subsequent "Saale" ice age.

The Saale ice age, which followed the Elster ice age after a short interglacial period, dominated the climate approximately 235,000 to 125,000 years ago and has shaped the present landscape's relief in the surroundings of the Lüneburger Heide nature reserve. In three subsequent periods the area was more or less completely covered by Scandinavian inland ice, each interrupted by short warmer periods. From the change of sedimented melt water sands at the glacier's front and silty ground moraine material in the glacier's core a typical succession of different sediments emerged.

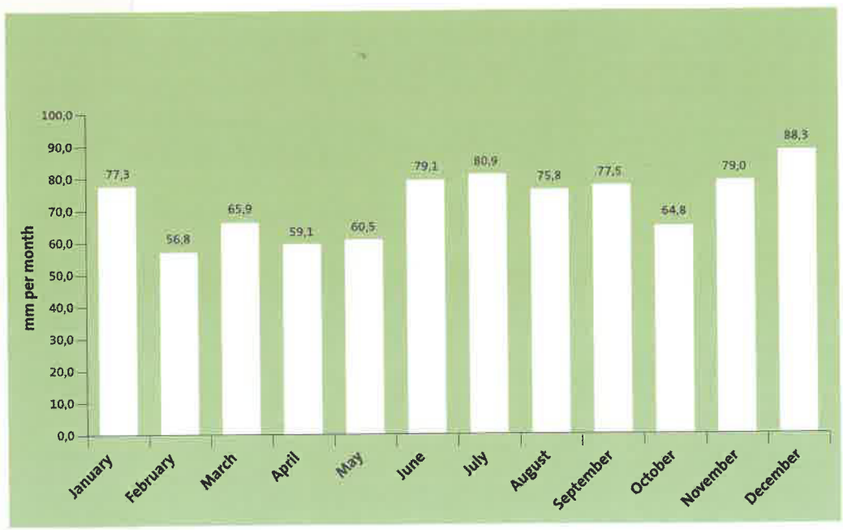
The first and third glacial advances were responsible for forming the considerable relief of the nature reserve, which is obviously stronger than its surroundings. The "Wilseder Berg", at 169.2 m the highest point in the nature reserve, lies at the intersection of two end moraines. The end moraine running from the Wilseder Berg in a westerly direction and forming the Wilseder Berg dates back to the first glacial advance; the second end moraine, passing in a northerly to south-easterly direction, emerged from the third glacial advance.

In the foothills of the end moraines the characteristic brook and river valleys with their wide alluvial planes can be found. The rock material of the Wilseder Berg itself stems from the first glacial advance.

The Pleistocene sedimentation of sandy material has not only formed the Lüneburger Heide nature reserve, but it has moulded a predominantly flat landscape with single end moraines and river valleys across the whole Central European lowlands.

The last of the Scandinavian inland glaciations, the so-called "Weichsel" ice age (115,000 to 10,000 years ago), did not fundamentally influence the relief of the Lüneburger Heide nature reserve as the glaciers did not reach the area but stopped about 100 km northeast of it. Nonetheless, the periglacial conditions led to strong, locally different processes of soil erosion and soil accumulation, caused by water and wind. As a result of these processes the present Lüneburger Heide nature reserve was mainly covered by a sandy layer without structure at the outset of the present interglacial period 10,000 years ago.

This nutrient-poor sandy cover from glacial drift was the basis for the soil development still going on today. Due to post-glacial emergent



Average monthly precipitation rates at Sellhorn, Lüneburger Heide nature reserve (based on measurements between 1960 and 2003).

woodlands, brown earth was the first soil type to develop. The land use introduced by pastoral farmers in the Neolithic period, particularly historical heathland farming as carried out intensively since the High Middle Ages, has contributed to impoverishment and acidification of soils in large parts of the area. Thus podsol soils, now typical of the whole Central European heathlands, have developed particularly below heath vegetation. This soil type is characterized partly by very thick organic layers (raw humus), by bleaching of the upper mineral soil horizon because of acidic leaching of iron and aluminium compounds together with humic matter and by accumulation of these compounds in lower, partly hardened friable iron-humus-pan or hardpan horizons.

Under heath vegetation these soils in their developed structure have partly survived to date. On sites which have been used for agricultural or forestry purposes afterwards, the podsol profiles have often been destroyed by deep ploughing.

Prerequisite for the mutual development of vegetation and soil is the climate. With a distance of 150 km to the North Sea coast, the nature reserve lies in a transitory region between Atlantic and continental climates. Longstanding average precipitation rates of 854 mm/a, strongly influenced by the end moraines, are considered as Atlantic, whereas the relative height of the area (70 to 170 m above sea level) leads to rather continental temperature conditions (annual average temperature on the southern fringe of the nature reserve for the period 1981-1992: 9.0°C; average number of days with frost in the same time period: 71.0).

Podsol soils typically develop from sandy soils under acidic heath vegetation.

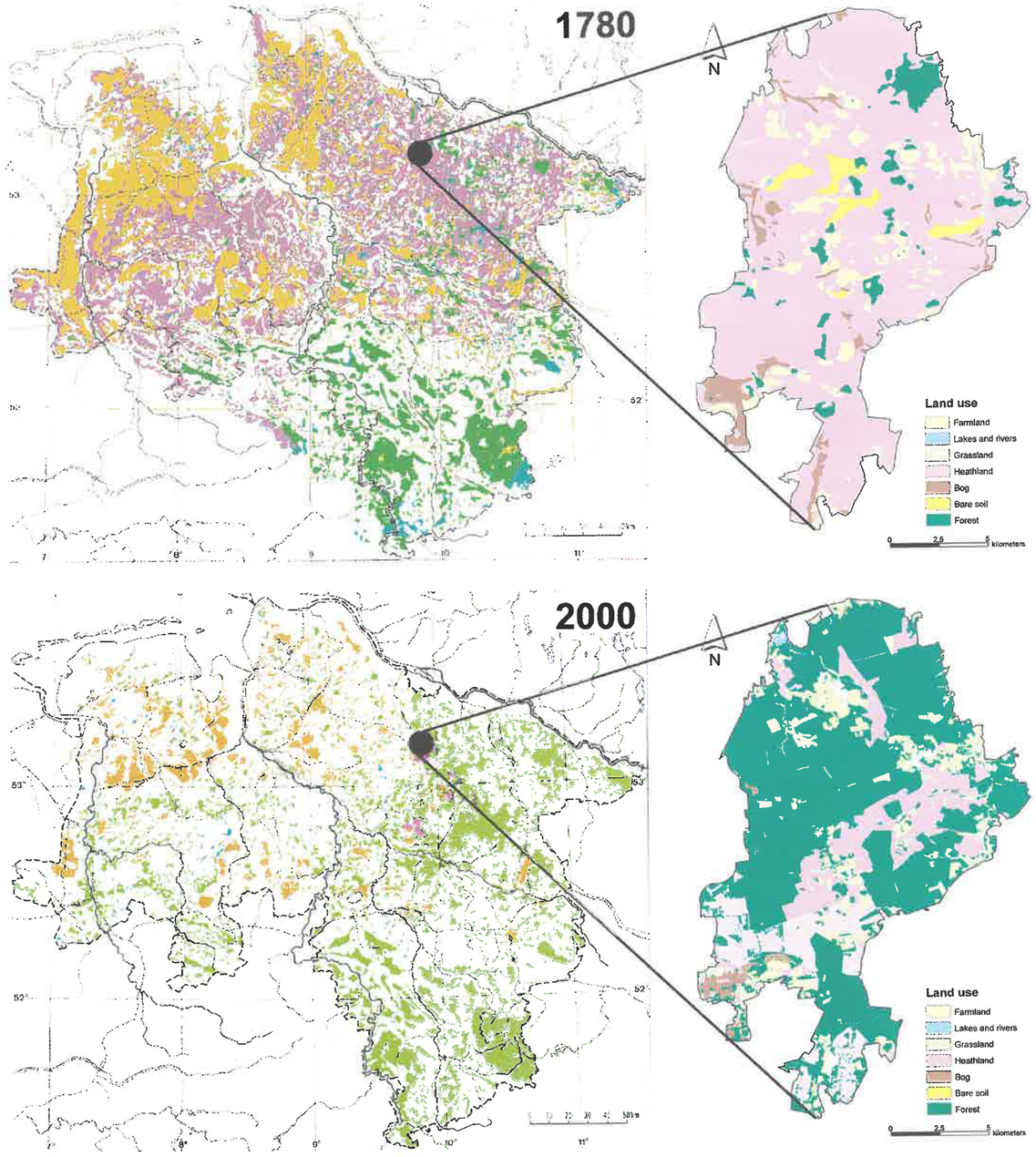
4.2 Landscape development

As many prehistoric findings prove, human beings were at least temporarily present in the area as hunter-gatherers during the last ice age and the post-glacial landscape development. Not until they settled did they influence landscape development.

Pollen analyses show that up until the 3rd century B.C. dense woodlands covered the present nature reserve. But even as the Neolithic Age was beginning, increased amounts of Calluna seeds indicating small-scale distribution of Calluna heaths could be found and continued through the Bronze Age until the first Iron Age (approximately 500 B.C.). These findings correspond to increased amounts of charcoal and greater numbers of plants which indicate human settlements. Therefore, a human-influenced emergence of heathlands from slash-and-burn practice is very probable. Podsol soils, which typically develop below heath vegetation and which were found below Bronze Age barrows (Chapter 4.4), point to the existence of heathlands before the Bronze Age as well.

During the Iron Age, pre-Roman times and Germanic migrations, afforestation alternated with phases of heathland development from the Roman Age.

The Middle Ages after the Germanic migrations (about 1000 A.D.) were a turning point for landscape development. Pollen diagrams indicate a significant decline in woodlands and increased spreading of Calluna heaths at this time. This was the result of an agricultural change from a more nomadic to a more sedentary land use. Non-permanent dwellings were substituted by permanent settlements, shifting single-crop areas by permanent fields with crop rotation systems, semi-wild by sedentary cattle flocks. The thinning out of deciduous forests, which was necessary for this, led to the extensive spread of sandy heaths, which were cultivated in the characteristic way of "historical heathland farming" (Chapter 4.3) with all its minor products. Intensive use of forests for fodder, wood and litter production resulted in the further extension of the heathlands, which reached its peak in the mid-18th century, as historical maps indicate.



Comparison of the land cover of the Bundesland Niedersachsen and of the Lüneburger Heide nature reserve at the time of maximum heathland distribution (1780) with the present situation (map based on HECKENROTH in LÜTKEPOHL & PRÜTER 2000, ATKIS courtesy of Landesvermessung + Geobasisinformation Niedersachsen 2004).

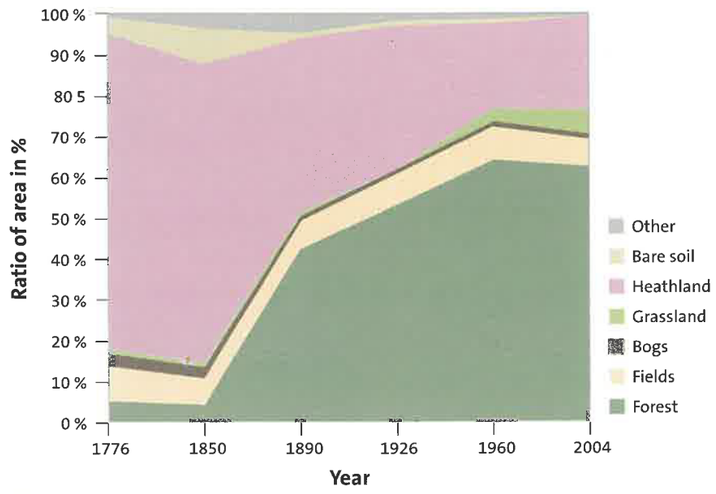
Over the following decades a sharp population rise and new rival products (e.g. mineral nitrogen fertilizer instead of sheep dung, refined sugar instead of honey, wool from Merino sheep from New Zealand instead of wool from the local sheep breed "Heidschnucke") forced the heathland farmers to overcultivate the already intensively cultivated heathlands, in order to compensate for their economic losses. The consequences of this were extensive devastation and siltation of the heathlands, which even led to the development of shifting sand dunes.

Then, at the outset of the 19th century, land ownership was reorganized (Chapter 7.1) and the heathland farmers were able to sell their complete farms or just their heathlands. Therefore, the traditional heathland farming system ceased to be practised and almost became completely extinct, as is perfectly illustrated by the decline in numbers of the Heidschnucken sheep in the Fürstentum (principality) of Lüneburg from 380,000 sheep in 1848 to 45,000 sheep in 1913.

With the basic idea to fixate and cultivate open sand areas and heathlands respectively and to improve soil fertility, water regime and local climate, extensive afforestation mainly by the public forestry administration began in the area of the present nature reserve in the second half of the 19th century. Furthermore, the afforestation was politically and economically necessary, in order to compensate for a wood deficit. With respect to the poor soil, the afforestation was almost exclusively done by the indiscriminate planting of undemanding pine trees (Pinus sylvestris), complemented by spruce (Picea abies) and oak (Quercus robur) trees here and there.

At the outset of the 20th century initial efforts to protect the rapidly declining heathlands developed, motivated not least by literary-artistic motifs, finally leading to the efforts of the Verein Naturschutzpark Association, which was founded in 1909 to protect the remaining heathlands and their surroundings (Chapter 7.1).

Under changing circumstances the protection of the original remaining heathlands has been successful until now. A large part of the nature reserve of about 3,000 ha, which was used by the military for tank driving exercises between 1945 and 1993, provides a special situation with these protection efforts.



Changes in land utilization in the Lüneburger Heide nature reserve (according to PELTZER 1975 in KOOPMANN 2002, extended).

Landscape drawings of the surroundings of Hof Tütsberg (drawings are based on 'Kurhannoversche Landesaufnahme' map from 1776 and present topographical maps).

ILL. ANNE KAISER

Idealized traditional heathland farm and methods of heath utilization at the time of historical heathland farming.

ANTJE KAYSER

4.3 Traditional farming systems

Under the conditions of nutrient-poor soils the settlers of the Central European lowlands were forced to cultivate the available land in a way that nutrients from common land (forests, heathlands) were concentrated on small single patches (fields, gardens). Deciduous forests with their nutrient rich litter layers and fruits (acorns and beechnuts) were overcultivated very quickly by litter usage for field fertilization and by forest pasture with cattle and pigs. Given the great demand for wood as well, forests could not regenerate. Heather, being perfectly adapted to nutrient-poor soils and the Atlantic climate, began to grow in the clearings at first and spread to extensive areas later on. Its acidic organic litter caused the development of podsol soil with its iron-humus-pan, which, together with intensive grazing, made regrowth of trees almost impossible.

Having been perfected since the Middle Ages, the technique of gaining nutrients from extensive heathlands as fertilizers for small fields and simultaneously making as many by-products as possible, is called "historical heathland farming" from the present point of view.

One of the most important prerequisites for this kind of agriculture was the availability of sufficiently large heathlands for a heathland farmer. As a consequence, the big single farmsteads of the farmers were located far away from each other, with smaller farms concentrated in villages. The farmsteads used to lie in the vicinity of brook valleys, enabling the farmers to lay out meadows for hay production when advanced melioration techniques were available in the 19th century. Each single farmstead was surrounded by a copse of oak and beech trees, which protected the farmstead against fire and supplied the farmers with important wood. Wet moorlands complemented the feed areas for 7 to 10 pigs, 15 to 20 head of cattle and 1 to 2 workhorses. The copse around the farmstead could be used for further fattening the pigs.

Common grazing of all available heathlands by flocks of Heidschnucken sheep of 100 to 250 ewes per farm was the centre of historical heathland farming. Heidschnucken are a small and very undemanding regional breed which were able to almost entirely live on heather, supplying the farmers with meat and wool. Even more important was the part they played in the transport of nutrients from the heathlands to the sheep shed, to which they were led every evening (and sometimes even at midday) by the shepherd after grazing all day.

Dung and urine produced by the sheep were absorbed by the shed's litter and later used as manure for the fields. A peripheral sheep shed, lying between a distant field and the heathlands, allowed the farmers to use more distant heathlands for grazing.

At many places, so-called "plaggen material" - heather plants cut with a special hoe together with the organic soil layer and the rooted mineral soil horizon near to the farmstead - was used as litter for the sheep shed. Due to the great need for plaggen material, a defined area which made up 20% or more of the available heathlands, was used in the way described. It was found that a typical farmstead in the 19th century had an annual demand of about 630 m^3 for plaggen material, being equivalent to a plaggen area of about 4 ha. Regeneration of "plagged" heath took about 10 to 40 years. A more frequent use could end up in the emergence of large sandy areas and shifting dunes.

Heather mown with special blades (so-called "Heidlinnen") and scythes more distant from the farmstead was used as litter (mostly for cattle) as well as for roof thatching, path improvement and broom production, but partly also as fodder. The lack of hay, caused by the lack of grassland, made it necessary to feed sheep with mown heather. In addition, a large amount of straw had to be fed to oxen, non-pregnant cows and sheep. Therefore, considering also the utilization of straw for roof thatching, only a small amount of straw was left. This was used as litter for the valuable horses in particular and sometimes also for pigs.

In order to improve the sheep pasture, that is by regenerating overaged heather, heathlands were burnt from time to time.

Crop rotation on the fields began with the addition of plaggen material, mixed with sheep dung. After this initial fertilization, rye (Secale cereale) was usually grown for four years, until the necessary nutrients were exhausted. Undemanding sand oat (Avena strigosa) and buckwheat (Fagopyrum esculentum), which even was able to cope with very acidic and nutrient-poor soil conditions, followed. At the end of the ten-year crop-rotation the fields were not cultivated for four subsequent years, in order to restore soil fertility. Over this period they served as a relatively fertile pasture, e.g. for draught oxen. The ratio of heathlands to cultivated fields was about 10 to 1.

In addition to crop and stock farming, beekeeping was practised, being of great importance for sugar supply as refined sugar was not available. The swarms of bees were brought to the flower-rich marshlands in spring and were put on the heathlands into so-called "bee fences" during the flowering period of buckwheat and heather in summer.

Small thickets called "Stühbüsche" provided the farmers with firewood and could be used for foraging purposes and winning of hay and litter from the foliage, in addition to the copses around the farmsteads. These thickets consisted of small stunted oak trees, very sel-

VNP

Extensive and scattered – heathland grazing by horned grey Heidschnucken sheep.

dom growing to any great height. Organic plaggen material from wet heather moorlands, so-called "Brennbülten", provided alternative fuel after drying.

Juniper trees were considered as a pasture weed and were systematically cut by the shepherds, so that only solitary trees could be found rather than dense copses.

Heidschnucken sheep

The central component of historical heathland farming was extensive grazing of the available heathlands by a sheep breed called "Graue gehörnte Heidschnucke" (horned grey heathland sheep). What made this sheep breed, which is supposedly decended from the moufflon sheep breed native to Sardinia and Corsica, so competitive compared with other grazing animals? Its decisive advantage was its remarkably undemanding nature and its ability to make use of heather as fodder. One of the earliest reports about "Heydeschnucken" sheep from the late 18th century mentions that even in winter these sheep were able to scratch their fodder with their hooves from under the snow. Their very robust health and their tasty meat made the sheep easy to care for and very utilizable domestic animals, whose wool could be used for blankets, socks, hats or gloves.

An important restriction on the rearing of Heidschnucken sheep flocks was the limited food supply for their lambs. Heidschnucken sheep rut between the end of August and November. With pregnancy lasting five months lambing takes place around March. Even today births of twins are quite rare compared with other sheep breeds. Due to insufficient food supply the weaker one of the twin lambs was given away or killed in former times, in order to at least guarantee the rearing of one lamb per ewe. Often shepherds were even forced to kill single lambs, so that two ewes could rear one lamb.

Attempts at improving wool quality or meat quantity of the Heidschnucken sheep, which originally weighed no more than 20 kg, by cross-breeding with other sheep breeds or by increased feeding in the early 19th century were unsuccessful. Higher productivity of meat and wool was not compatible with the extreme undemanding nature of the sheep and their robust health. Nonetheless, the sheeps' average body weight increased in the 20th century. Ewes, which weighed about 25 kg on average in the late 19th century, nowadays have a body weight of about 45 to 50 kg. The weight of rams increased from 35 kg to 75 or even 80 kg over the same period.

As a consequence of the breakdown of historical heathland farming (Chapter 4.2) and the corresponding declining sheep numbers, regional breeders' associations were founded in 1830, 1876 and 1920; however, they closed down or were forced to close down after a few decades. In 1949 the "Verband Lüneburger Heidschnuckenzüchter" Association (Association of breeders of Heidschnucken sheep of Lüneburg) was founded and still exists. Under its influence, sheep numbers, which declined from World War II until 1970, were raised again and held at a stable level until today (in 2004 the number of Heidschnucken sheep in the Bundesland Niedersachsen was about 10,000, in Germany about 14,000; due to a relative high number of unreported animals this estimate is quite rough). The main factor in this development was the increasing importance of Heidschnucken sheep for nature conservation and landscape management, but the establishment of numerous small flocks of Heidschnucken sheep throughout Germany and neighbouring foreign countries also contributed to the increase in sheep numbers.

Present day breeding aims for Heidschnucken sheep are recommended mainly by the Verband Lüneburger Heidschnuckenzüchter Association. The essential aim is the breeding of a native country sheep, as undemanding as possible, robust and suitable for landscape management. Prerequisites for that are properly developed hooves and a corresponding stature. The horns, which are carried by both sexes, should not be clinging too tightly to the head, so as not to cause injuries. If possible, slaughtering weights shall be increased, but without endangering the ability to live on heather. Ideally, the coat is of silver-grey colour and has a black breast bib. Nowadays, births of twins, which were undesirable for centuries, are being supported in order to improve breeding profitability.

Although only one breed of Heidschnucken sheep was mentioned a few centuries ago, which was originally common across the whole Atlantic heathland belt of northwest Europe and was later distributed in northwest Germany, two more breeds of Heidschnucken sheep besides the "Graue gehörnte Heidschnucke" are known today.

The first pure breeds of the "Weiße gehörnte Heidschnucke" (horned white heathland sheep) were supposedly not tended before the end of World War I. The animals, which occur in small but stable numbers (about 1,500 animals in 1991), are distributed particularly in the northwestern part of the Bundesland Niedersachsen.

The breed called "Weiße hornlose Heidschnucke" (hornless white heathland sheep), with the synonym "Diepholzer Moorschnucke", is mentioned for the first time in the early 20th century as an individual breed, but is supposed to have actually existed in the numerous flocks of "Weiße gehörnte Heidschnucken" sheep before that time. Above all, this breed continues to contribute to landscape management in the extant bog areas in the southwestern part of the Bundesland Niedersachsen.

JOHANNES PLÜTER

Witnesses of prehistoric settlements – barrows from the Bronze Age in the Lüneburger Heide nature reserve.

4.4 Cultural heritage, monuments and architecture

Earthworks

As a result of limited soil treatment during historical heathland farming and the long tradition of nature conservation in the Lüneburger Heide nature reserve, many earthworks have been preserved in the area until now. The ancient monuments lie partly in the open heathlands, clearly visible, and partly hidden under the afforested areas. Only in those heathlands, which had been used for military purposes, such earthworks were destroyed.

One well preserved stone tomb, erected from solid erratic blocks on the eastern border of the nature reserve, dates from the Neolithic Age and indicates the settlement of human beings and the introduction of crop and stock farming, as is also shown by pollen diagrams (Chapter 4.2). Other individual tomb hills and tool findings date back to the same period.

More than 1,000 barrows in the nature reserve can be ascribed to the Bronze Age. At the core of these 0.5 to 2 m high hillocks of heath turf or pure sand with diameters of 10 to 18 m, sometimes enclosed by a circle of stones, lies the grave, consisting of a wooden coffin, sometimes protected by stones. Often, bronze objects of were put in the graves of the dead.

According to pollen diagrams, earthworks dating back to the German migrations are absent, reflecting the sparse settlement of the area at that time. The function of single objects from the Middle Ages often remains uncertain. A ring-shaped rampart of stones, whose foundations can still be seen today, may have served as a location to collect interest.

Traces of historic paths are younger, dating back to the 16th century. Typical of these old paths are the many tracks they consist of, sometimes extending over 100 m wide. This was a result of the unsurfaced, often bottomless sandy soil, which forced people to create new tracks beside the old ones on a path in bad condition.

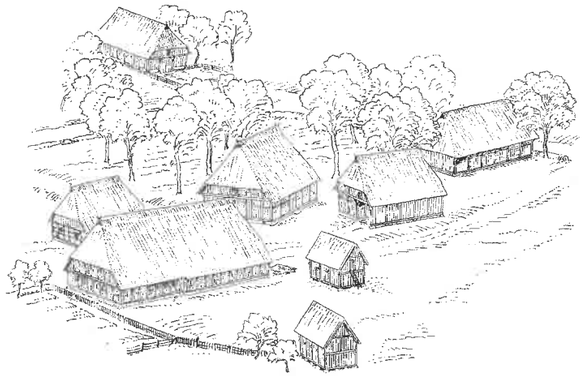
Architecture

It was characteristic of the regional architecture of farmhouses dating from the 16th to the 19th century, that humans and animals (cattle and horses in particular) lived under one roof. Many of these houses are still used today, although often in a different way. These houses, being very large, more like halls, and thatched with straw, had an area of about 240 m² or more and were about 10 m high. They consisted of three parts, the hall ("Diele"), the room with the open hearth fire ("Flett") and the living rooms.

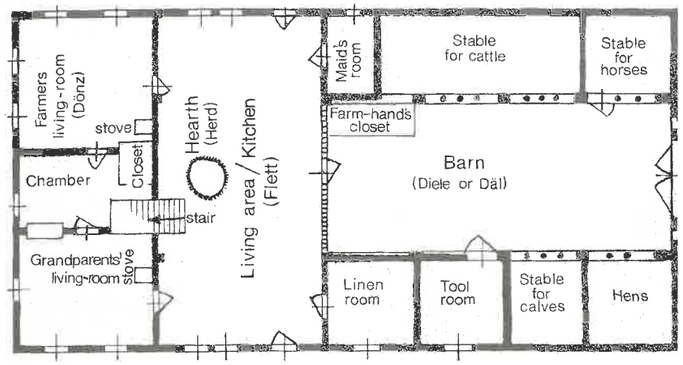
The hall, which was entered at the front of the house through a big winged double door, made up the largest part of the house, with a length of 7 to 9 m, sometimes even 20 m. It was used as a stable for cattle, which stood on each side of the hall, and for threshing corn on the clay soil in the middle of the hall. The loft above the hall served as a storeroom for corn.

The Flett, a 5 or 6 m long room, which extended over the whole width of the house, followed the hall without any partition. Here, the open hearthfire was located, whose smoke had to find its way through the thatched roof to the outside.
Separated from the Flett by a wall, the living rooms made up the remaining far end of the house.

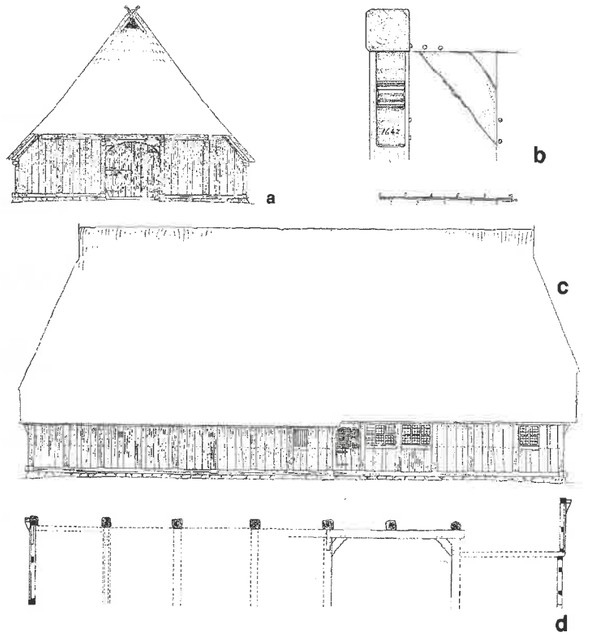
The loft and the roof of the house lay on two wooden trusses, which extended parallel to the side walls of the house, at a distance of 1.5 to 2 m to them. The longitudinal beams of these wooden trusses were supported by 2 to 3 m high pillars, each standing at a distance of 3 m from the others. These longitudinal beams supported the cross-beams extending from one wooden truss to the other.



Typical farmstead in the Lüneburger Heide with outbuildings which were usually built on wooden trusses – "Emmhof" near Soltau. Idealized pen-and-ink drawing in perspective EITZEN 1955

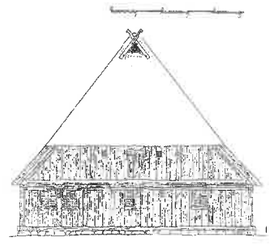


Ground plan of a typical farmhouse
VEREIN NATURSCHUTZPARK ASSOCIATION 1977



Typical construction of an old farmhouse built on two wooden trusses ("Zweiständerhaus") ("Kote Rieckmann")
KLAGES IN CORDES ET AL. 1997

a View on household gable, reconstruction
b Detail: strut of the "Flett"
c View on right longitudinal side, reconstruction
d Longitudinal section, right row of pillars, situation in 1990
e View on living gable, reconstruction



JOHANNES PRÜTER

The Bockheber farmstead – view of the stable gable of a characteristic old farmhouse in the Lüneburger Heide nature reserve.

The oak wood for these beams and for the side walls made out of half-timbering were probably taken from the copses around the farmsteads. Erratic blocks found on the heathlands served as a source for the stone foundations. The erratic blocks were worked with the help of small wooden wedges soaked in water, which were put into prefabricated notches and finally burst open the erratic block.

The sheep sheds typical of historical heathland farming showed different architecture. The peripheral sheds, lying distant from the farmstead in the heathlands, were usually pure roof constructions. On two rows of stones thin stems of coniferous trees were put up against each other. Therefore, the thatched roof reached down to the ground. Both of the end walls were dominated by a large gate.

The typical sheep shed at the farmstead, however, was constructed in a more complex way like a half-timbered house, in some cases in the style of the above-described farmhouses.

JOHANNES PRÜTER

Worked erratic block in the Lüneburger Heide nature reseve – at the sharp edge typical work traces can be seen.

RAINER KÜPSELL

A pure roof construction – peripheral sheep shed in the Lüneburger Heide nature reserve.

ANTJE KAYSER

Sleeping area for the Heidschnucken sheep – typical sheep shed at a farmstead in the Lüneburger Heide nature reserve.

4.5 Biodiversity

The link between the Atlantic heathlands is their emergence from human influence. Specific types of land cultivation (Chapter 4.3) led to the replacement of certain vegetation types (usually forests) by other vegetation forms (heathlands). Therefore, it can also be assumed for the Lüneburger Heide nature reserve that its potential natural vegetation consists of forests: especially beech forests on acidic soil, mixed with occasional oaks. Only in extremely dry or extremely wet locations could pine, birch or alder trees stand their ground.

The thinning out of dense, shady forests, the creation of new habitats and gradients between habitats is likely to have contributed to a greater diversity of species communities, many of which are now strictly protected by European nature conservation directives.

Type of heath	Characteristic species	Abundance on ... % of the 1,400 study plots
Typical sand heath	Needle Whin, Hairy Greenweed	85%
Bilberry sand heath	Bilberry	65%
Wet sand heath	Purple Moor Grass, Cross-leaved Heath, Deergrass	34%
Crowberry sand heath	Crowberry	27%
Lichen-rich sand heath	Lichens of the genus Cladonia	24%
Loamy sand heath	Common Heathgrass, Pill Sedge	1%

Heath vegetation is quite uniform in the Lüneburger Heide nature reserve. Heather *(Calluna vulgaris)* dominates the impression of the extensive sand heaths.

Needle Whin *(Genista anglica)* and Hairy Greenweed *(Genista pilosa)* together with Common Dodder *(Cuscuta epithymum)* are further characteristic species for typical sand heaths. In wetter locations Cross-leaved Heath *(Erica tetralix)* occurs as well. Further Ericaceae species, which may be found numerously on small areas, are Bilberry *(Vaccinium myrtillus)* and Crowberry *(Empetrum nigrum)*, the latter especially in shady locations. Cowberry *(Vaccinium vitis-idaea)* is more abundant south of the nature reserve, Cranberry *(Vaccinium oxycoccus)* is restricted to peat bogs and heath bogs.

The complete heathland area was mapped in 1992, in order to produce a management and development plan for the nature reserve. In doing so more than 1,400 more or less homogeneous heathland plots were identified. The table above shows to what percentage different types of heath occur on these plots, at least to a small extent.

Of course, transitional vegetation types occur in gradients to other habitats, like heath-forest-, or bog-heath-habitats. Heaths with high ratios of Wavy Hair-Grass *(Deschampsia flexuosa)* could be found on 62% of the plots at the time of mapping.

According to the present level of knowledge the flora of the Lüneburger Heide nature reserve consists of 721 ferns and flowering plants.

With regard to the Red Data Book of Niedersachsen 4 species are threatened with local extinction, 50 species are highly threatened, 108 species are threatened and 1 species is potentially threatened.

45 of 721 species are considered as heathland species, 18 of them are subject to the Red Data Book.

The high diversity of ferns and flowering plants is complemented by approximately 170 moss species and 260 lichen species, of which 116 species are subject to the Red Data Book. Many of these cryptogams live in old forests having occasionally survived in the heathlands.

JÜRGEN BORRIS

Heather (Calluna vulgaris)

VNP

Needle Whin (Genista anglica)

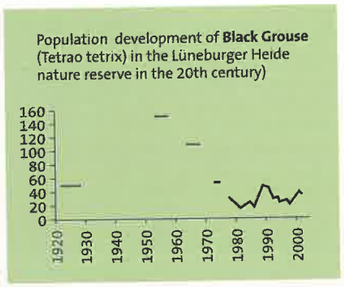
JOHANNES PRÜTER

Cross-leaved Heath (Erica tetralix)

JOHANN SCHREINER

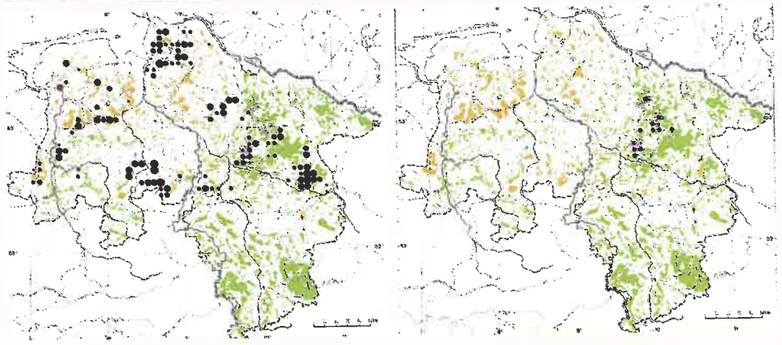
Bog Asphodel


JÜRGEN BORRIS



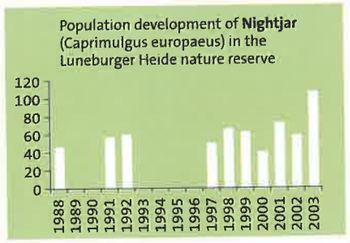
The Black Grouse (Tetrao tetrix) makes great demands on its habitats. It prefers a small-scale diversity of structure, coexistence of scrubby and open, dry and wet habitats.

Only recently have moorlands in the Western parts of Niedersachsen provided suitable habitats. Today the occurrence of Black Grouse is restricted to the Lüneburger Heide nature reserve and more southerly military training areas which are also dominated by sand heaths.
Due to its complex habitat demands Black Grouse is of great importance for nature conservation as a target species.

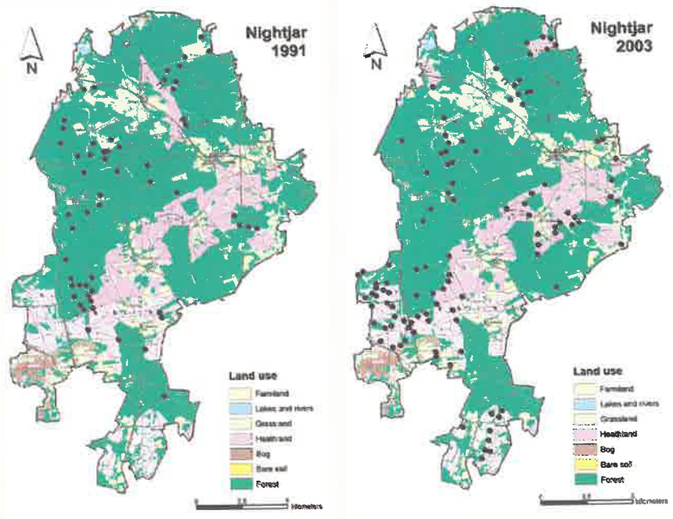


Distribution of Black Grouse in Niedersachsen in 1976 (left) and 2002 (right)


BERNHARD VOLMER



The Nightjar (Caprimulgus europaeus) lives on open sand heaths with single trees as well as in thinned coniferous forests. Its impressive purring is especially likely to be heard on former military training areas with single-thinned regenerating forests. Coniferous forests have become denser with more deciduous trees and are being increasingly abandoned.

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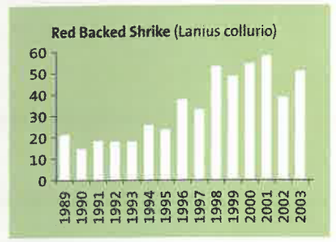
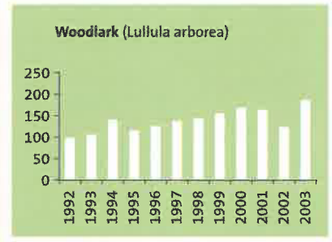


Many other bird species protected by the European Birds Directive live in the Lüneburger Heide nature reserve: Woodlark (Lullula arborea) and Great Grey Shrike (Lanius excubitor), Red Backed Shrike (Lanius collurio) and Stonechat (Oenanthe oenanthe), Wryneck (Jynx torquilla) and Green Woodpecker (Picus viridis), Wheatear (Saxicola torquata) and Curlew (Numenius arquata) – all these species indicate the high complexity of the habitats in the nature reserve with their different ecological establishment of niches.

Their population development trends point to different situations: increasing population numbers of Woodlark, Great Grey Shrike and Stonechat; fluctuating numbers of Nightjar, Wryneck and Green Woodpecker; declining numbers of Wheatear and Curlew. In each case population development inside the nature reserve is at least as good as from the supraregional point of view, in most cases population numbers in the nature reserve are stable even while declining supraregionally.


JÜRGEN BORRIS

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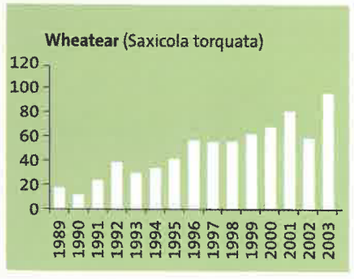

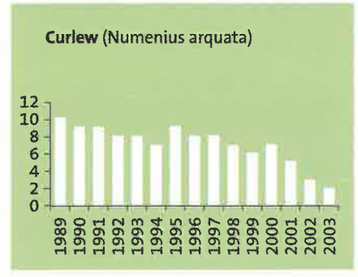

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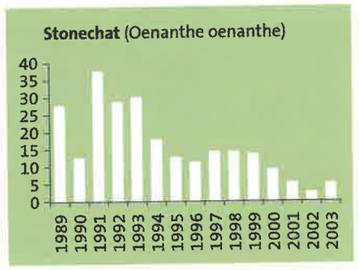
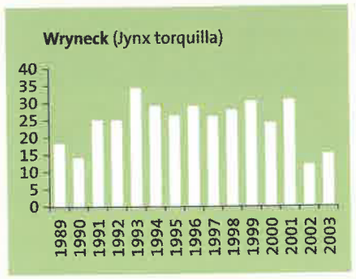
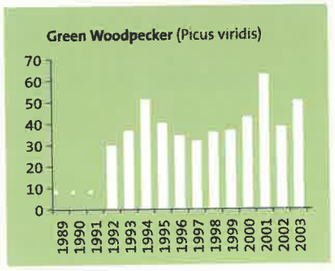


WOLFGANG STEINBORN

BERNHARD VOLMER





JÜRGEN BORRIS

The Sand Lizard (Lacerta agilis) settles in heaths only in the vicinity of open sand areas, which it needs for egg-laying. Successful reproduction of several populations can be seen in the nature reserve.

BERNHARD VOLMER

Adders (Vipera berus) are the only poisonous snakes in the nature reserve. They typically live in transition areas between fens and drier heaths or forests. Above all, the species can be found in the nature reserve at the edges of brook valleys.

BARBEL PUTT-OBERER

A typical species of the former military training areas in the nature reserve is the Natterjack (Bufo calamita). Its territory is sandy raw soil in the vicinity of stagnant water with sparse vegetation, drying out temporarily.

The high diversity of animal species on the heathlands in the nature reserve should not obscure the fact that some species that are quite numerous in other habitats hardly occur here at all. This particularly concerns numerous epi- and endogeic species, such as Woodlice, Centipedes, Earthworms, Collemboles and Enchytraeidae. Acidic dead material from heather plants contribute to living conditions in the organic humus layer which are not suitable for these organisms.

The caterpillar of the Alcon Blue (Maculinea alcon) lives on one single plant only, the Marsh Gentian (Gentiana pneumonanthe), before it is carried by ants to their nest and lives there parasitically. The adult butterfly also lives with its host ant in wet habitats with only small changes of the water-level. This extreme specialisation is the reason for the species' scarcity.

EKKEHARD WACHMANN

The Heather Beetle (Lochmaea suturalis) and its larvae live solely on heather, eating its leaves, buds and bark. In wet years the beetle can cause extensive heaths to die, due to its feeding. Old heaths with thick organic layers are most likely to be attacked.

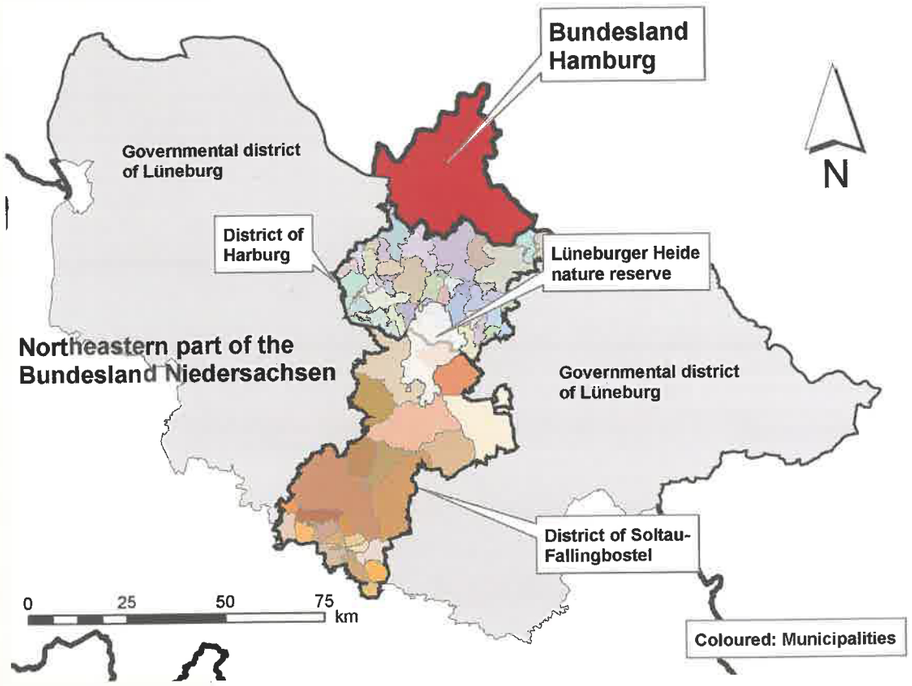
JENS-HERMANN STUKE

Sandy footpaths and other sandy areas in the nature reserve are inhabited by Spider Wasps. Adult animals stun spiders and carry them to holes in the ground, where they serve as food for their larvae, which hatch from eggs laid there.

JENS-HERMANN STUKE

Wild Bees are not very numerous in the nature reserve. This is due to the small number of suitable flowering plants. Heather occurs extensively as a flowering plant, but only for a short time, and, in addition, wild bees often come off worst against honey bees introduced by humans.

Administrative boundaries in the vicinity of the Lüneburger Heide nature reserve (map based on: GEOSUM, courtesy of Niedersächsisches Umweltministerium 2004).



4.6 Population and settlements

Presumably, the surroundings of the Lüneburger Heide nature reserve have been part of the relative sparsely populated regions for a long time. Ultimately, it has also been the nearly 100-year-old conservation status that further limited the development of settlements. Accordingly, the population density in the Lüneburger Heide nature reserve is still very low today, with five to six inhabitants per km² (i.e. 1,200 to 1,400 residents on 234 km²).

In the two districts surrounding the nature reserve population densities are much higher. For the district of Harburg lying to the north, which in turn borders immediately on the southern fringes of the conurbation of Hamburg, a population density of 191 inhabitants/km² results from a population of 237,204 inhabitants and a surface area of 1,244 km². The district of Soltau-Fallingbostel in the south, with a population density of 76 inhabitants/km², is populated more sparsely. This figure results from a population of 142,264 inhabitants and a surface area of 1,873 km².

Both districts are below the average population density for the Federal Republic of Germany, which amounts to 231 inhabitants/km². With regard to the Bundesland Niedersachsen (168 inhabitants/km²), the district of Harburg is populated more densely, the district of Soltau-Fallingbostel more sparsely. Together, both districts make up 6.6% of the total area of the Bundesland Niedersachsen, but only 4.8% of its inhabitants.

A historical comparison also shows that the area inside the borders of the nature reserve is populated relative sparsely. Even in the

year 1895 the then separate districts of Soltau and Fallingbostel had, with 18 and 26 inhabitants/km², higher population densities than the present nature reserve. These population densities increased relative slowly over ten years to 23 (district of Soltau) and 29 (district of Fallingbostel) inhabitants/km2 in the year 1905. A faster population growth can be shown for the district of Harburg. There, population density increased from 36 in 1821 to 46 in 1895 and 72 inhabitants/km² in the year 1905, certainly caused by proximity to Hamburg.

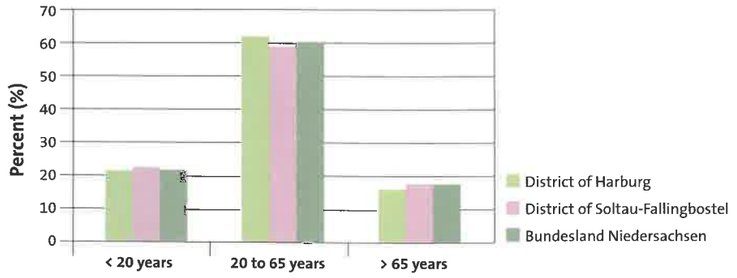
Both districts are characterized by an extensive distribution of many small settlements.

The district of Harburg comprises 130 "locality parts" ("Ortsteile"). Locality parts are the smallest administrative unit for which inhabitant numbers are available. Half of these 130 locality parts (65 locality parts) are populated by less than 1,000 residents. A further 55 locality parts have population numbers between 1,000 and 5,000, six locality parts between 5,000 und 10,000. Only in four locality parts do more than 10,000 people live. Nonetheless, in the district of Harburg, settlement and traffic areas have with 14.0% of the total area a higher share than in the whole Bundesland Niedersachsen (12.1%). Presumably, this is also caused by the vicinity to Hamburg.

The situation in the district of Soltau-Fallingbostel is similar, although even more rural. Of 129 locality parts 108 (i.e. 84%) are inhabited by less than 1,000 residents, and16 locality parts have between 1,000 and 5,000 residents. Between 5,000 and 10,000 people live in one locality part and only four host more than 10,000 inhabitants. With an area of 8.5% of whole district, settlement and traffic areas are under-represented compared with the Bundesland Niedersachsen.

The age structure illustrated by the following figure does not show any obvious differences between the districts or in relation to the Bundesland Niedersachsen.

Age structure



A prediction for the population numbers up to the year 2015 forecasts population growth for the districts of Harburg and of Soltau-Fallingbostel of 6.2% and 3.6% respectively. This is the opposite of the trend for the Bundesland Niedersachsen, whose population number is predicted to decrease by 1% by 2015. The higher-than-average number of incomers, which is reflected by the increasing area being built on with residential buildings in the vicinity of the nature reserve, may be explained by the region's landscape quality in the hinterland of the metropolis of Hamburg.

The unemployment rate amounted to 7.3% in the district of Harburg and to 8.1% in the district of Soltau-Fallingbostel in June 2004. For the whole Bundesland Niedersachsen the unemployment rate was 9.1% for the same month.

The employed population obliged to participate in social security is distributed among selected sectors of the economy as follows:

Sector of the economy	*District of Harburg*	*District of Soltau-Fallingbostel*	*Bundesland Niedersachsen*
Agriculture, forestry and fishery	2,3%	2,0%	1,4%
Manufacturing industry	13,6%	21,0%	26,0%
Commerce	25,6%	16,7%	16,1%
Tourism	3,9%	5,7%	2,7%
Public administration	6,0%	11,5%	6,9%
Public and private services	18,6%	19,5%	20,4%

Noticeable divergences from the Bundesland Niedersachsen are marked in purple.

The ratio of people employed in tourism in the Lüneburger Heide region is significantly higher than in the Bundesland Niedersachsen, in the district of Soltau-Fallingbostel even twice as high.

One reason for this is certainly the crowd-puller "Lüneburger Heide", but also a special concentration of large-scale leisure centres (zoos, leisure parks, holiday centre "Center Parcs"), which have developed in the hinterland of the neighbouring conurbations.

The number of overnight stays for the districts of Harburg and of Soltau-Fallingbostel in the year 2003 were as follows (only accommodation establishments with more than eight beds are included):

District of Harburg:
465,549 overnight stays for 221,772 guests (with an average duration of stay of 2.1 days per guest, this led to a used capacity of beds of 30.3%) On top of this there were 21,783 overnight stays on campsites.

District of Soltau-Fallingbostel:
1,859,567 overnight stays for 526,370 guests (with an average duration of stay of 3.5 days per guest, this led to a used capacity of beds of 46,0%; these numbers include Center Parcs Bispinger Heide). On top of this there were 502,328 overnight stays on campsites.

The trend of overnight stays is decreasing slightly.

Thus, the district of Soltau-Fallingbostel has a share of 5.8% of all overnight stays for the Bundesland Niedersachsen. Considering the land area of this district of the Bundesland Niedersachsen (4.0%), this is disproportionately high.

With reference to all establishments, i.e. also those with less than eight beds, a statistical analysis of the "Soltau Touristik" tourist centre provided a figure of 1,376,898 overnight stays for the district of Soltau-Fallingbostel in the year 2003 (without Center Parcs and without campsites).

A statistical analysis by the "Schneverdingen Touristik" tourist centre found a figure of 207,046 overnight stays in 2003 for the city of Schneverdingen, which lies partly inside the nature reserve at its western border (including establishments with less than eight beds and two youth camps). This is equivalent to eleven overnight stays per resident.

5 Current objectives for safeguarding heathlands

Conservation targets for nature reserves and other objectives for nature conservation are usually based on scientific findings and are valued according to present value systems in a political process. The results of this valuation are legally codified as the outcome of negotiations and compromises.

Many objectives of nature conservation are laid down on a European level today and implemented by the member states of the European Union. In Germany the objectives of nature conservation are codified in Article 1 of the Federal Nature Conservation Act:

> In view of their intrinsic value and importance to human life, and considering our responsibility towards future generations, nature and landscape both inside and outside areas of human settlement, shall be conserved, managed, developed and, where necessary, restored, in order to be safeguarded on a lasting basis
>
> 1 the functioning of the ecosystem and its services,
> 2 the regenerative capacity of the natural resources and their sustained availability for human use,
> 3 fauna and flora, including their natural habitats and sites,
> 4 the diversity, characteristic features and beauty of nature and landscapes, as well as their intrinsic value for human recreation.

According to the federal structure and respective rules of the German constitution, the nature conservation regulations of the Federal State can be adapted and put in concrete terms by the German Bundesländer. The above-mentioned regulation can be found in almost all Bundesländer in a virtually unchanged form.

Based on the nature conservation acts of the Bundesländer, decrees are issued for nature reserves and other items of nature conservation, which put the given objectives into concrete terms for the area or item considered.

The legally regulated objectives being pursued by the designation of the Lüneburger Heide nature reserve can be found in Article 3 of the nature reserve decree from June 17th, 1993. The instruments for implementing some of these regulations are described in Chapter 7 of this book.

Chapter 1 of Article 3 of the decree states:

The conservation aim is the preservation and development of an extensive part of the landscape of the central Lüneburger Heide together with its historically developed heathlands and adjacent forests. The area is especially dominated by the Wilsede end moraines, by shifting sands and dunes, brook valleys and dry valleys. It is of outstanding importance for habitat and species conservation. The heathlands are the largest coherent heathlands of the northwest European Geest landscape and are, therefore, of special national and international importance.

Thus it is stated from the beginning that at the centre of all conservation efforts is the preservation of a coherent landscape in the Lüneburger Heide natural area. Heathlands and forests are stressed, but they are ultimately to be conserved as parts of the whole dynamic habitat complex. After naming the specific gla-

NNA

An invitation to stroll around – characteristic landscape impression in the Lüneburger Heide nature reserve.

JOHANNES PRÜTER

Habitat for many animals and plants – richly structured heath in the Lüneburger Heide nature reserve.

JOHANNES PRÜTER

Flowing boundaries instead of sharp edges – forest-heath-transition in the Lüneburger Heide nature reserve.

RAINER KOPSELL

Finally free to grow – the now mighty oak trees of the 'Stühbüsche' in the Lüneburger Heide nature reserve were stunted oak thickets at the time of their intense use.

cial and geomorphologic features of the area the international dimension of the coherent heathlands are stressed and the landscape's emergence is put into the historical northwest European context.

Chapter 2 of Article 3 puts the decree's conservation aims in concrete terms by describing twelve individual objectives:

1 **Preservation of the historically developed, by pre-industrial heathland farming influenced heathlands**
Large parts of the heathlands preserved in the nature reserve date directly from the historical cultural landscape. Safeguarding them means knowing the relevant influencing factors and basing modern methods and instruments on these factors.
The basic idea is not to reproduce a given historical state like a museum, but to enable development continuity, enclosing present and possibly new valuation systems. A nature reserve decree can only incompletely define the legal framework. A more precise determination of the aims of landscape development has to be done with the help of further concepts and the nature reserve's management and development plan (Chapter 7.2).

2 **Preservation and development of natural used and unused forests as well as preservation of deciduous forests on ancient woodland sites and of historical types of forest utilization**
Forests are to be conserved in addition to heathlands. They shall be developed in a very natural way, particularly by the implementation of sustainable types of forestry (e.g. increased amounts of deciduous trees and dead wood, careful soil treatment). Coniferous forests dating back to afforestation in the 19th century give evidence of the fundamental change in the heathland-dominated landscape. They are part of the historically developed cultural landscape. Tree populations closely connected to historical heathland farming have to be conserved or developed as rare structures, like ancient copses around farmsteads, "Stühbüsche", i.e. groups of oak trees which were used for firewood, or thin forest-heath-gradients.

3 **Preservation of geologically and pedogenetically derived appearances, dominating the surface of the nature reserve**
The Pleistocene formed relief (end moraines, dry valleys, shifting sands) is particularly apparent on heathlands. The soil types developed here give evidence of the natural vegetation dynamics and, in the case of the prevalent podsol soil, of cultural historical influence.
Relief and soil are archives of landscape history and should not be affected by soil quarrying, earth banks, building up or sealing more than absolutely necessary.

4 **Safeguarding the nature reserve's natural hydrological balance**
The Lüneburger Heide nature reserve is the headwater of numerous lowland rivers of Niedersachsen. It's a matter of conserving or restoring their dynamics as naturally as possible. Bogs can be found particularly in the form of raised bogs and so-called "Heidemoore" (heath fens), which are typical of the nature reserve and have developed from the inflow of nutrient-poor groundwater. Stagnant waters used to be artificial, but they are of cultural historical importance and provide important temporary habitats for many species typical of heathlands.

Management conflicts often result from groundwater extraction for drinking water, since impacts on surface waters cannot be precluded.

5 **Protection and support of the autochthonal plant and animal species and their communities**
In the heathlands great importance is attached to safeguarding and developing populations of autochthonal plant and animal species whose communities have developed over centuries of habitat continuity.
If possible, non-autochthonal species should be pushed back, reintroductions should not be undertaken.
Conflicts result from the silvicultural use of non-autochthonal tree species and questions concerning the necessity of hunting as means of conserving species.

6 **Preservation and development of natural habitat types and of cultural habitat types typical of historical heathland farming**
Not just single species and communities are to be conserved, but their habitats as well, which is a conservation aim also pursued by European regulations. In the Lüneburger Heide nature reserve the remaining natural and semi-natural bogs, deciduous forests and running waters are to be specifically considered, and, of equal importance, heathlands as examples of cultural habitats. But farmland such as fields or grassland which are managed under ecologically sound practices, provide important habitats for many species as well. The preservation and development of these habitats sometimes depends on intensive human intervention, sometimes on refraining from intervening. Questions of priorities are raised when valuable habitats develop into other valuable habitats in dynamic processes by natural succession, as is very typical of cultural landscapes.

7 **Preservation and management of traditional, cultural-historically significant structural features, constructions, buildings, types of settlements and other features typical of the landscape as parts of the historical cultural landscape**
Historical heathland farming has left behind many single features of cultural-historical importance, also caused by early conservation efforts in the nature reserve: sheep sheds, single houses, farmsteads, complete villages. Some of them are kept in an at least partly original state, some have been changed by subsequent forms of utilization. Above all, it is the financial aspect which is at the forefront when priorities of preservation for the many valuable features have to be established and some features do not experience necessary management. Other features have been modernized for topical reasons (e.g. a sheep shed due to veterinary considerations). Features which have been shaped in a traditional manner and are considered as characteristic of heathland landscapes, but are in fact quite new, are borderline cases for preservation of historic buildings and monuments. Should dense thickets of juniper trees, for example, which presumably were considered as pasture weed and cut down in recent times, be preserved or removed?

8 **Imitation and reintroduction of types of land use once typical of historical heathland farming on selected plots**
The best way to preserve a historically developed cultural landscape is to apply those forms of land use which led to its emergence and existence. Therefore, it is in the interest of the nature reserve's administration to preserve the traditional land use or,

JOHANNES PRÜTER

The "Totengrund" in the Lüneburger Heide nature reserve – result of intense periglacial morpho-dynamic processes.

JOHANNES PRÜTER

Bare sandy soils, which were widely distributed at the time of very intense heathland farming, are now rare habitats for pioneer species of the animal and plant world.

where this is not possible due to socio-economic reasons, to implement corresponding treatment of the areas with modern methods. Grazing with Heidschnucken sheep and prescribed burning of heaths are examples of traditional land use, heathland management with machines is an example of the imitation of old techniques of land use (Chapter 7.4). On a museum scale the heathland farmer's traditional crop-rotation-system is demonstrated on small fields in the nature reserve, with the typical initial fertilization with plaggen material, but with the help of modern agricultural machines.

9 **Preservation and management of prehistoric and ancient historic buildings and soil monuments**
The soil monuments described in Chapter 4.4 are to be preserved and, if necessary, to be managed. This covers all monuments in the nature reserve, on heathlands as well as under forests. This conservation aim is of utmost importance when it comes to heathland management: old trackways or barrows, for example, should not be destroyed by soil treatment with machines, but be preserved by, for example, prescribed heath burning.

10 **Development of destroyed or affected parts of the landscape for the purposes of the heathland landscape in the former scope of the Soltau-Lüneburg agreement**
Since 1963 the Soltau-Lüneburg agreement had regulated the use of certain areas in the nature reserve for military training purposes, especially tank driving exercises, which had begun after World War II. It expired in 1994 with the withdrawal of the British army. Therefore, 3,000 ha of more or less barren, highly compacted sandy areas returned to the care of nature conservation (Chapter 7.1). The aim for these areas is to develop them for the purposes of the heathland landscape. This does not mean completely transforming them into heathlands, but developing the high structural diversity once typical of historical heathland farming, at least on a small scale; for example in the form of forest-heath-gradients and forest succession, temporarily dry stagnant waters and open sand areas, but of course extensive heathlands as well (Chapter 7.4).

11 **Preservation and possible restoration of the characteristic features, outstanding beauty, peace and quiet of the nature reserve, with focus on its value for human recreation**
This conservation aim takes up and puts into concrete terms the landscape aesthetic motives that among others were the basis for the first conservation efforts on the nature reserve. The beauty of the nature reserve does not primarily result from its diversity, which is often only seen on second sight, but from the characteristic features lying in the extensive open heathlands – a landscape impression which may give people a feeling of regional identity while other landscapes increasingly adapt to each other. Peace and quiet in the nature reserve is explained by the lack of traffic and settlements. All these factors are of great importance for people searching for recreation and lead to high numbers of visitors. Nonetheless, a constant compromise has to be found between differing and partly contradictory visitor interests.

12 **Preservation of the nature reserve in its importance for science, natural and local studies**
In Germany, nature reserves should always serve the purposes of science, natural and local studies. The specific opportunities for cultural-historical and interdisciplinary landscape ecological research provided by the Lüneburger Heide nature reserve have been used intensively for many decades. Therefore, present management of the nature reserve can be based on the availability of substantial scientific results.

Detailed knowledge of the development of a specific, centuries old sustainable land use and the interaction of ecological, economic and social factors, together with a lot of illustrative material, makes the nature reserve an ideal extra-curricular place for courses of education in sustainable development.

Result: Heathland conservation in the Lüneburger Heide nature reserve is conceptionally integrated in a holistic understanding of the landscape, which especially emphasizes the coexistence of diverse landscape features. The preservation of historical landscape features and their continuity of development is equally as important as the aim of supporting natural dynamic processes in bog, forest and water ecosystems.

Potential conflicts between different options for landscape development are today being solved by integrative development planning.

Mysterious and colourful – misty juniper heath in the Lüneburger Heide nature reserve.

RAINER KÖPSELL

6 Threats to heathlands

The distribution of sand heaths in the northwest European lowlands has declined from 30,000 km² in the late 18th and early 19th century to 4,000 km² today. This is a loss of about 85%. A similar decline can be shown for the lowlands of Niedersachsen. There, 450 km² of more or less coherent heathlands are to be found, partly on military training ground. This shows that the main reasons for the threats of heathlands were effective even in the past.

The historical reasons for the heathlands' decline can be separated into:

- abandonment of historical heathland farming, and
- intensification of agricultural use in and around extant heathland areas

Historical heathland farming in the Central European lowlands and correspondingly in the present Lüneburger Heide nature reserve lost its economic viability at the end of 18th and the outset of 19th century. The invention of artificial fertilizer made labour-intensive sheep farming and its function for nutrient transfer from heathlands to fields unnecessary. Additionally, the import of sheep from New Zealand reduced marketing opportunities for Heidschnucken sheep. Many heathland farmers therefore abandoned the utilization of heathlands and focused on crop farming, which were originally of low yields but could now be improved by artificial fertilization within certain limits. Thus, transformation of the nutrient-poor heaths into additional fields was also possible. Further heaths were left fallow and were subject to natural succession, developing via scrub stages into forests in the long run. A big deficit of wood, which probably lasted for centuries, promised afforestation as a lucrative source of income in the long term. Almost 60% of the former heathlands in the Lüneburger Heide nature reserve have been afforested, and similar amounts presumably occurred in other parts of northwest Germany.

The extant heathlands have to face other threats today. Above all, the negative influence on heathland plant and animal communities resulting from heathland fragmentation has to be recognized. Many small populations of less-mobile animal and plant species have to be considered as isolated, which may cause problems of genetic impoverishment.

The main problem with the extant heathland patches throughout northwest Europe is non-existent or inadequate management. If the necessary land use or management measures are never or too seldom carried out, the heathlands can experience a functional change from nutrient source to nutrient sink. Accumulation of organic material in the form of raw humus and succession of the vegetation via grass-rich stages and scrub encroachment to forest development are the consequence.

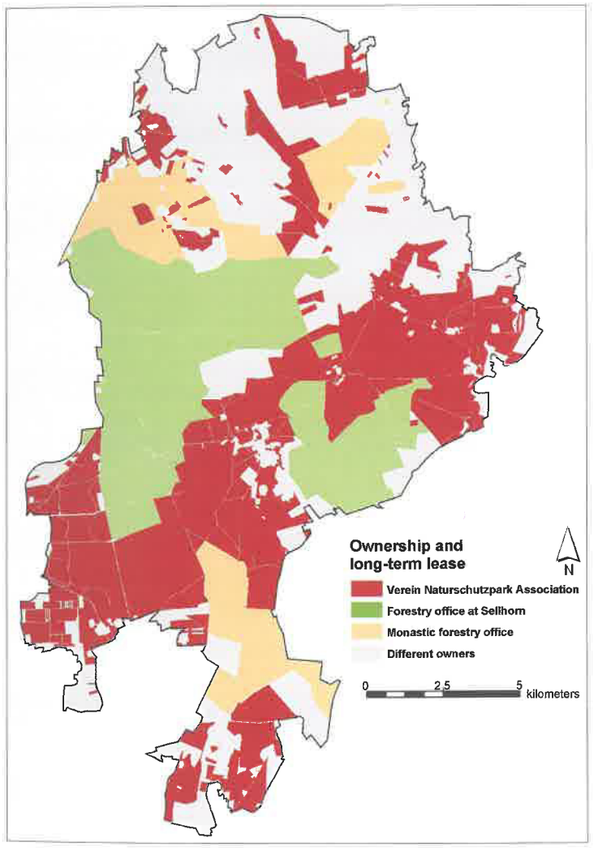
This creeping qualitative change is intensified mainly by increased input of nutrients from the atmosphere. Nitrogen and phosphorus in particular are of importance here. They stem from intensive animal breeding, typical of northwest Germany and The Netherlands, intensive fertilization of fields and increased private motor car traffic. The annual deposition of nitrogen on the Lüneburger Heide nature reserve is about 23 kg/ha. Increased input of nutrients obviously supports certain grass species, like Wavy Hair-grass (Deschampsia flexuosa) or Purple Moor Grass (Molinia coerulea), which in the medium term displace the heather.

In addition to these contemporary human influences threatening heathlands, other factors may cause a reduction of the ecological value of the heathlands.

Management measures can be inadequate not only if they are done too seldom, but also if they are done too often or at the wrong time. Overgrazing, prescribed burning during the nesting season or the establishment of very large management areas can create healthy looking heathlands, but can cause a loss of animal and plant species on the areas.

Furthermore, it should be considered that not only is the total size of heathlands of importance, but the size of individual patches and their spatial location to each other counts as well. Finally, the functional coherence with other habitat types also plays its part.

Fragmentation does not just lead to ecological devaluation of heathlands. The value for human recreation is affected by the loss of the areas' peace and quiet and their open range as well. At the same time, it should be considered that modern types of recreational activities like mountainbiking, gliding or balloon riding may disturb heathlands adversely, even when they do not lead to visual negative effects, particularly when being practised under conditions of mass tourism.



Ownership in the Lüneburger Heide nature reserve; for the Verein Naturschutzpark Association long-term leased areas are also shown (map based on geodata of the respective landowners).

7 Conservation and management

7.1 Development of ownership and legislation

The approximately 5,100 ha heathlands in the 23,440 ha Lüneburger Heide nature reserve are owned or leased long-term by the Verein Naturschutzpark Association to an extent of 98%.

85% of the bogs with a total size of about 450 ha are owned by the Association.

Furthermore, the Association owns 450 ha of farmland and about 2,500 ha of forests. Other owners of forests are the Bundesland Niedersachsen (5,100 ha), the monastic chamber of Hannover (2,700 ha), other corporations (350 ha) and private owners (4,150 ha). Further farmland of about 2,500 ha in the nature reserve is privately owned by individual farmers. (See prev. page)

The present property conditions were determined by privatization of heathlands that were used as common land in former times. In the first half of 19th century these areas were shared between the villages at first and then between the individual farms. Many farmers sold their areas then, especially to the State and the monastic chamber of Hannover. The Verein Naturschutzpark Association, having been founded in 1909, began to systematically purchase areas for nature conservation purposes in 1910. Land purchase by this Association still continues today.

Just twelve years later, in 1922, a police decree came into effect which designated an area defined on an official map as Lüneburger Heide nature reserve. The borders of this area were almost the same as the borders of the present nature reserve. Two more police decrees regulated the activities within this new nature reserve. When the Nature Conservation Act of the former "Deutsches Reich" came into effect in 1935, the police decrees remained valid. After the end of World War II this Nature Conservation Act remained valid in Niedersachsen until 1981, when the Nature Conservation Act of Niedersachsen came into effect, which was based on the German Federal Nature Conservation Act introduced in 1976. Even then the police decrees remained valid, complemented by regulations of the Nature Conservation Act of Niedersachsen, which have direct effects.

But when in 1990 the original map with the borders of the nature reserve could no longer be found, the police decrees were declared as invalid. Then the Bundesland Niedersachsen, represented by the district government of Lüneburg, elaborated a new decree for the nature reserve, which clearly defined the nature reserve's borders and included some former military training areas into the nature reserve. This decree came into force in 1993 (Chapter 5).

Being protected by the European Birds Directive as well as by the Habitats Directive, the nature reserve is now also subject to European law.

At the outset of the 20th century, large parts of the present nature reserve were designated as nature park. This status of protection particularly obliges to preserve the recreational potential of the area and to use its natural resources in a sustainable way. A widening of the borders of the nature park is just being discussed.

Also, the first honouring with the European Diploma of the European Council in 1967 was an important, although not legally binding, conservation status for the nature reserve. The award as area of special importance for European nature conservation has been continually renewed and will be valid until 2007.

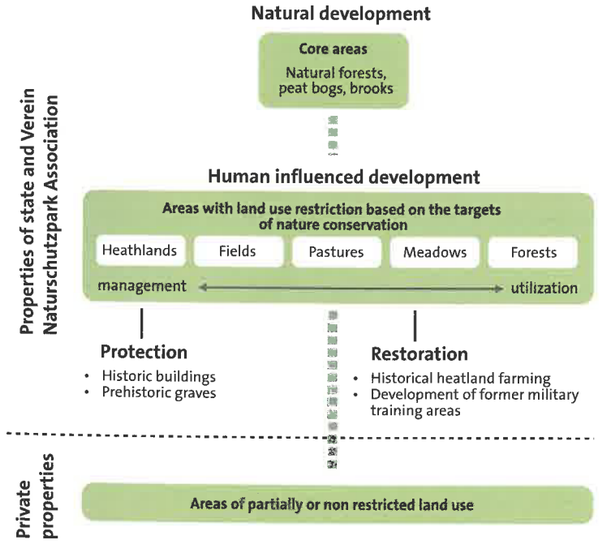
Special regulations were added to the decrees in the time period between 1963 and 1994 by the Soltau-Lüneburg agreement, which permitted military utilization of parts of the nature reserve by British and Canadian troops. The agreement became necessary after Germany became a sovereign State in 1955 and the status of the British troops,

which had been on the nature reserve since 1945, changed from occupying to stationed forces. The agreement regulated specific rights for the troops, in particular all year round use of a 4,600 ha area, of which 3,000 ha lay inside of the nature reserve. But obligations for the troops and restrictions concerning exercises in order to protect residents were put down in writing as well.

For further development of the Lüneburger Heide nature reserve one should also consider the so-called "Naturschutzgroßprojekt Lüneburger Heide" (Federal large-scale conservation project "Lüneburger Heide"). This project, which is mainly financed by the German Federal State, aims to establish and preserve valuable natural areas and landscapes of national importance. In the Lüneburger Heide nature reserve land purchase by the Verein Naturschutzpark Association and initial restoration practices such as transforming forests into heaths or restoration of bogs and wet meadows are supported. Through this financial support the German Federal State influences the further development of the nature reserve although the State is not the appropriate authority for it according to the German legal system.

7.2 Concepts, strategies and management planning

The objectives for the Lüneburger Heide nature reserve as described in Chapter 5 should not be considered as individual isolated aims. Rather, there is a need for a coordinated concept for the nature reserve enabling the joint achievement of all defined aims and thus stressing the coexistence of these objectives. This higher idea is reflected in the following figure showing differentiated concepts of conservation and utilization.



Differentiated concepts of conservation and utilization in the Lüneburger Heide nature reserve.

The figure illustrates the differences between the utilization of private land on the one hand and the properties of public authorities and the Verein Naturschutzpark Association on the other. Although private land used for agricultural, silvicultural or fishery purposes is, as a rule, only seldom subject to restrictions of use, there are some far-reaching obligations for the public authorities or for the Verein Naturschutzpark Association when managing their own areas in a specific way.

Depending on the respective development concept, further distinctions can be made for the latter areas. Few habitats (natural forests, peat bogs, brook valleys) shall, as core areas of the nature reserve, be subject to largely uninfluenced natural development, also enabling them to be used for observation of a not human influenced natural development.

By far the largest part of the areas is, however, subject to human influenced development, for which it is a matter of combining in the best possible way the ecological demands of nature conservation with the justified economic objectives of land use.

In the traditional field of conflict between management and use, between the need for subsidies and profitability, one traditionally moves on a scale here. The respective position depends on market conditions, the condition of public finances and the current aims of nature conservation.

Public subsidies flowing into all segments are to be minimized. This is done by making efforts to create saleable products even in the course of managing such supposedly unproductive parts of the landscape as heathlands.

On this scale it is also an important objective for a project being supported by the European Union (under the LEADER+ programme) to further raise the efficiency of marketing of products and by-products resulting from land management, and to thereby change the management character of these areas to a great extent into a utilizable character.

There are soil and architectural monuments standing outside of this areal consideration. If possible, they should be protected in their present state. Inasmuch, the nature reserve is obliged to such a museum approach as well.

The restoration of a specific method of land cultivation (historical heathland farming) is the aim on a few hectares of agricultural land in the nature reserve. On a much larger area the aim is to develop the former military training areas into a condition close to that which existed before military use. The developing habitats then gradually turn into the above-described scale of management and utilization.

This higher concept is being put into concrete terms and implemented in planning by the management and development plan for the nature reserve dating back to 1995. This plan mainly sees itself as an integration and revision of pre-existing plans. Nonetheless, intense faunistic and vegetation-ecological investigations for numerous habitats have been carried out, which had not been examined in detail before. These investigations formed a detailed ecological basis for the management and development plan, which many of the former plans lacked.

The landscape plan for the area ran from 1969 until 1995. This plan assigned to the nature reserve the three functions of: nature conservation; recreation; agricultural and silvicultural use. All the scientifically and culturally important natural features were to be preserved and managed.

For the heathlands it became obvious at the outset of the 1980s that intensive and almost exclusively applied grazing with Heidschnucken sheep since the mid of the 20th century had led to faunistic impoverishment. Inasmuch, the new management and development plan was an important means of reacting to the observed loss of species and of evaluating the diversification of heathland management measures, which was initiated in the mid of the 1980s, against the backdrop of detailed ecological investigations, and of making planning statements from this.

There existed a separate plan considering nature conservation issues on the former military training areas that were abandoned by the British army in 1993/94, which was integrated into the management and development plan.

The model of management and development comprises "a landscape, which includes elements of the natural landscape (running waters, bogs, natural forests), of the historical cultural landscape (heathlands, oligotrophic grasslands, 'Stühbüsche' and grazed forests, historical settlements, less intensively used grasslands and fields) as well as of the current cultural landscape (ecologically sound cultivated forests and less intensively used fishponds)".

The example of the heathlands shows that the deduction of dynamic development objectives for specific areas from the usually rigid planning procedure requires a special methodology of planning, which also underlies the management and development plan. For the heathlands, for instance, limits of tolerance have to be defined with regard to the heathlands' spatial distribution and their different age stages, which should neither be exceeded nor fallen short of. This means that an individual heath on a specific site may be allowed to develop into other habitats, as long as the overall age structure and distribution of heaths is in a favourable state and, possibly, a comparable new heath is restored on other sites. Monitoring of structures and species numbers in the course of annual management implementation contributes to short-term evaluation of the limits of tolerance for specific areas and thus to the immediate planning of management practices. The normally usual intense and single inventory at the beginning of the planning process can thus be largely dropped.

According to this idea an annual inspection of the grazing areas with all shepherds is carried out in the Lüneburger Heide nature reserve, supporting the shepherds to fix priorities for grazing, but also supporting the selection of areas for mechanical management and prescribed burning.

The plans for forest management carried out by the forestry departments in the nature reserve are immediately coordinated with the responsible nature conservation administration, so that these plans have the character of a management and development plan at the same time.

The Forestry Office at Sellhorn started to intensively integrate nature conservation objectives into silvicultural planning as early as the 1970s, so that this area has become quite a model for further development of silviculture in the Bundesland Niedersachsen.

7.3 Responsibilities

There is no nature conservation administration that is specifically responsible for the Lüneburger Heide nature reserve. Responsibility for and supervision of nature conservation issues in the nature reserve are regulated legally and are presently delegated to the Bundesland Niedersachsen, represented by the district government of Lüneburg. Niedersachsen is also responsible for financing the continuous habitat management in this nature reserve as well as in other nature reserves.

Due to a planned reform of the administration of Niedersachsen these tasks will probably be delegated to the adjacent municipalities in 2005. Some specific functions are already being carried out by them.

The other institution of Niedersachsen with sovereign tasks within the nature reserve is the Forestry Office at Sellhorn, responsible for the management of about 5,100 ha of forests. The Alfred Toepfer Academy for Nature Conservation is an institution of Niedersachsen as well, but has no sovereign rights. Its task is to deal with education, research and public relations for nature conservation.

As almost all of the heathlands within the nature reserve belong to the Verein Naturschutzpark Association (Chapter 7.1), the Bundesland Niedersachsen has signed a comprehensive contract under public law with this Association regulating that heathland management practices done by the Association are publicly financed, as well as the ecologi-

The Forestry Office at Sellhorn cares for large forests in the Lüneburger Heide nature reserve.

*The Alfred Toepfer Academy for Nature Conservation has its office at the former heathland farmstead Hof Möhr. Its logo dates back to its former name **Norddeutsche NaturschutzAkademie**.*

cally sound cultivation of the Association's agriculturally productive land.

The registered Association was founded in 1909 and has 3,780 members today (as of December 31st, 2003). It is led by a seven-member managing committee, which is consulted by a thirty-member advisory board. About 20 full-time employees work in the departments of Landscape Management and Forestry, Landscape Farmstead Hof Tütsberg (including sheep breeding) and Preservation of Buildings.

The Verein Naturschutzpark Association is also bearer of the Lüneburger Heide nature park, which lies inside the borders of the Lüneburger Heide nature reserve.

Together with the relevant institutions of the Bundesland Niedersachsen and the municipalities, the Verein Naturschutzpark Association participates in a monthly steering group for the Lüneburger Heide nature reserve that is led by the district government. This group is intended to elaborate strategies for the nature reserve and to make easier the co-ordination of the institutions involved in order to fulfil their respective tasks concerning the nature reserve.

The responsibility for the continuous monitoring of the development of protected habitats and animal and plant species within the nature reserve, as is explicitly stated by the European nature conservation directives for all sites of community interest, is legally defined and delegated to the Bundesland Niedersachsen. In the Lüneburger Heide nature reserve the monitoring activities are essentially co-ordinated by the Academy for Nature Conservation and, partly with financial support of the Bundesland Niedersachsen, are also implemented by it. The Academy is indispensably supported by the Verein Naturschutzpark Association, the Forestry Office at Sellhorn and a working group consisting of local residents interested in local nature studies (Chapter 7.6).

Furthermore, the Academy looks after basic research activities within the area, which are often done in co-operation with general universities and universities of applied sciences (Chapter 7.6).

Environmental education tasks in the nature reserve are fulfilled by all the relevant organisations (Chapter 7.6).

The institutions try to involve as many stakeholders as possible in all activities, on a partly institutional, partly informal basis, in order to realize the participative idea of sustainable development and to ensure the approval of all the stakeholders concerned.

VNP

The office of the Verein Naturschutzpark Association (VNP) is situated in Niederhaverbeck – Central office for heathland management in the Lüneburger Heide nature reserve

7.4 Management practices

7.4.1 *Heathland management practices*

An important legal and planning objective for the Lüneburger Heide nature reserve is to preserve healthy heathlands with their specific internal development dynamics and their numerous transitions into other habitats. To achieve these aims, application of continuous management practices is necessary, which will have the same effects as the historical cultivation systems that led to the emergence of this cultural landscape.

Depending on the actual initial situation and objective, the following management practices are being applied on the heathlands: all-year grazing with Heidschnucken sheep; prescribed burning; mechanical mowing; removal of the complete organic soil layer ("plaggen"); removal of parts of the organic soil layer ("schoppern"); and removal of tree saplings ("entkusseln"). With some exceptions, prescribed burning and the mechanical operations are carried out in winter (from the beginning of October to the end of February). An important aim of all management practices is to remove nutrients from the traditionally nutrient – poor heathlands, which today accumulate not only through natural processes in the soil and vegetation but also through continous input from the atmosphere.

With respect to the extent and intensity of this remoral the management practices differ considerably.

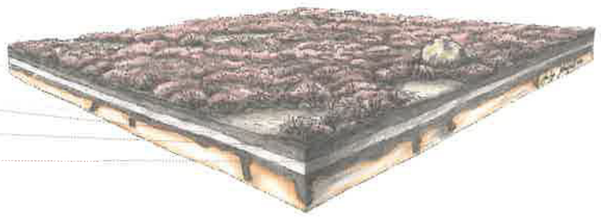
With the help of the available data about nutrient transfer, it can be determined how long it takes for the output of nutrients by a single management treatment to be compensated by the continuous input of nutrients by deposition in the following years (constant deposition rates assumed).

This value (for a specific nutrient) is called "theoretical effective period" in the following.

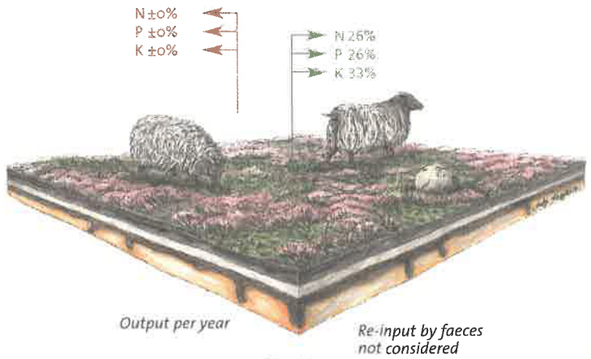
See next page for illustrations.

Nutrient stocks

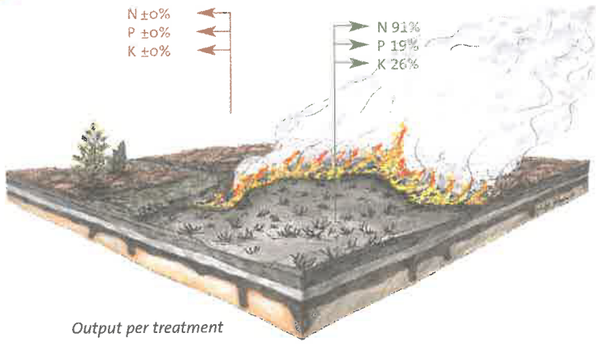
	N	P	K
	(percentage of total stocks)		
Vegetation	5%	6%	15%
Organic layer	39%	30%	17%
Mineral horizon (Ah)	56%	64%	68%
Total (kg/ha)	1,990	84	180
Findings of a single measurement		100%	



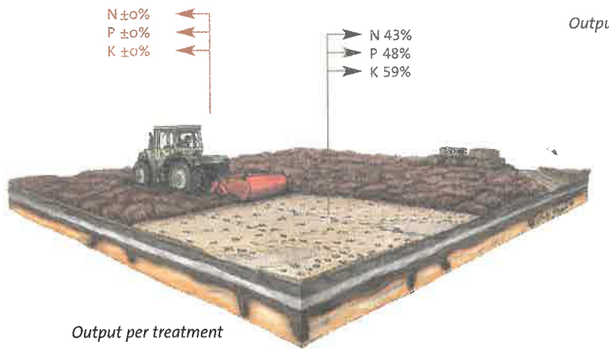
Typical initial situation – healthy heath



Grazing



Prescribed burning in winter



Mowing

Idealized illustration of the impact of grazing, prescribed burning in winter and mowing on the nutrient stocks of vegetation (green colour) and soil (brown colour).

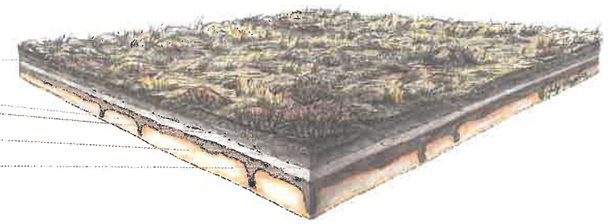
The given figures for nutrient stocks and removal are typical values in a wide range of possible values (without statistical significance), illustrating orders of magnitude.

Ill.: Antje Kayser

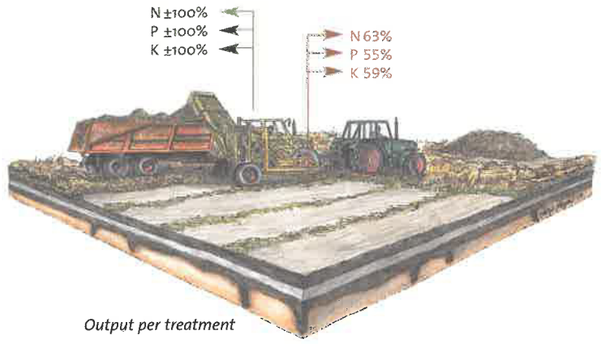
N: Nitrogen
P: Phosphorus
K: Potassium

Nutrient stocks

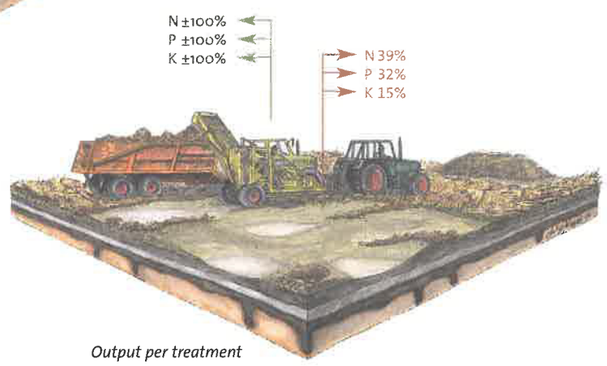
	N	P	K
	(percentage of total stocks)		
Vegetation	4%	5%	8%
Organic layer	34%	26%	11%
Mineral horizon (Ah)	62%	69%	81%
Total (kg/ha)	2,787	146	468
Findings of a single measurement		100%	



Typical initial situation – overaged heath



Plaggen



Schoppern

Idealized illustration of the impact of plaggen and schoppern on the nutrient stocks of vegetation (green colour) and soil (brown colour).

The given figures for nutrient stocks and removal are typical values in a wide range of possible values (without statistical significance), illustrating orders of magnitude.

Ill.: Antje Kayser

N: Nitrogen
P: Phosphorus
K: Potassium

All-year grazing with Heidschnucken sheep

Grazing of the heathlands is currently the most extensive and most important management practice within the nature reserve. Each flock of sheep is tended all year round by a full-time shepherd who is aided in his work by dogs. Apart from some areas where grazing does not take place, partly for comparative purposes, the animals are tended on all the extant heathlands, including the former military training areas. Grazing periods in the morning and afternoon are interrupted by a midday break, which takes places on separate areas in or on the border of the heathlands, in order to avoid input of faeces. Not before late afternoon, when the sheep are sated with heather, the sheep are allowed to graze on grasslands, which they used to prefer to heather. As was usual in times of historical heathland farming, the eight flocks of sheep within the nature reserve, each consisting of 300 to 500 ewes, are led to their sheds every evening and stay there overnight. Six of the eight flocks are owned by the Verein Naturschutzpark Association, two are privately managed.

In order to counteract encroachment by pine and birch trees on former military training areas, goats have been integrated into the respective sheep flocks, because they eat young trees more eagerly than sheep do. Therefore, these sheep flocks of the Verein Naturschutzpark Association are going to include about 20 goats each.

The average grazing intensity is presently about 1.13 sheep (ewes, yearlings, rams and wethers; lambs not being counted) per ha heathland, but it differs considerably depending on accessibility of the grazing grounds and their distance from the sheep sheds. Grazing intensity is likely to decline in the future due to the recent integration of the former military training zones into the grazing area and the re-integration of some large, formerly un-grazed (mechanically-managed) heathlands, which were not effective from the Verein Naturschutzpark Association's point of view. Possible negative consequences of under-grazing shall be compensated by mechanical practices. In order to protect bird breeding, grazing is foregone on areas of a total size of about 575 ha between April 1st and July 31st.

As recent studies show, the basic objective of heathland management (removal of nutrients from the heathlands) can be achieved. Nutrient output by sheep grazing is higher than nutrient input from sheep faeces. Furthermore, experience with actual heathlands in the Lüneburger Heide nature reserve shows that under present circumstances sheep grazing alone can preserve healthy heathlands, with a given grazing intensity of 1.1 to 1.4 one-year-old and older sheep per ha. But it has to be considered that such long-term grazing may reduce structural diversity of the heathlands. Areas on slopes or those with very dense Deschampsia or juniper populations, which cannot be managed mechanically, are given first grazing priority.

Prescribed burning in winter

After the use of prescribed burning was prohibited in Germany (under nature conservation and waste disposal laws), the first special exemptions to burn heathlands in a prescribed way within the Lüneburger Heide nature reserve were granted in 1993. The aim was to explore and assess possibilities and risks of re-introducing this traditional cultivation practice dating back to prehistoric times. Having now had ten years' experience of prescribed winter burning, it is clear that it can be a reasonable addition to other management techniques.

Typical areas for prescribed burning are healthy heaths of the same age with small numbers of tree saplings, heaths on slopes, and areas with many stones and not too much grass. But dried up heaths, additionally damaged by the heather beetle, and Molinia-rich areas can also be regenerated by prescribed burning if Molinia regrowth can be prevented by subsequent grazing.

Good climatic conditions for burning are during cold high pressure after a few dry days, most common in northwest Germany in February. In order to prevent the fire from spreading uncontrollably it should not be too windy. Gentle wind, on the other hand, aids the controlled burning process. Typically, the haw frost thaws in the morning and leaves behind dry heaths with comparatively wet organic soil layers that can be burnt in the afternoon. To prevent the fire spreading, the area to be burnt, which is seldom larger than 1 ha, should be enclosed by a mown strip of about 3 m width in good time. The area to be burnt should not be rectangular, but should fit organically into the landscape. With the help of gas burners and drip torches the fire is initially lit on the leeward side of the area, burning against the wind. This fire normally goes out after few metres and thereby enlarges the strip for fire prevention. Then a fire is lightened on the windward side of the area, burning the heath with support from the wind and going out as soon as it meets the vegetation already burnt. Unintended flames are extinguished with firebeaters (long sticks with fireproof material at their ends), before they can spread to neighbouring areas. The central office of the fire brigade and the neighbouring municipalities are being informed before the burning takes place. Usually, the fire brigade accompanies the practices.

Depending on the intensity of the fire, more or less all that remains in the area are burnt heather stalks. They often start to sprout from the roots and begin to blossom even in the growth period immediately following the fire. Good development of heather from seed banks in the soil can also be observed. As burning in winter only slightly raises temperature in the organic soil layer, animal species hibernating in this layer are virtually unaffected by the fire. Individual insects or spiders, who spend immobile development phases during winter in higher vegetation layers, are immediately affected. But their species' can re-settle the areas from neighbouring heaths if the burnt areas are small enough and healthy heaths are present in the vicinity.

An indirect consequence of the fire can be a significantly changed, warmer micro-climate in the thinned out heath strongly influencing the remaining organic layer for the following months. Moss layers, which have not been immediately affected by the fire, used to dry out due to the more intensive exposure to the sun. Different indirect effects seem to amount to a worsening of the nutrition situation for Deschampsia compared to Calluna plants. As a whole, the litter is mineralized, resulting in a short-term nutrient transfer from upper to lower soil horizons.

Nonetheless, prescribed burning removes nutrients from the system. Depending on its initial situation, biomass supply on a heath is about 11,200 kg/ha (10-year-old vegetation stock without moss and grass) to 17,200 kg/ha (15-year-old vegetation stock with moss and grass). This biomass is removed by prescribed burning to an extent of 50 (15-year-old stock) to 80% (10-year-old-stock). With a share of 0.8 to 1.1% of nitrogen in the biomass, the system loses about 90 kg/ha of nitrogen due to burning.

In order to describe the efficiency of nutrient removal by management practices, the "Theoretical Effective Period" is used. It is defined as the period in which the input of nutrients by deposition is equivalent to the output by a single management treatment (constant deposition rates assumed). For prescribed burning and nitrogen, the theoretical effective period is about 5 years, indicating that it takes about 5 years for the nitrogen input to compensate the nitrogen output through a single application of the management practice.

As a whole, about 70 ha have undergone prescribed burning since 1993. Therefore, the average annual area of prescribed burning within the nature reserve is about 6.4 ha.

JOHANNES PRÜTER

As in previous centuries, the heaths in the Lüneburger Heide nature reserve are grazed by horned grey Heidschnucken sheep. On former military training sites a couple of goats help to eat birch and pine saplings.

VNP

Prescribed burning of overaged heaths in winter was re-introduced into the Lüneburger Heide nature reserve in 1993. Mown strips prevent the fire from spreading to adjacent areas.

VNP

Mowing of heaths was done manually in former times, but is now carried out with the help of machines.

JOHANNES PREUTER

A typical border between a mown heath (in the foreground) and an older heath, approximately one year after mowing.

VNP

Mechanical 'plaggen' of overaged heaths with thick organic layers is the most intense heathland management practice.

The normally short period of suitable burning weather is a problem. In recent years these periods have lasted about three or four days on an average.

Mowing

As described in Chapter 4.3, manual mowing was an important part of historical heathland farming. Mowing is currently the most extensively used mechanical management practice in the Lüneburger Heide nature reserve. Healthy heaths with limited grass populations, which regenerate easily by re-sprouting, are typical mown areas. Mechanical mowing cannot be carried out on very stony areas. The mown heather material is baled with baling presses into heather bales. High quality material can quite easily be sold and is used particularly in the bio-filter industry for factories with high organic shares in the waste air, for pig and poultry farms and for traditional roof thatching.

As with prescribed burning, the micro-climate of the area changes after the removal of vegetation, i.e. it gets warmer and dryer. This can also lead to a worse nutrition supply for Deschampsia compared to Calluna, which is probably caused by water stress.

By mowing, a biomass of about 8,000 kg/ha is removed from the area. Together with this material the heath loses nitrogen at about 96 kg/ha. The theoretical effective period for mowing and for nitrogen is about 5 years. Due to ecological reasons, heaths cannot be mown at this frequency so additional management practices have to be applied in order to guarantee long-term nitrogen output.

Since the first mechanical mowing of heaths a total area of about 420 ha have been mown in the nature reserve, this is equivalent to an average annual mowing area of 42 ha.

"Plaggen" system

The plaggen system, which was introduced in the Middle Ages in order to win fertilizer for the fields and litter for the sheep sheds, is presently being imitated with modern machinery and serves more for initial restoration of over-aged heaths with thick organic soil layers than for continuous management. Dying heaths with dense grass populations or heaths with thick organic layers of more than 3 cm thickness are typically treated with plaggen machines. On a small scale healthy heaths are managed in the same way in order to create open sandy areas.

With the help of a specifically designed plaggen machine the complete organic layer down to the mineral soil is removed and taken away. In order to minimize the volume of removed soil, modern machines can vary the depth to which the organic layer is removed during work, so that the mineral soil is not seized. Thus, the soil's micro-relief is preserved in the best possible way. Nonetheless, in most cases a certain amount of mineral soil is taken away. On steep areas it is sometimes necessary to use excavators. Stony areas also complicate the use of plaggen machinery.

Plaggen material can be used for humus enrichment on arable fields or, as has already been done, for building noise barriers or for the establishment of bilberry plantations.

Areas treated with plaggen machinery can show their first heather shoots after just one year, assuming good weather conditions. After three to five years the areas are almost completely covered by heather plants. In order to provide habitats for animal species like the sand lizard, which require long-term open sandy areas, small plots are treated with excavators, taking away the mineral soil to a greater depth so that the areas stay open for a longer time.

Due to the immense amount of biomass and soil material (about 356,000 kg/ha) that plaggen machines remove compared to other practices, they remove the highest amounts of nutrients (about 1,700 kg of nitrogen per ha), as would be expected. Therefore, plaggen has very long theoretical effective periods for nitrogen (90 years) and for phosphorus (150 years), which of course are put into perspective by the actual vegetation development of the area.

Since the introduction of the plaggen system with machines in 1986, about 185 ha of the nature reserve have been treated with plaggen machinery, partly with machinery other than that described.

"Schoppern" system

"Schoppern" refers to a mechanical management practice that, in addition to mowing, seizes the organic layer but does not take it away down to the mineral soil like the plaggen practice. On average an approximately 0.5 cm thick organic layer remains on the area. In terms of working intensity schoppern therefore stands between mowing and plaggen. The heather roots are not completely removed, so that even in the first growth period after treatment new shoots develop, most of which blossom.

Typical areas for schoppern treatment are heaths with limited grass populations or those with organic layers less than 3 cm thick. Old heaths can be treated in the same way even if the organic layer is up to 4 cm thick as long as the area has been mown beforehand. Stony areas are not suitable for this management practice.

Although different machines were used for the plaggen and schoppern practices until recently, these two practices can only be distinguished by the depth of treatment, as both can be carried out with the same machine today.

The organic layer won by schoppern treatment can potentially be used as a substitute for peat, according to pedological analyses and planting experiments. Practical experience of this kind of usage has not been gained yet because the construction of a composting plant has yet to be done.

Due to the removal of biomass and soil material of about 50,000 kg/ha, nutrients can be successfully removed by the schoppern practice. Nitrogen output amounts to about 1,050 kg/ha. The theoretical effective period of the schoppern practice for nitrogen is about 64 years. Still unresolved are the reasons for the occasional dense grass cover after schoppern treatment, occurring despite nutrient removal over many years.

As the most recent management practice, schoppern practices were introduced into the nature reserve in the mid of the 1990s. Since then about 120 ha have been treated in this way.

Treatment of saplings and extant copses

In addition to the above management practices, most young pine and birch trees together with their saplings are periodically removed from all extant heaths (so-called "Entkusselung"). Heaths tend to get scrubby over only few years, particularly near forest margins. Wood mulchers and brushcutters are used, the latter particularly in the course of voluntary work. Since 1994 about 3,200 ha of heathland have been cleared of pine and birch saplings.

Like almost all northwest European heathlands some non-native tree species can be found within the nature reserve. Black cherry (Prunus serotina) in particular should be mentioned, and it is removed along with the other trees. Due to its high regenerative powers, specially equipped mini excavators are being used sometimes that can pull out the plants together with the roots. The spread of bracken (Pteridium aquilinum), which can be seen on many other heathlands, is not significant in the nature reserve. In contrast to bracken, Purple Moor Grass (Molinia coerulea) seems presently to be spreading more intensely than in recent years.

The present management and development plan for the nature reserve prescribes the clear fell of some older forests, which divide or isolate extant heaths. Current experience shows that even after the

VNP

In contrast to 'plaggen', a thin organic layer remains on the site after 'schoppern' treatment, contributing to quicker heather regeneration.

VNP

Removal of young birch and pine trees is an important practice to prevent heaths from becoming overgrown with trees. Often this is done by groups of volunteers.

NNA

After the withdrawal of the British army in 1993 the former training sites in the Lüneburger Heide nature reserve resembled sand deserts. In the background coniferous plantations can be seen which were intended to reduce wind erosion, but also fulfilled military training purposes

Fine-leaved Sheep's-Fescue (Festuca filiformis) was sown extensively on the former military training sites, in order to fix loose sand. At the same time, first seedlings of heather (Calluna vulgaris) were able to develop in the humid shade of the grass.

removal of 100-year-old coniferous forests, which resulted from heath afforestation, spontaneous heath development from the seed bank takes place, as long as the organic soil layer had been removed by machinery in advance.

In order to avoid distinct borders between the forests that resulted from heath afforestation and the extant heaths, efforts are taken to shape the forest margins. Creating scalloped edges, grazing some parts and encouraging deciduous trees leads to forest-heath gradients with a diversity of structure, which as broad ecotones have a positive effect on species diversity.

7.4.2 Heathland restoration on former military areas

Former military training areas within the Lüneburger Heide nature reserve require very special habitat management. Many questions relevant to management were raised when the British army started to withdraw from an area of 3,000 ha at the beginning of the 1990s. Under a panel of experts, which was created by the Verein Naturschutzpark Association, studies of the pre-military state of landscape and the post-military state of soils and vegetation were analysed in close co-operation with the British army, leading to development objectives for the areas and practices for their implementation.

Before military use the study area had been dominated by lichen-rich sand heaths, partly complemented by some remarkably large populations of bearberry (Arctostaphylos uva-ursi). Small to very small fragments of regenerating forests, fields, grasslands, remnants of the former "Stühbüsche" (Chapter 4.3), fens and raised bogs were distributed throughout the whole area, in addition to other types of sand heaths.

Military training left behind a more or less heavily devastated and bare sand landscape, interspersed with rectangular forest plantations of about 1 ha size, which consisted of mostly non-native tree species that were established for military reasons and the prevention of erosion. The soil was affected heavily or even maximally across the whole area, meaning on the one hand it was torn up, and on the other it was heavily compacted. Therefore, historical soil profiles can now only be found on very small areas. In order to prevent erosion from uncontrolled water run-off, dams and small reservoirs were created. Additional periodically water bearing stagnant waters developed on compacted soil profiles. Pollutants were only found in small areas, particularly at bivouac locations and intensively used location routes. At the borders of the military training ground there remained unaffected bogs and some heaths full of gaps. But heather seed banks in the soil have been extensively destroyed. The remaining diversity of animal species proved to be quite limited as well.

Based on these findings, development objectives for the former military areas were defined and practices for their implementation were laid down for specific areas. The fundamental model for these areas was and still is development towards a large-scale heathland, rich in structure, with a rich inventory of typical habitats, very similar to that which existed before military use. In addition to landscape-dominating sand heaths, this model comprises the rest of the extant former "Stühbüsche" (Chapter 4.3), open areas with shifting sand, spring mires and silting fens, undisturbed running waters and floodplains, temporary stagnant waters as well as transitions between these habitats, especially forest-heath gradients.

The practices, which on the whole were carried out by British army staff, can be classified into three groups:

– In order to restore the original landscape shape in the best possible way, the micro-relief caused by tank tracks was exhaustively removed by levelling the ground and filling hollows with soil material.

– Artificial dams and embankments with a volume of 100,000 m^3 have been partly or completely removed. The material was used for levelling the area. The forest plantations formerly planted to prevent soil erosion were significantly thinned and non-native tree species removed.

– For restoration of vegetation and for short-term erosion control, Fine-leaved Sheep's-Fescue (Festuca filiformis) was sown on large areas. Material from plaggen, mowing and threshing of heath was spread on some of the areas, in order to initiate heather growth. This was partly combined with the sowing of Fine-leaved Sheep's-Fescue and partly done separately.

Furthermore, an area of about 200 ha was left to natural succession. A new network of footpaths, taking into account both visitor and nature conservation demands, was planned and established.

Over the last ten years it has been shown that Fine-leaved Sheep's-Fescue quickly establishes an exhaustive grass layer, which can fix the soil very successfully. In its shade the first heather plants germinated in some locations after just one year. In other places it took five or six years for the heather to germinate. At present dense heaths can be found on many areas. Pine and birch populations have developed unexpectedly quickly in many locations, so that large-scale removal of these trees has become necessary. The number of animal and plant species has significantly increased compared to the starting point.

7.4.3 Bog and fen restoration

The restoration of the natural hydrological balance is the priority management objective for the raised bogs and heath fens within the nature reserve, most of which were previously drained. Former drainage channels have partly been filled with peat, in order to prevent the outflow of water. In order to reduce evapotranspiration via the leaves of trees, in some bogs and fens the trees are removed. Where possible, the margins of bogs and fens are grazed by sheep.

7.4.4 Brook restoration

Many of the brooks which have their source within the nature reserve have been significantly changed by retaining and channelling in historical times. Diverse restoration practices aim to improve their structural and hydro-chemical quality in accordance to the current European Union Water Framework Directive. Continuity of rivers is to be established and riparian tree growth to be allowed, in order to create favourable conditions for water biocoenoses.

7.4.5 Building of paths and visitor management

Only autochthonal soil and stone material typical of the location shall be used for the establishment of footpaths within the nature reserve, so as not to change the soil conditions of the surroundings.

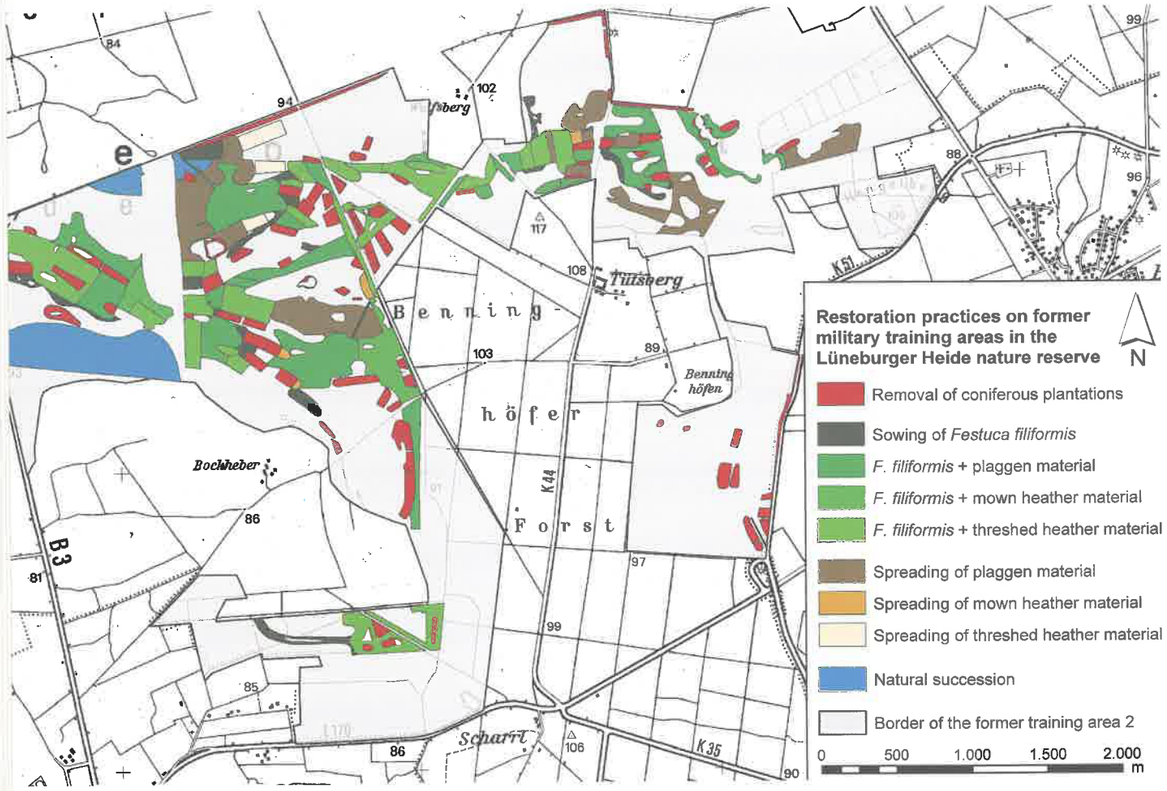
Motorized traffic is forbidden on principle, except on some roads dedicated to public transport that cross the nature reserve. Visitors to the area are transported by horse and carriage, ride bicycles or walk. There are about 700 km of footpaths available. A network of bridle paths of about 300 km is way-marked separately. In the centre of the nature reserve a circular path has been specially designed for wheelchair use. According to nature conservation law in the Bundesland

THOMAS KAISER

Within ten years of the abandonment of the training sites, pioneer plants had grown again on many parts of the former open sandy areas – the Red Areas become green.

JOHANNES PRÜTER

Rewetting of the Pietzmoor bog near the town of Schneverdingen began in the 1970s. Today, former peat-ditches are filled with water, and Sphagnum moss has started growing again.



A detailed plan for the development of the former military training sites was developed, which resulted in the prescribed treatment of areas (digital map based on: analogue map of the Verein Naturschutzpark Association).

Niedersachsen visitors have to stick to footpaths on principle. Furthermore, it is possible to close certain paths for special reasons of species conservation.

7.4.6 Hunting

In Germany the right to hunt is bound to property on principle. The whole country is divided into hunting districts, which have to comprise a minimum coherent area of 75 ha. This is also valid for nature reserves in principle.

If only one landowner is concerned in such a hunting district, he is allowed to carry out hunting by himself, he can prove special hunting training. If several landowners are concerned, the right to hunt is leased to one person, usually for twelve years.

On principle, game can also be hunted within the Lüneburger Heide nature reserve. On property of the Verein Naturschutzpark Association and in State forests, hunting concentrates on wild boar, red deer and roe deer. Foxes are the only predators and are hunted with low intensity. On large areas of the open heathlands hunting is not carried out all year round.

7.5 Current land use systems

7.5.1 *Agriculture*

A big challenge in dealing with heathlands at present is to not only safeguard them with the help of expensive management practices, but, to a certain extent, to consider extant heathlands as part of an economically viable, environmentally sound and sustainable agricultural system. Such an approach is being pursued by the landscape management farm Hof Tütsberg. As a farm with a desired model function for the complete region it is exemplarily presented.

JOHANNES PRÜTER

A field with buckwheat (Fagopyrum sculentum) – part of a demonstration site at which historical agriculture 'Dreeschwirtschaft') is imitated.

The farm, run by the Verein Naturschutzpark Association, is provided with 265 ha of fields and 312 ha of grassland, of which 100 ha are both mown and grazed. Since the farm is responsible for sheep breeding as well, the nature reserve's heathlands are also part of its agriculturally productive land. Many of the fields belonging to the Hof Tütsberg farm today were cultivated by other farms in former times before being purchased by the Verein Naturschutzpark Association and integrated into the "Toepfer Landbau KG" limited partnership, which was owned by the businessman Alfred Toepfer from Hamburg and had its central headquarters at the Hof Tütsberg farm. It follows from this that many fields are scattered across the heathlands and that the average distance between the farmstead and the fields amounts to about 5 km, which is quite large.

Due to geological conditions, the dominant soil types of the fields are sand and loamy sand. Therefore, the average soil productivity index (i.e. an index for the fertility of the soil) is only 18 to 33. To draw a comparison: Best soils can reach a soil productivity index of 100.

In 1988 four general objectives for the landscape management farm were fixed in the contract under public law between the Verein Naturschutzpark Association and the Bundesland Niedersachsen (Chapter 7.1):

- The agriculturally productive land is cultivated in an environmentally sound way concerning the natural resources of soil, water and air.
- Heathlands formed by historical heathland farming are to be preserved.
- The agricultural biocoenosis typical of the sites should be preserved and developed.
- An economically sustainable concept should be developed for the farm.

VNP

All-year round, robust cattle and horse breeds have grazed an area of about 130 ha with diverse habitats in the valley of the Radenbach brook since 2004. The grazing aims to preserve the semi-open landscape.

VNP

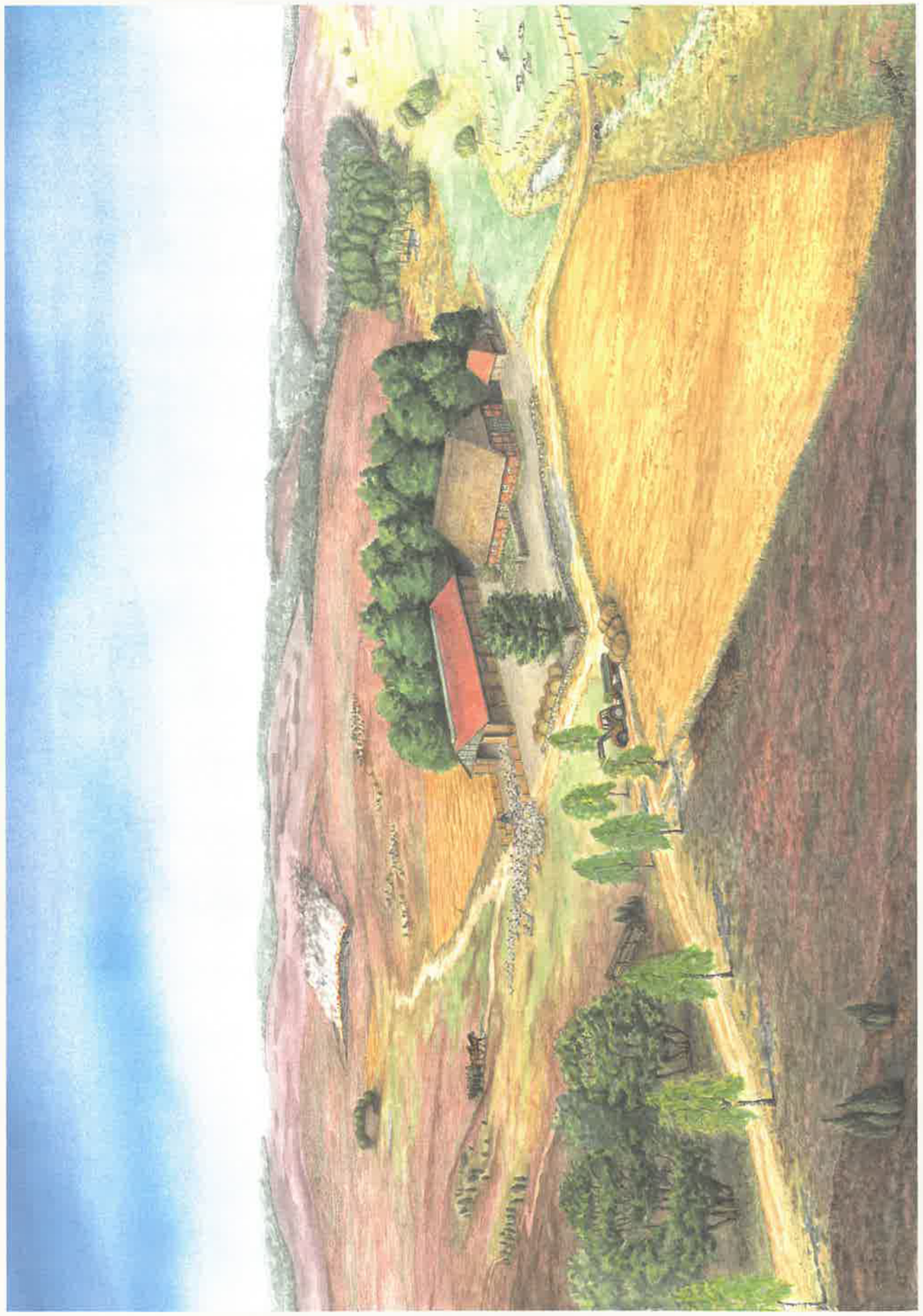
The landscape management farm Hof Tütsberg carries out organic farming on 265 ha of fields. Part of this method of cultivation is the use of the harrow instead of chemical pesticides for weed control.

NNA

The recently built sheep shed at Hof Tütsberg is more translucent and pervious to air than old sheep sheds. At the same time, costs of fire insurance are lower than for the old sheds with their thatched roofs.

JOHANNES PRÜTER

The foregoing of chemical pesticides at the landscape management farm Hof Tütsberg has supported many plant species typical of the flora of agricultural crops on sandy soils; here yellow flowering Lamb's Succory (Arnoseris minima) and white flowering Downy Hemp-nettle (Galeopsis segetum).



Idealized drawing of the present farming system as done by the landscape management farm Hof Tütsberg. ILL.: ANJA KAYSER

Environmentally sound cultivation/ Organic farming

The cultivation principles which were agreed upon in 1988 aim among other things at only growing of crops adapted to the sites, at the renouncement of chemical pesticides and artificial irrigation, at the extensive renouncement of purchased fertilizers and at the growing of old crop species. These criteria of cultivation with low intensity have been complemented by the conversion of the farm to cultivation according to the principles of organic farming in 1999. Since then the criteria of the German crop growing association "BIOLAND", which are in many ways stricter than the respective criteria of the European Union's decree 2092/91, are valid for the farm.

In order to improve soil fertility the typical crop rotation begins with the growing of nitrogen binding leguminoses, typically as a mixture of clover and grass, followed by spring crop. The three-year crop rotation is ended by the growing of a winter crop. Depending on the fertility of the soil different crops can be used. On poor soils with a soil productivity index below 25 mostly rye, buckwheat, spring triticale (a hybrid of wheat and rye), oat, flax, garden vetch and winter vetch are grown. Soils with a productivity index of more than 25 are cultivated with rye, spelt, winter or spring triticale, oat, potatoes or peas. Many of the crops are grown by means of seed propagation, for example crimson clover. For weed control a weeder harrow ("Striegel") is used, chemical pesticides being renounced.

Chemical nitrogen fertilizers are forgone and sheep dung is used instead, which is produced by the sheep flocks within the nature reserve. About 3,000 to 3,400 adult sheep in seven flocks are tended on the nature reserve's heathlands. The principle of sheep breeding still corresponds to historical heathland farming: by leading sheep into a sheep shed during the night, nutrients from the heathlands are concentrated in the shed and can later be spread on the fields. Modern sheep husbandry does not use plaggen material as litter in the shed any more, but straw from its own fields. In order to both optimize animal health and to save work, some sheep sheds have been modernized or completely built anew, considering modern trends.

Additional feeding of the sheep in winter, particularly after lambing time, is done exclusively with home grown oat and peas, hay and silage.

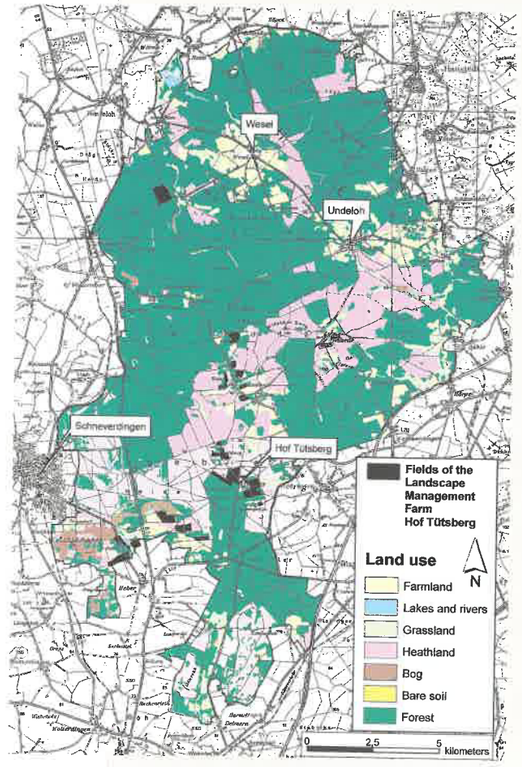
In addition to the flocks of sheep, a richly structured area of 130 ha in a brook valley is grazed at a low intensity all year round by robust breeds of cattle and horses. Within the heaths are a mosaic of carrs, grasslands and forest-heath gradients to a size of about 70 ha.

Preservation of the heathlands

Large-scale grazing with Heidschnucken sheep provides a significant contribution to preserving the extant heathlands in their pre-industrial form. Sheep tracks, fields, fallow land, sandy xerothermic grasslands and scattered copses are typical features of historical heathlands and are supported by the landscape management farm. Additionally, the crop rotation system of historical heathland farming is demonstrated on selected fields to a total size of about 5 ha.

Preservation and development of agricultural biocoenosis typical of the sites

Due to the impact of intensive crop growing, many once frequent animal and plant species experience a decline, even those of sandy fields. The landscape management farm aims to preserve the complex biocoenoses on its sandy fields. Therefore, the flora associated with agricultural crops, especially the Arnoseris minima community, is specifically supported by renouncing fertilization on selected field margins. Studies show 190 plant species on 26 fields, of which 108 species are associated with agricultural crops. In addition to the Arnoseris mini-



Having been created from different former heathland farms, the fields of the landscape management farm Hof Tütsberg are situated throughout almost the whole Lüneburger Heide nature reserve (map based on: ATKIS, courtesy of Landesvermessung + Geobasisinformation Niedersachsen 2004).

JOHANNES PRÜTER

Very enchanted looking are the beech forests with their large amounts of deadwood – a stated objective on a large part of the woodland in the Lüneburger Heide nature reserve is development from pine to beech forest as potential natural vegetation.

RAINER KOPSELL

Shifting sand dunes that developed after the ending of historical heathland farming were afforested in the 19th century. Nowadays, they are being partly cleared of pine trees, as they are important sites from an ecological point of view.

NNA

Children are an important target group of the nature conservation educational work of the Alfred Toepfer Academy for Nature Conservation

ma community, the Apera spica-venti, Papaver argemone, Anchusa arvensis and Digitaria anguinalis-Setaria pumila communities also occurred.

Development of an economically sustainable concept

The conversion of the farm to organic farming contributes to realising an economically sustainable concept. The farm's high-quality products in the crop and meat sector can be put on the market at a higher price than medium-quality conventionally produced ones. The main buyer of the cereals is a producer's association for organically cultivating farms, which carries out the central marketing of the cereals. The sheep are sold individually, mainly to local slaughterhouses.

Furthermore, the farm receives funding from the Bundesland Niedersachsen and the European Union, which can be considered as compensation for the effort to produce diverse, not immediately saleable ecological benefits. Forms of cultivation caring for the soil, water and air, preservation of heathlands and the old Heidschnucken sheep breed, as well as supporting the biocoenoses of nutrient-poor sandy fields are part of these benefits.

The tasks described above are carried out by one farm manager, two agricultural employees and seven shepherds. In times of high work intensity (hay and silage making, harvesting) the farm is supported by other farmers.

The landscape management farm sees itself as model farm for other farms in the region. The ecologically and economically sustainable cultivation system of the farm can encourage other farmers to carry out agriculture in a corresponding way and thereby integrate further nature conservation objectives into their ways of cultivation.

The products produced by mechanical heathland management have a connection to the agricultural farm and can partly be used by the farm. Chapter 7.4.1 gives examples for marketing of these products.

Heather honey is an agricultural by-product. Numerous beekeepers still put beehives in the heathlands to produce this popular heather honey.

7.5.2 Forestry

Since about two thirds of the nature reserve's area are covered by forests, forestry also has an important part for the development of the complete area. The silvicultural use of the forests is basically restricted to a very small extent by special regulations (Chapter 5).

In forests owned by the Bundesland Niedersachsen and by the Verein Naturschutzpark Association, great importance is attached to developing greater naturalness in the coniferous forests that resulted from afforestation. This means supporting deciduous tree species in particular, above all beech. For nature conservation reasons the timber harvest is restricted to winter. Growing of foreign species is renounced.

Furthermore, in the forest owned by the Bundesland Niedersachsen three areas totalling about 250 ha have been designated as strict forest reserves, which are not used at all and where natural forest development is being observed.

7.6 Research, education and communication

Research and monitoring

Observations resulting from natural and social studies in the area of the present Lüneburger Heide nature reserve are as old as or even older than the nature reserve itself. Therefore, the historical development of the area to date is understood in detail, at least in many aspects. In contrast to the beginning, when it was interested laymen who collected and wrote down such observations, scientific interest in the area came into emergence during the 20th century, which was often caused by questions which the recent nature conservation administration had to face. An important milestone for the co-ordination of research and monitoring activities as well as for collecting their results was the foundation of the Alfred Toepfer Academy for Nature Conservation in 1981. With the public assignment to carry out education, research and public relations for nature conservation, the Academy concentrates on activities in the nature reserve, due to its immediate surroundings, without neglecting other research topics. The establishment of its own library, with publications from all natural and social scientific areas relating to nature conservation topics, has supported both the Academy's staff and all other interested persons in carrying out research activities since then. Presently, the library's holdings amount to more than 1,500 publications with reference to the Lüneburger Heide nature reserve. Those are especially useful for student projects or doctoral theses about the Lüneburger Heide nature reserve, which are often supervised by the Academy's staff.

Numerous smaller projects about, for example, the renaturation of brooks, the significance of ancient woodlands or nature conservation-oriented agriculture, have been carried out by the Academy itself. More extensive joint projects about, for example, the relationship between grassland farming and nature conservation or about present questions of heathland management, have been led and co-ordinated by the Academy. In some national and international projects the Academy has participated as a project partner.

For several years the Academy has collected and analysed data from natural studies within the nature reserve, partly with the help of Geographic Information Systems (GIS), thereby fulfilling the monitoring obligations resulting from the European nature conservation directives. A focus lies on ornithological observations. These data are to a great extent delivered by a working group consisting of voluntarily working residents, and more data are surveyed by the Academy's staff itself or with financial support from the Bundesland Niedersachsen. Some studies are based on the legal prescriptions to monitor ecological development on Natura 2000 sites and on sites being managed by means of agri-environment measures.

A significant partner in all activities within the Lüneburger Heide nature reserve is the Verein Naturschutzpark Association, on whose properties the studies used to be carried out. Its staff's practical experience with the management of the area and its own observations as well as analyses of the Association's own library often flow into the research results.

JOHANNES PRÜTER

Coach rides provide a good opportunity for visitors to get to know many facets of the Lüneburger Heide nature reserve.

NNA JOHANNES PRÜTER

Comprehensive but discreet signposting is important for orientation and information for visitors to the Lüneburger Heide nature reserve. Matching designs of information panels at many car parks in the area (bottom left) pro-

Collection of publications with a focus on the Lüneburger Heide nature reserve – reports of the Alfred Toepfer Academy for Nature Conservation, a quarterly member's newspaper of the Verein Naturschutzpark Association, articles published in the regional newspapers and books with a focus on natural studies.

There is a long tradition of aiding scientific work on own land in the Forestry Office at Sellhorn, ensuring that forestry is based on solid expertise. Thus, detailed knowledge about forest ecology and nature conservation in forests is available today.

Environmental education, environmental communication and visitor information

Environmental education and environmental communication concerning the nature reserve are carried out by the Alfred Toepfer Academy for Nature Conservation, the Verein Naturschutzpark Association and the Forestry Office at Sellhorn. These three institutions run visitor information centres and lead guided walks with special topics, if desired. The visitor centres use historical buildings for their exhibitions and products. A heathland museum run by the Verein Naturschutzpark Association supplements this material, and a visitor information centre with special focus on the European dimension of heathlands as cultural landscapes is currently being planned.

The Academy for Nature Conservation furthermore carries out numerous seminars and conferences concerning many nature conservation topics. Conference venue is Camp Reinsehlen, the former headquarters of the British army.

A heathland-related event was the "European Heathland Workshop" in July 2003, which was attended by about 60 heathland experts from all over Europe being organized in the loose group of the "European Heathland Network". The two-day conference was complemented by field trips to the Lüneburger Heide nature reserve and heathlands in eastern Germany and Poland.

Specific environmental educational programmes for children are also offered by the Academy.

Guided walks for visitors are arranged by the local tourist information and led by local honorary guides. The Verein Naturschutzpark Association employs guides on a part-time basis.

Furthermore, coachmen impart interesting facts about the nature reserve during the popular trips with horse-drawn coaches. In order to ensure a standard quality for these guided trips and walks training units for "Certificated Guides for Natural and Cultural Landscapes" are currently being considered. A uniform ranger system does not exist. Some ranger tasks are carried out by four local residents, who have been asked to do so by the Verein Naturschutzpark Association and are being employed on a part-time basis. In times of high visitor numbers two mounted policemen carry out some control functions.

A uniformly designed visitor information system serves to provide visitors with basic information about the nature reserve. Information panels in the vicinity of car parks present a map of the area, present location of the visitor, general information about the area and guidelines for visitor behaviour. At many crossroads additional stones with signs enhance visitor orientation. On thematic hiking trails interesting facts about running water, forests, agriculture, historical heathland farming and habitat fragmentation within the nature reserve come across in an easily understandable and vivid way. Information panels dealing with striking features complement the visitor information system.

Local residents are informed about current developments in the nature reserve by a monthly page appearing in the regional newspapers. Contributions to these articles are mainly provided by members of the steering group, its editing is done by the Alfred Toepfer Academy for Nature Conservation. Members of the Verein Naturschutzpark Association receive a quarterly member's newspaper with up-to-date information about the nature reserve.

7.7 Economy of conservation and management

Due to legal regulations, the German Bundesländer are presently obliged to preserve existing heathlands in a favourable state. For this they are responsible both technically and financially. Private owners of heaths can be forced to tolerate heathland management on their properties, but in this case the costs are borne publicly.

Heathland management in the Lüneburger Heide nature reserve is mainly carried out by the Verein Naturschutzpark Association (the biggest landowner in this area) which, in accordance with its statutes also has a special interest in heathland preservation.

After the necessary management measures had initially been arranged and accounted for individually, a contract under public law was signed in 1988, which secured heathland management by allocating lump sums related to a given area for a period of five years each. At that time, a value of 170 German marks per hectare was taken as a basis for carrying out mechanical management measures and prescribed burning on 2,600 ha. At the same time, the establishment of a landscape management farm at the Association-owned farmstead Hof Tütsberg was agreed upon within this contract. Agriculture, which has subsequently been carried out under specific conditions, was also financially supported by the nature conservation administration of the Bundesland Niedersachsen. The respective shares falling under heathland management and agriculture have changed during the course of the extension of heathlands on the former military training areas and due to the new supporting framework during the farmstead's conversion to organic farming. Without public means having increased in the meantime, the Association has to manage 5,100 ha of heathland today. With sheep grazing being supported by the European Union nowadays, it is not subject to this contract any longer.

Voluntary payments from municipalities to the Association supplement the financial support from the Bundesland Niedersachsen.

Furthermore, the Bundesland Niedersachsen and the Association try to get additional support for heathland management, be it in form of public subsidies and project support or in form of membership fees and private donations.

In addition to the financial means for heathland management arranged in the contract, the Bundesland Niedersachsen together with the European Union supports grazing of heathland (180 €/ha) and nutrient-poor grassland (150 €/ha) and preservation of flora associated with agricultural crops.

Substantial amounts of money, which have been used for heathland management in recent years, have come from Federal funding in the course of the presently expiring Federal large-scale conservation project Lüneburger Heide. Between 1992 and 2004 about 3 million € could be used for initial restoration of heaths. Another million € was used for producing the management and development plan. Additionally, the Verein Naturschutzpark Association was provided with further means to purchase land in core areas of special value.

The Association's involvement in projects of the European programme LEADER+ and in diverse research projects generates further income.

Donations are promoted with the help of general appeals and appeals relating to specific features in the Association's membership newspaper, with the help of donations boxes in shops and tourist facilities in the nature reserve, newspaper reports on interesting Association activities (e.g. sheep shearing) as well as television shows like one in the year 2000.

Income through leasing and renting is a result of ownership of buildings and land, although one should consider that the costs for the preservation of buildings are equal to or even surpass this income. Selling agricultural products like corn and meat from the landscape

management farm Hof Tütsberg generates income as does charging parking fees on the Association's own car parks.

Economic sponsorship is particularly important for the purchase of new vehicles and equipment. The implementation of merchandising concepts has recently begun.

A significant part of the expenses necessary for the Lüneburger Heide nature reserve is explained by the costs of heathland management and personnel connected with it. Investigations into costs of the Verein Naturschutzpark Association have shown the following area-related expenses for the different management practices. For mechanical practices and prescribed burning, the following expenses refer to a single application, for grazing they refer to one year.

Grazing by Heidschnucken sheep costs between 138 and 171 €/ha. The maintenance of sheep sheds is particularly expensive. Through modernization, which is partly underway now, these expenses can be reduced in the medium term.

With 300 to 380 €/ha, prescribed burning is more expensive than expected. These costs can be explained by relative high personnel costs (which, as a rule, cover four workers mowing a strip against undesired fire spread, for practical realization of burning and for fire control) and for the expenses for rare interventions by the fire brigade when a fire gets out of control.

Costs of 50 to 500 €/ha are incurred for mowing of heaths. The significant range of these costs results from the varying usability and therefore saleability of the emerging mown heather material.
Plaggen treatment costs about 2,800 to 3,500 €/ha. The high cost can particularly be attributed to the expensive transport and disposal of the emerging organic and mineral soil material. A yet to be further tested use of this material (e.g. for bilberry plantations) might reduce the costs significantly.

Transportation and disposal of the organic soil material is also responsible for the high cost of schoppern treatment, amounting to a total of 1,500 to 2,000 €/ha.

Yet to be tested composting procedures and a possible usage of this material as a peat substitute might reduce these costs in the medium term as well.

It should be borne in mind that these costs related to a specific area are only of limited expressiveness if the nutrient-related effectivity and thus the theoretical effective period of the measures (Chapter 7.4) are not been taken into consideration. Only when it is known how often a measure is actually used or intended to be used can its cost be compared to those of other management practices.

Costs for visitor information and management are further costs related to heathland management. In this connection, costs of maintenance of buildings hosting visitor information centres, personnel costs for looking after visitors and information centres, maintenance costs for foot- and bridlepaths as well as expenses for the establishment and maintenance of the visitor information system, should be mentioned.

Finally, for the cost of basic research activities, continuous monitoring, and elaboration and continuation of the management and development plan for the nature reserve, also relate to heathland management.

Thus far it has been policy to not pass a share of the costs of heathland management onto the population or the visitors to the nature reserve (and therefore users of Association-owned properties). Nonetheless, interviews show that there is a willingness in principal to pay a nature tax, amounting to 1.50 to 2.00 € per visitor per day. Multiplication of this number with the average number of visitors leads to an idealistic value of the nature reserve of about 3,000,000 to 4,000,000 € per year.

Thus for the time being the situation remains that actually quantifiable costs of nature conservation and landscape management in the Lüneburger Heide nature reserve should be compared with economic effects, which even exist for the neighbouring regions and above all influence the tourism sector as well as many other economic sectors, but which cannot be calculated definitely.

8 Visions and Perspectives

Perspectives for utilization and safeguarding of extant heathlands

The long-term conservation of extant heathlands can only be achieved by continuous human intervention in the form of heathland cultivation or management practices. Under the current socio-economic conditions in Central Europe, heathlands like the Lüneburger Heide nature reserve are of only secondary importance as profit providing property. Indirectly, some sectors of the economy profit from heathland conservation (e.g. tourism sector, groundwater providers).

Without an economic interest, the responsibility for heathland conservation has to be mainly taken by public authorities, which finance the necessary management practices from the local up to the European level. In the case of the Lüneburger Heide nature reserve the State is supported by the privately organized Verein Naturschutzpark Association. A special case is heathland conservation through military use.

Like all areas being answered for by public authorities, heathland conservation is also subject to a political process, which again is mainly influenced by the public opinion of the members of society. A continuous change in peoples mood, partly linked to business development or to fashions and trends, partly caused by sudden changes like environmental disasters, influences the importance of the safeguarding of cultural landscapes for politicians. A certain continuity in these processes is provided by legal Acts like the Habitats Directive, whose compliance and implementation, however, again depend on political priorities.

Therefore, there cannot be a long-term guarantee for the safeguarding of heathlands. Rather, there should be continuous consideration of new and adapted possibilities for utilizing heathlands. Their pre-existing importance for economically and politico-economically relevant processes should be emphasized and imparted on a broad basis.

In this connection, a benefit-oriented approach may be helpful. The heath as an ecosystem with its biotic and abiotic components provides a lot of benefits in the fields of production, recycling and transportation, regulation and filtering, conservation of natural and local heritage as well as of genetical resources, bio-indication, innovation and recreation. Close interactions exist between many of these benefits.

The heathlands' production benefits are of particular economic interest. Primarily, heathlands provide food for many animals like sheep, goats, cattle and horses, but also for bees and game. Many of these animals, or their by-products like honey, wool or leather can be put on the market. Against the background of the heathlands' poor productivity, it is particularly the high-quality, healthy, environmentally sound food and other products that can compensate for the competitive disadvantage of low quantity.

In addition, material resulting from mowing, "plaggen" or "schoppern" of heaths as well as sheep dung can be used as bio-filter, for roof thatching or humus accumulation, as a peat substitute or fer-

tilizer. It may even be possible to use woody heather material as renewable fuel when fossil fuels such as oil run short.

Heathlands provide wide, open, quiet and attractive spaces, which raise life-quality in the living environment, but above all they are of great interest for visitors looking for recreation. Linked to this is not only the aesthetic importance of heathlands for landscape painting and literature, but also for everyday landscape perception during walks, rides, bicycle tours or trips with horse and carriage. Depending on the current travelling trend and overall economic situation, the number of visitors varies over years and decades. Nonetheless, tourism is often, and demonstrably in the Lüneburger Heide nature reserve, an important regional economic factor and therefore influences the labour market.

Of more politico-economic interest is the high rate of high-quality groundwater recharge under heathlands, which can also be put down to the outstanding regulatory, filtering and recycling functions of the sandy soil.

Furthermore, heathlands are able to bind specific substances from the air and to transform them into plant material. The transformation of carbon dioxide into oxygen and the utilization of nitrogen compounds play an important role in view of climate change.

Many animal and plant species are at home in the heath ecosystem (Chapter 4.5). They should not only be protected because of their intrinsic value, but also due to their functions for the ecosystem and their potential future importance for mankind, which may yet not be fully appreciated. For these organisms heathlands provide habitat and possibilities to spread. Extensive heathlands enable the conservation of a broad genetic diversity, as well as old breeds of domestic animals, and they allow further genetic differentiation of these species.

In addition to the animal and plant species, heathlands frequently contain soil and cultural monuments (Chapter 4.4). On closer inspection the latter in particular reveal the extraordinary innovative abilities of heathland farmers, as far as the best possible adapted cultivation of the unproductive soil is concerned. Linked to this are architectural or mechanical inventions, which continue today (e.g. machines for heathland management).

The experience with such a cultivation system, even if it can only partly flow into present agricultural practices, can be used for imparting a sustainable cultivation method to future generations.

For the political decision-making, all aspects described can provide important reasons for the safeguarding of heathlands, both now and in the future.

Heathlands existing because of military training present a special situation. Their long-term conservation mainly depends on the international political situation, which requires military training at varying intensities. On military training areas currently in use, the conservation of heaths is partly a "by-product" of military use (above all of tank driving exercises and target practice), but it also partly results from selective management measures used to keep the areas in an attractive state from the military point of view. Particularly on training areas that can be "rented" by different troops for training purposes, the conservation of heaths can be of economic importance, since an insufficiently managed training area would be more difficult to lease.

If military reasons and security risks do not prevent it, a further opening up of the areas for tourist or scientific purposes could be considered, as is already known from parts of some training areas in north Germany. In relation to this, very far-reaching concepts exist in the United Kingdom.

Training areas could significantly contribute to the safeguarding of heathlands, in particular those that have been abandoned in eastern Germany over recent years. However, their tourist and also agricultural use often requires a relatively expensive clearance of ammunition.

Of course, the importance of former military training areas for valuable habitats other than heathlands must also be considered.

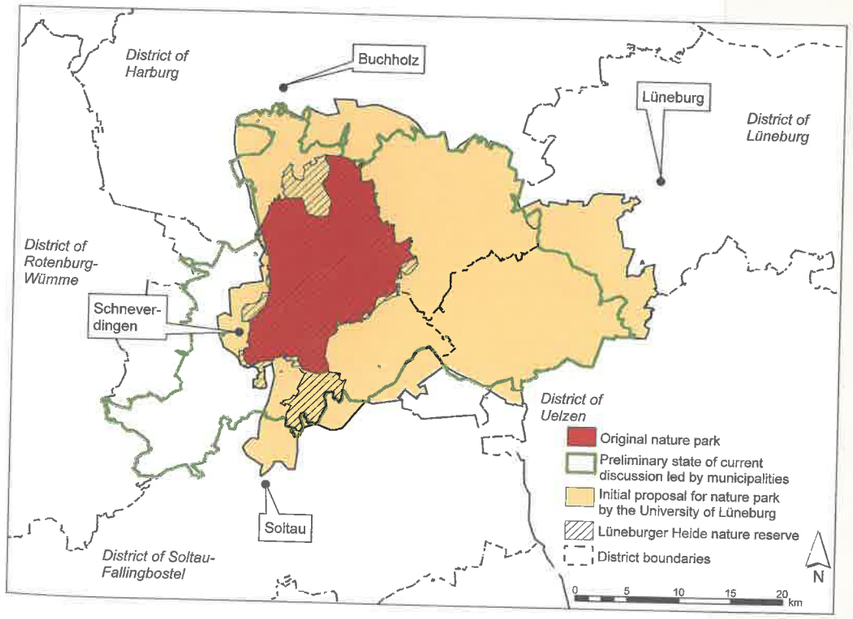
Visions for the future importance of heathlands

Presumably, unproductive and nutrient-poor areas are going to be abandoned on a large-scale in future, due to the ongoing change in agricultural structure in Europe, the enlargement of the European Union and the concentration of agriculture on highly productive sites. In particular, fields and grasslands in sandy, peaty or very wet locations are likely to be concerned by this development. In the long term these areas will develop into forests, unless possibilities for further use or management of open landscapes can be found.

In the discussion about keeping open these landscapes, in connection with their re-dynamisation, large-scale grazing is going to play a more and more important part, particularly in the densely populated regions of Central and Western Europe. All-year grazing by robust, undemanding grazers like cattle, sheep or horses promises to be an at least cost-covering way of safeguarding open landscapes like heathlands, grasslands or boglands, since the comparatively small costs for personnel and materials may be covered by selling of some the animals.

Furthermore, it does not appear to be improbable that these marginal sites may gain future importance for the production of specific ecological benefits, and that the social demand for these products and benefits is going to rise. The possibility of further modulation in the Common Agricultural Policy, i.e. further shifting of the support system from area-oriented financial support to the support of ecological and social benefits of agriculture, which has recently been decided, indicates a corresponding development. Therefore, it may be profitable for single farmers in future to develop unprofitable nutrient-poor sandy fields into heaths and to graze them with sheep, or to abandon mowing of very wet meadows on bog locations and to initiate bog restoration accompanied by sheep grazing.

The decisive factor for this type of land use is always its corresponding economic acceptability and indirectly, therefore, consumer behaviour. For economic reasons it might also be profitable for residents to (re-)develop specific areas into heaths or other types of open



Many adjacent municipalities may profit from the planned enlargement of the existing Lüneburger Heide nature park – the map shows possible boundaries of an enlarged nature park initially proposed by the University of Lüneburg and presently planned by the LEADER+ Regional Management Agency. At the moment, the given boundaries are subject to a process of planning and discussion and, therefore, must not be considered as final proposals.

landscapes for tourist purposes, which are currently being used for other purposes. Under specific circumstances it might even be economically reasonable to (re-)establish a system of common land rather than to use small plots of land individually.

Without aiming to return to historical land use, the experience of and knowledge about land use traditions that lasted centuries or even millenniums might be utilized for present conditions. In relation to this, available knowledge about the historical development, ecology and economic usability of different nutrient-poor open landscapes (like sandy fields, heathlands, grasslands and boglands) should be combined because certain experiences might also be applied to other habitats, and the landscape itself often comprises complexes of these habitats.

A primarily non-economic motive for the future safeguarding of open landscapes like heathlands might be the desire to create or support regional identity. Often it is particularly nutrient-poor habitats like bogs or heaths which, with their characteristic features, set the tone of a region and give it or its population uniqueness on a supraregional level. Inasmuch, these regions become unmistakable in a uniform European landscape dominated by agricultural land use.

The present discussion about the possible widening of the current Lüneburger Heide nature park indicates that the uniqueness of a landscape has great potential. The strong interest in this enlargement from municipalities in the vicinity of the present nature park can partly be explained by the wish to make their mark with the help of the "Lüneburger Heide" label. The restoration of small heaths on former fields or marginal sites, which has already been carried out in some municipalities, points in the same direction.

9 Concluding Assessments and Recommendations

The focus of attention of this report is the Lüneburger Heide nature reserve, representing a typical heathland of the Central European lowlands: its historical development; its present components with naturally and culturally important features; current approaches to its conservation and management; and its development perspectives.

In summary, the chapters of the report show that under the present conditions and with the given co-operation of many protagonists, safeguarding of heathlands is possible. The report does not aim to make detailed proposals for dealing with actual heath areas. Nonetheless, it has become clear that the described combination of the heathland management practices of grazing, prescribed burning in winter, mowing, "schoppern", "plaggen" and removal of saplings all contribute to successful continuous rejuvenation of heaths under the given climatic and pedological conditions of the Central European lowlands, without unreasonably affecting the area's biodiversity.

In combination with practical experience in individual cases, the concept of the theoretical effective period of a heathland management practice can provide an important indication of the best possible combination of practices and the frequency of their realization.
The described management practices orient themselves through historical cultivation systems. Inasmuch, the respective historical cultivation methods should be investigated for each heathland area, in order to orient the present management measures (or their combinations) to the historical cultivation.

The economic considerations have shown that management of heathlands is very expensive. The reduction of these costs is to be aimed at in future, be it by improved techniques or by opening up new ways of marketing for the diverse products from heathlands.

The high costs of heathland management being mainly borne by public authorities requires wide acceptance of the safeguarding of heathlands by the population, since long-term political interest in heathland preservation would not exist otherwise. As experience with visitor interviews show, many management measures meet with reservations. This may have to do with the fact that almost half of the visitors to the Lüneburger Heide nature reserve mistake heathlands for natural landscapes and do not know that only continuous human interference has contributed to their emergence and existence. Furthermore, acceptance of heathland management could be increased by further imparting the diverse benefits that are provided by heathlands, directly and indirectly, to the general public.

Honouring heathlands with supraregional recognition or marketing regional products with the help of a unique label could contribute to regional identity created by heathlands.

It is of decisive importance for the future of the heathlands in the Central European lowlands to observe agricultural structural changes in Europe, to realize decisions which may have a positive effect on the safeguarding of heathlands, and to impart this knowledge to all land users who may profit from heathland preservation or restoration in their respective regions. Ideally, heathland cultivation then really represents an economically viable land use and not a management measure.

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