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ORIGIN AND DESTRUCTION OF NORTHWEST EUROPEAN HEATH VEGETATION

J.T. de Smidt

The controversy on the question whether heath is a natural vegetation has lasted for more than seventy years. FOCKE, florist and paleobotanist (Bremen), presented in 1871 the view that heath is a natural formation, at least in the coastal belt, which he considered 100-200 km wide. In 1873 his countryman BORGGREVE, forester and familiar with farming in heathland areas, stated the opposite, namely that the origin and survival of all so-called "perpetual heaths" are dependent on the cutting of sods, the grazing of sheep, and on the procedure of regular burning-off; abandoning heath would mean a return to woodland within 5-20 years. FOCKE agreed with BORGGREVE in 1873, and attempted to explain the natural habitat of heathland species in open places in woodland, in marginal woodland areas and in peat-moors, although natural heath is found as well in exposed coastal localities. KRAUSE in 1892 formulated two other conditions next those connected with farming (burning, grazing, cutting sods), a humid climate and a sandy soil. Today's descriptions, in terms of atlantic and subatlantic climate and acid soil poor in nutrients, are fundamentally not different from KRAUSE's description. KRAUSE agreed with both predecessors that the podsolprofile must be a product of the heath vegetation, which was later confirmed by TÜXEN (1957).

FOCKE, BORGGREVE and KRAUSE solved the problem of the origin of the heath, but they disagreed on the question why farther inland heath is replaced by grassland. FOCKE attributed this to a decreasing air humidity, which was confirmed by STOCKERs ecofysiological research in 1923, BORGGREVE and KRAUSE, on the other hand, shared the opinion that the replacement of heath by grassland towards central Europe was caused by a difference in agricultural methods. They observed a relation between agricultural system and vegetation, but they failed to take into account that both are affected by one and the same factor, the climate.

The discussion on the question whether heath is natural vegetation was kept alive by GRISEBACH, MÜLLER and GRAEBNER. Phytogeographical and pedological considerations play an important role according to these authors. GRISEBACH (1884) noticed an increase

in the number of species of *Ericaceae* towards the North Sea.He observed a maximum increase in Portugal, where the dwarfshrubs also become twice to three times as high as for instance on the Lüneburger Heide. Correctly, he concluded a relation to the humid oceanic climate, but he failed to recognize the human influence, and this made him believe that most of the heath is mostly a natural vegetation.

The great authority of GRISEBACH in phytogeography was equalled for pedology by the danish scientist MÜLLER whose typology of humus published in 1887 still holds good. After his investigation of podzol in heath areas in Jutland, he proposed in 1924 that these soils are relics of a tundra and were formed shortly after the last glaciation period. MÜLLER, who supposed that trees are unable to grow on heath soils, assumed a continuous heath cover ever since the tundra time. He combined the influence of soil and geomorphological and vegetational features into a model for the origin. Unfortunately, however, he generalized too much in interpreting particular local conditions.

GRAEBNER (1925), following GRISEBACH, emphasized the increase towards the west of atlantic species and he related this to the climate. He explained the origin of the heath as the result of accidental circumstances. First of all, there is the natural leaching of nutrients in the humid climate during the thousands of years since the end of the glacial period. Next, GRAEBNER mentioned the removal of nutrients by cutting the woods. This was followed by accelerated leaching of the bare soil and removal of the raw humus. This process was repeated and repeated in the course of time. GRAEBNER supposed that as a result the virginal forest gradually degenerated into an open brush vegetation, in which heliophilous heathland species developed. The soil acidified, causing raw humus to be formed instead of the easily decaying mild humus. The resulting humic acids again accelerate the leaching process. Moreover, the thick layer of raw humus prevents the germination of tree seeds, thus impeding rejuvenation. Finally, only heathland remains. GRAEBNER contributed to a better understanding of heathland ecology by pointing on the effect of leaching and the role of raw humus. He failed, however, to assess the agricultural function of the heath and the influence of agricultural methods. GRAEBNER considered the observations of BORGGREVE and KRAUSE on spontaneous development of

trees after cessation of grazing as erroneous and he referred to his chapter on raw humus. In later years, FIRBAS (1949) pointed out that the leaching effect of the humid climate was generally overrated. As long as forests remained, this process could not have had any appreciable effect.

The problem of natural heath was finally solved by pollenanalytical and archeological research, which also revealed the age of heathlands. The following picture developed from the publications of VAN GIFFEN (1941,1943), FLORSCHÜTZ & WASSINK (1941), FIRBAS (1949,1952), WATERBOLK (1951) and VAN ZEIST (1959,1967), and from the review by GIMINGHAM (1972).

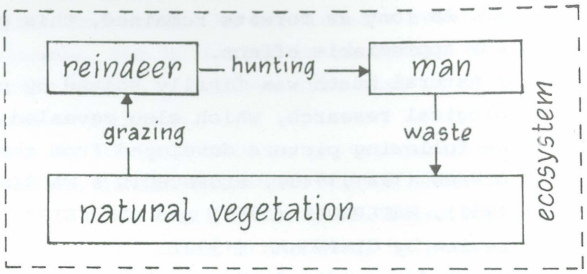
About 2200 B.C. herdsmen joined the mainly crop raising megalithic people in northwest Europe, and practised shifting cultivation (landnam) on a large scale. On abandoned fields, the redevelopment of forests was prevented by cattle grazing fields. The first heathlands originated at that time, as proved by an increasing number of pollen of *Ericaceae* in pollendiagrams, and by podzols found under tumuli. Under neolithic tumuli the podzol is absent, but under Bronze Age tumuli it may be present. According to EDELMAN (1960), however the podzol profiles may have developed on humid and poor soils in open oak-birch woods (probably Querco-Betuletum molinietosum). Forest podzols do not contain the black humuslayers (so-called Ao and B2h)so characteristic of heathpodzols. Moreover, the excavations by VAN GIFFEN and WATERBOLK proved the tumuli to consist entirely of sods. These have been so well preserved that they can hardly have been cut from loose forest soil.

It was concluded that heath gradually originated from virginal forests as a result of agricultural activities and raising cattle. The oldest heaths originated in the Bronze Age, about 4000 years ago, probably in small plots not larger than ten to twenty hectares. Largerheaths were laid out since the Middle Ages. (Fig.1).

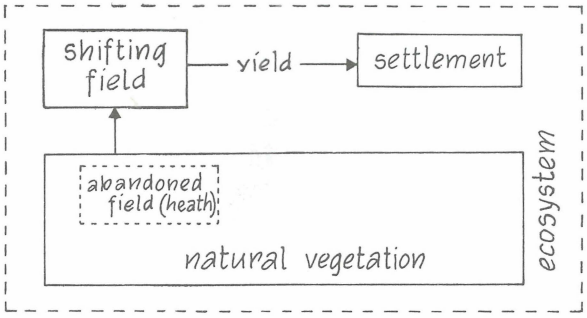
NATURAL HEATH

To avoid misunderstanding it should be mentioned that there are also natural heaths.These are found on coasts from southwest Norway to northwest Spain, where they represent the local climax; on acidic coastal dunes along the North Sea and Baltic Sea they probably represent the permanent terminal stage (WESTHOFF et al.1971); on stabilized sand dunes a successional stage; on

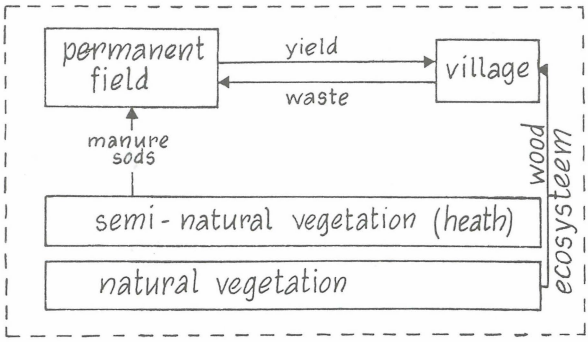
FIG 1. Exchange of nutrients between culture and nature



a. Reindeer hunters 14.000 - 8.000 B.C.



b. Landnamsystem 3000 B.C. - Iron age



c. Heath-sheep system A.D. 800-1900

high sandy soil in the transitional area from bog margin to forest they may be present in a narrow belt.
Natural heaths are also found at the arctic and alpine timberline, where they are floristically and ecologically very much different from the lowland heaths.

THE ROLE OF INDUSTRIALIZATION

In historic time, industrial activities accelerated the expansion of the heath. RICHTER (1967) found in Schleswig-Holstein numerous remnants of smelting furnaces of Late Roman Age, A.D. 300. The smelting of iron ore required so much wood that in vast areas only sandy hills remained. Large oak forests must have been burned in the Middle Ages by the Lüneburg salt boilers (GRAEBNER 1925, TÜXEN 1968). GIMINGHAM (1972) reported forest destruction in England and Wales about the year 1100; it reached a climax in the sixteenth century and was completed by the end of the seventeenth century. From the sixteenth to the eighteenth century, forests in Scotland supplied wood for charcoal used for iron-smelters.
In the Netherlands burning charcoal on the Veluwe, as indicated by red sand in many localities, may have had the same destructive effect on the forests as reported for other countries.

ORIGIN AND FLUCTUATIONS

The first expansion of the heath is dated at the transition from Neolithic to Bronze Age, i.e. at the end of the Atlantic period, 2000 B.C., in Denmark (IVERSEN 1941,1949, JONASSEN 1950), Germany (FIRBAS 1949,1952), the Netherlands (WATERBOLK 1954, VAN ZEIST 1959), and in England (GIMINGHAM 1972). In Scotland the expansion is of later date, about 500 B.C. (DURNO 1965). In southern Sweden, forest destruction began not earlier than late medieval times, but possibly somewhat earlier (A.D. 400-1000) on some islands off the southeast coast (GIMINGHAM 1972).
From the period between the end of the Roman Age and the early Middle Ages, from A.D. 300-800, information on human activities in continental northwest Europe is scarce. At the time of the Great Migration the population density decreased considerably, and most of the cultivated land was abandoned (JONASSEN 1950, WATERBOLK 1954);forests developed again on the fields and heaths.

In medieval times, A.D.800 and thereafter, new permanent settlements were established. This was the beginning of the second pe-

riod of heath expansion, but on a much larger scale. This period lasted only a thousand years, instead of the more than two thousand years from the Neolithic to the Iron Age. A third difference was that manure from sheep grazing on the heath was used as fertilizer on the fields.

Data on the enlargement of the heath during the early Middle Ages have again been mainly obtained by pollenanalytical and archeological research. IVERSEN (1969) concluded the presence of open heath on high sandridges in Jutland during the Viking period, about A.D.830. The presence of charcoal in the soil profile indicates a regular burning of the heath. This type of management was maintained for 900 years. About 1750, the heath apparently was abandoned as grazing ground, and an oak-beech forest (probably Fago-Quercetum) developed. JONASSEN (1950) mentioned evidence of heathland expansion in Denmark around the year 1200. Archeological and pedological research on plaggensoils in Emsland (FASTABEND & von RAUPACH 1961) and on the Veluwe (HEIDINGA 1972) dates the expansion to have taken place in the eighth century. The earliest historic source is from 1432. In that year, duke Arnold permitted the inhabitants of the Veluwe to decide on the burning-off of the heath (SLOET cited by HACKE-OUDEMANS 1969). He was reluctant to do so, as the burning would drive away his game. The concession is evidence of a well-established common law pertaining to the use of heathland. Heath reached its greatest expansion between 1500 and 1850, at the cost of the Querco-Betuletum and the Fago-Quercetum vegetation that had covered the sandy Pleistocene soils as climax forest since Atlantic times (FIRBAS 1949, IVERSEN 1969, JONASSEN 1950, MENKE 1963, GIMINGHAM 1972).

THE USE OF HEATH FOR AGRICULTURAL PURPOSES

For ecologically understanding the heath vegetation its agricultural use should be taken into account.

Originally, heath was probably a fire cultivation. BÖCHER (1941) assumed the origin to stem from the landnam. By the time all forests had disappeared as a result of landnam, a similar fire cultivation was practised on the heath. BÖCHER quotes at length HOFFMANs description from 1738, when this method of farming was still applied in Denmark. The heath was burnt, then ploughed. After one year it was ploughed again, probably to bring the nutrients from the ashes and from the partly decayed humus to the

surface again; buckwheat was then sown. After harvest time, sods were cut on the adjoining heath, stacked around the arable fields to dry, burnt, and the ashes spread out over the field as fertilizer. For two years rye was grown, then one year buckwheat, and again one year rye. At the end of this cycle the soil was exhausted, and had to be left to heath vegetation for 10-20 or even 50-60 years. When sufficient humus had accumulated, the burning practice was resumed. BÖCHER cited also SELMER, who mentioned that the fields could be used only for two years and then required a rest of 20-30 years.

This type of fire cultivation on heath is unknown from northwest Germany, the Nederlands and Belgium. Buckwheat cultivation on peatbogs, however, was practised in these countries and this was based on the same principle. On peaty heaths, burning was probably applied for agricultural purposes. MENKE (1963) reported charcoal layers southwest of Bremen, dated from the 13th to the 16th century, found in peaty podzols containing pollen of E r i c e t u m t e t r a l i c i s. Farther south, fire cultivation on heath was known also, but only in higher places in the Eifel and the Vosges (PAFFEN 1940, ISSLER 1942). This "Schiffelwirtschaft" in the Eifel was practised until this century, mainly for growing buckwheat. After the last harvest but before the soil was rested for 15-20 (sometimes 60) years while covered with heath, *Sarothamnus scoparius* was sown. This species of *Papilionaceae* contributed considerably to restore soil fertility by its nitrogen binding capacity.

A common ecological feature of these three habitats, where fire cultivation survived until recent times, is the storage of dead organic matter, facilitated by the topography (bogs) or the cool and humid climate (Denmark and the uplands). This means a store of combustible material, of which the nutrients in the ashes act as fertilizer. In these habitats the landnam type of agriculture, earlier practised in the forests, could be continued on the bogs and heaths.

On dryer soils, fire cultivation is unknown, probably owing to a deficiency in humus. In such places plaggensoils are found. The transition from landnam type to plaggenmanure can be explained as borne from sheer necessity, described as follows. After 4000 years of fire cultivation, the impoverished soil forced the farmers to move more and more frequently to other fields

and to leave the ground alone for ever longer periods. Consequently, the fields were situated ever further from home. This caused two problems, a decreasing production and an increasing haulage distance. The problem of the distance could be solved by moving the farmhouse, which was actually done by the neolithic landnam people. A more solid construction of the houses and a probably more complex social structure, however, did not stimulate this solution. The low productivity presented a more fundamental problem. In order to obtain sufficient food, the arable fields would have to be enlarged considerably, but this inevitably led to a situation in which more labour was required than could be supported. The problem was solved by the discovery of manure. Probably this was the first application of the recycling principle by an interaction between man and nature. Production of the fields was used to feed man and animal, the waste was carried back to fertilize the fields. During this cycle a certain loss of nutrients was inevitable, e.g. by leaching, wind-erosion, volatilization, and by sale of agricultural products. The loss was made up by nutrients supplied by the heath. In order to collect these nutrients, sheep were tended on the heath during part of the day and kept in the stable during the rest of the day and in the night. The sheep were mainly kept for manure. Liquid manure was collected by spreading heath sods in the stables. The mixture of sheep manure and the nutrients of the sods was essential to maintain an adequate fertility of the arable fields. In accordance with the stable type, this agricultural system is called the potstalsystem. It was applied from the 8th until the end of the 19th century in the northwest European lowlands between Antwerp and Hamburg. Geographically the area coincided with the distribution of the postglacial cover sands and of the G e n i s t o - C a l l u n e t u m vegetation.

The distribution of the potstalsystem can exactly be traced by the so-called plaggen soils (Fig.2 PAPE 1970). The sods contained some sand, although this was avoided as much as possible. This resulted in raising the fields. Sometimes sand rich in nutrients was intentionally deposited on the fields, for instance sand from roadbanks or from below the podzol layer. In the course of centuries a layer of black humus-containing sand was formed, up to 1.40 m thick. Covered by the plaggensoil, an undisturbed podzol profile may be present with a layer of char-

Fig.2. Distribution of areas with plaggen soils (from PAPE 1970, by courtesy of Elsevier)

coal on top (PAPE 1970). According to PAPE the charcoal must have been produced by burning the heath before working the field, but it may also be witness of a preceding shifting cultivation. A gradual transition from the nutrient-exhausting fire cultivation to the use of manure as fertilizer on the same field may explain the undisturbed podzol profile also. If the field had been ploughed from the very beginning, the upper layer of about 30 cm would have been disturbed. This not being the case, the use of sod manure must be older than the use of the ploughshare.

PAPE (1970) mentioned for the Netherlands a total of 417.280 ha of plaggensoil, of which 221.080 ha thicker than 50 cm. He estimated that the farmers moved 2.086.400.000 m^3 of soil from the heath, by way of the stable, and back to the field. The ratio between heath and arable field varied from 2:1 to 10:1. To raise the surface of the fields 50 cm, 5 to 25 cm had to be used from the topsoil of the heath in the course of time. If each time when sods were cut, 0.5 cm sand was removed, the heaths must have been cut 10 to 50 times. Assuming the period between two cycles to be 10 to 20 years, the total time in which this method was applied must have lasted from 100 to 1000 years. This agrees with the result of historical, pedological, archeological and pollenanalytical research.

The question can be raised what the effect was of the nutrient flow from the heath towards the fields, particularly on the floristic composition of the heath vegetation.

WATERBOLK (1954) came to the conclusions that the heath of the Bronze Age was preceded by herb-rich poor grassland of the Violion caninae type. It is not known whether this sequence existed again in the Middle Ages. Although the forests on the high sandy soils impoverished since Atlantic times (WATERBOLK 1954, VAN ZEIST 1969), it may be supposed that again Violion communities came first, succeeded by Calluno-Genistion vegetation. The first heath communities were probably grass- and herb-rich types of Genisto-Callunetum sieglingietosum. This subassociation, differentiated by *Sieglingia decumbens*, *Carex pilulifera*, *Potentilla erecta* and in the eastern part of its area also by *Agrostis tenuis*, prefer moder podzols. Plaggen soils on the Veluwe are indeed nearly all situated on moder podzol and they are surrounded by this soil type (TEN HOUTE DE LANGE 1977). This means that the heaths preceding the

Fig.3. Map showing the decline in the extent of heathland and peatmoors in the province of Drente from 1850 (from Provinciale Planologische Dienst of Drente)

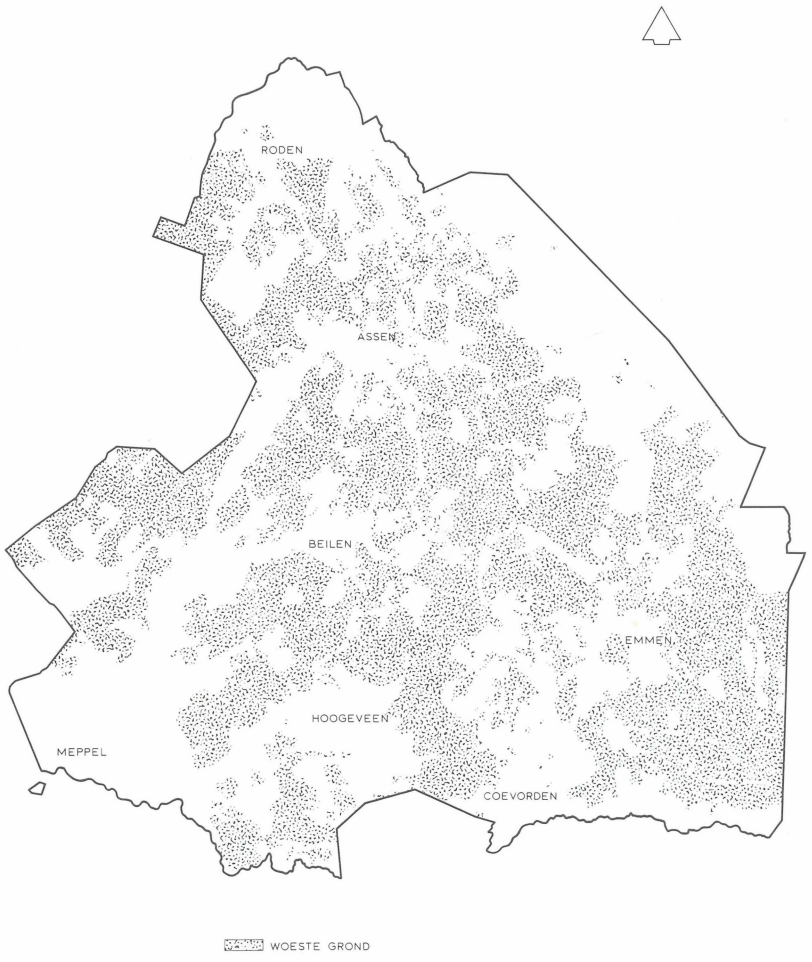


Fig.3. Map showing the decline in the extent of heathland and peatmoors in the province of Drente from 1900 (from Provinciale Planologische Dienst of Drente)

Fig.3. Map showing the decline in the extent of heathland and peatmoors in the province of Drente from 1950 (from Provinciale Planologische Dienst of Drente)

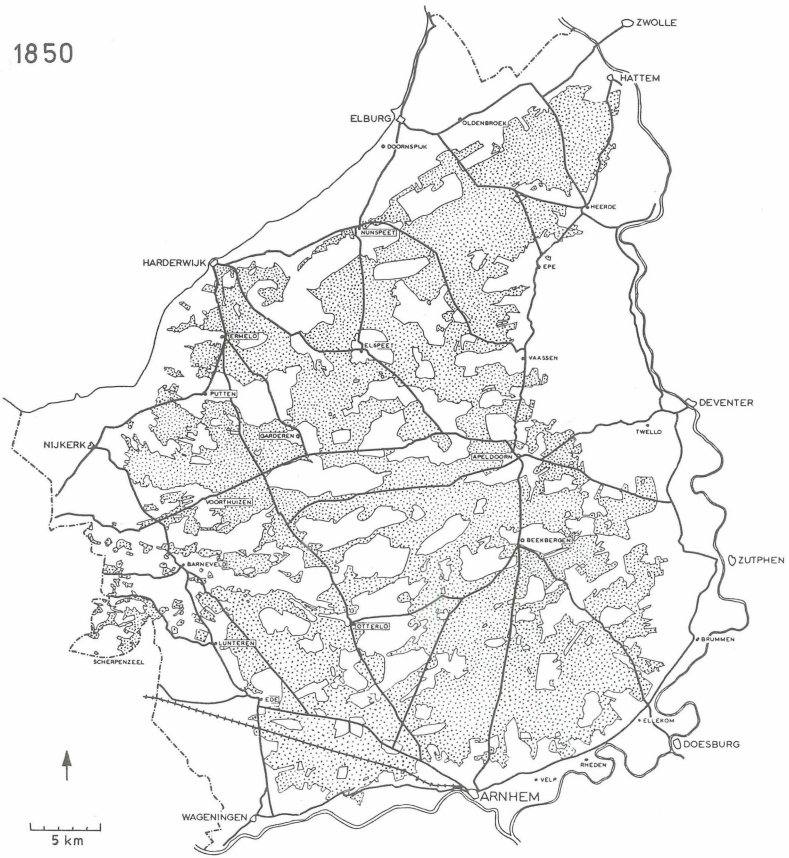


Fig.4. Maps showing the decline in the extent of heathland on the Veluwe from 1850 (from Rijks Planologische Dienst)

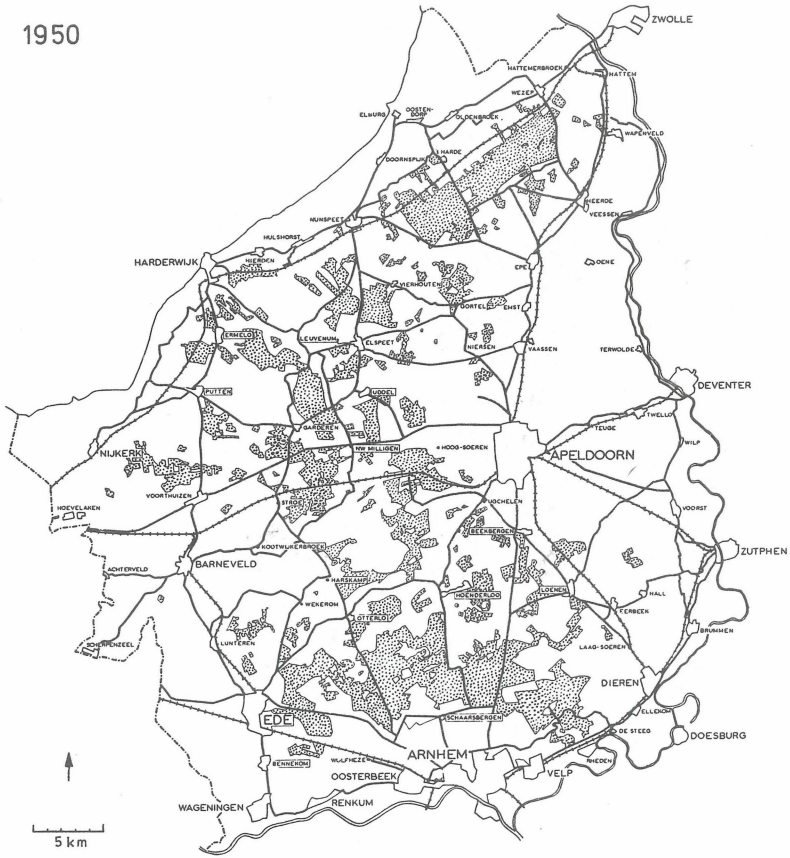


Fig.4. Map showing the decline in the extent of heatland on the Veluwe from 1950 (from Rijks Planologische Dienst)

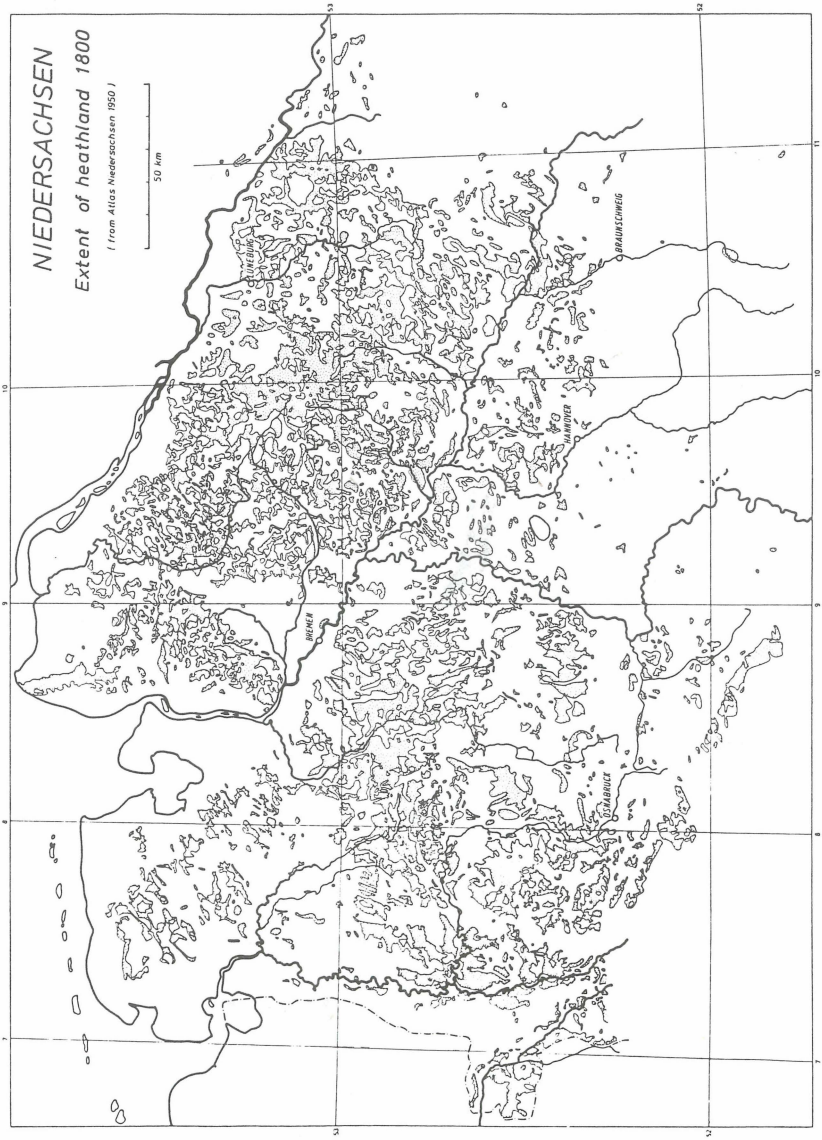


Fig.5a Map showing the decline in the extent of heathland in Niedersachsen (after Atlas Niedersachsen)

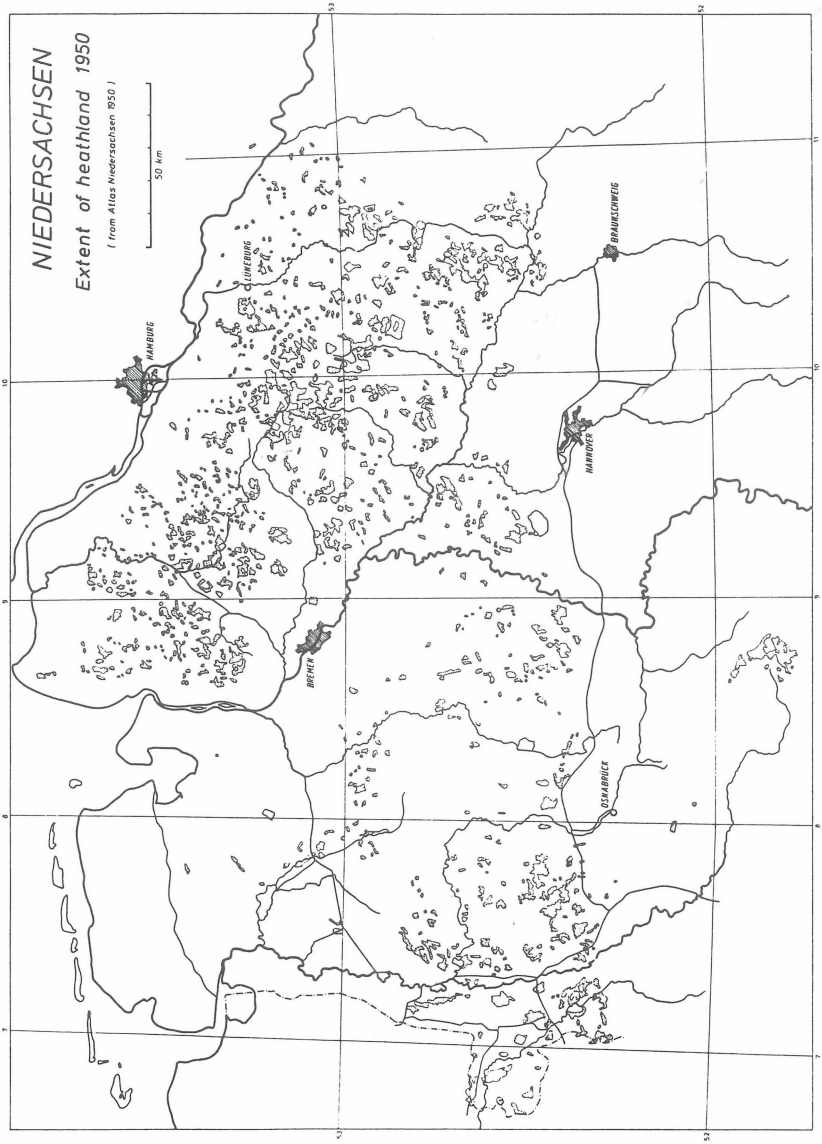


Fig.5 b. Map showing the decline in the extent of heathland in Niedersachsen (after Atlas Niedersachsen, 1950)

Fig.6. Maps showing the decline in the extent of heathland in east Dorset and Hampdhire west of the River Avon, from 1811 (from GIMINGHAM 1972, by courtesy of CHAPMAN & HALL Ltd.).

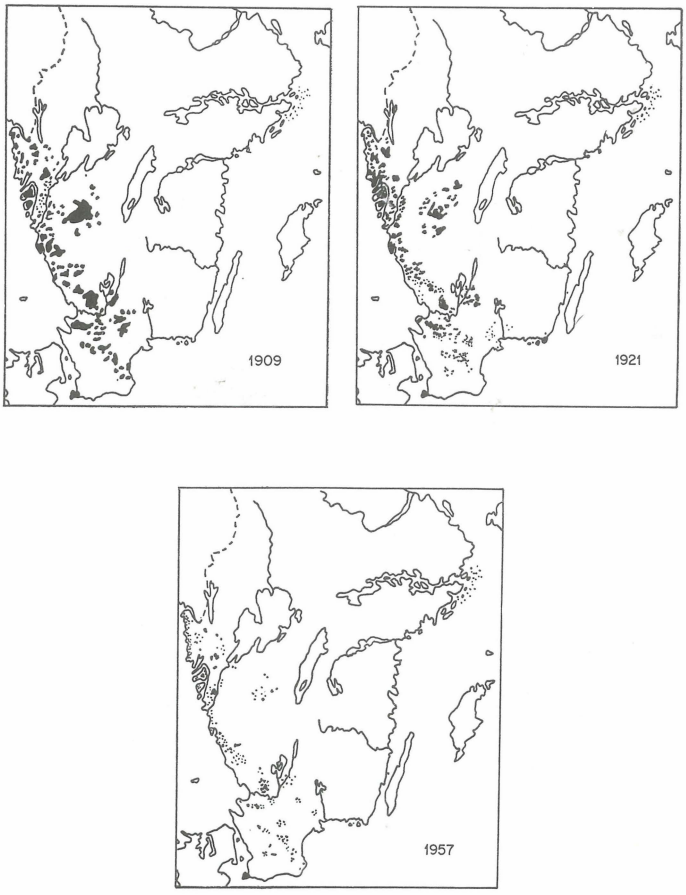


Fig.7. Maps illustrating the decline in the extent of heathland in Southern Sweden from 1909 (from GIMINGHAM 1972, by courtesy of CHAPMAN & HALL Ltd.)

introduction of plaggenmanure were situated on moder podzols. It means also that the first arable fields were surrounded by Genisto-Callunetum sieglingietosum. Gradually the heath expanded and incorporated the poor-soils, in which humus podzols were formed. The transition from the Querco-Betuletum on the poor soils to heath may have been marked by Thero-Airion communities. Finally, Genisto-Callunetum typicum and Genisto-Callunetum cladonietosum developed in these places. Heath with Thero-Airion species can still be found on stabilized sand dunes, and on former fodder fields on heathland layed out to provide red deer with food.

Intriguing questions are how long it took Genisto-Callunetum to replace the Violion or the Thero-Airion communities, and how the heath community could stand the cutting of sods and the grazing over a period of a thousand years. Even more interesting is the question whether the heath would have been perpetually tolerant to this management or would have been finally destroyed. The answer is of interest to a better understanding of mineral cycles in ecosystems.

The problem became of lesser importance to agriculture about a hundred years ago by the discovery of industrial fertilizers, which rendered the sodmanure superfluous.The new fertilizers were unlimitidly available and relatively inexpensive. The sheep lost their vital position in the agricultural system, also by the importion of cheaper and high quality Australian wool. The number of sheep decreased rapidly, and so did the total heath area. In the Netherlands, with a total of 1.400.000 ha of sandy soil the area decreased from 600.000 ha in 1833 to 61.000 ha in 1970 (fig.3 and 4). The northwest German lowlands (fig.5) of 6,5 million ha were reported to contain 0,5 to 1 million ha heath and 400.000 ha peatbog (GRAEBNER 1925). Except in nature reserves, the heath has practically disappeared. The same change took place in South-England (fig.6) and in South-Scandinavia (fig.7). In the dryer places the heath was planted with pine trees; in other parts it has been transformed into arable fields and grassland. This process of reclamation was halted between 1950 and 1960 by the activities of nature conservationists.

Today the heath is still threatened by army activities, urbanization, road construction and by recreation. The peaty heath,

the habitat of the E r i c e t u m t e t r a l i c i s , has become very rare, and its existence is further threatened by the lowering of the ground water table for agricultural purposes.
To preserve the heath in the nature reserves is not easy, since the former agricultural methods have been abolished . The best results are obtained in areas where sheep are kept and older parts can be burnt. Where this cannot be practised, the heath is rapidly being replaced by successional stages towards woodland, unless it is mowed every ten to fifteen years, which also prevents the heather beetle (*Lochmaea suturalis*) to become a pest.
A yet unanswered question is, whether chemical changes of the topsoil by recreation and air pollution precipitated by rain will affect the heath.

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DISKUSSION

K.-E.BEHRE

Zur Datierung der ersten Heiden und zum Alter der Plaggenwirtschaft, die Voraussetzung zur großflächigen Ausdehnung der Heide war, gibt es inzwischen neue Untersuchungen aus Nordwestdeutschland. Danach kennen wir mindestens von einer Stelle - aus dem Bereich eines Megalithgrabes bei Aurich/Ostfriesland - durch einen sicher neolithischen Heidepodsol die ersten Besenheideflächen bereits für die Jungsteinzeit. Für die Bronzezeit sind sie dann aus zahlreichen Hügelgräbern über *Calluna*-Podsol oder aus Heidesoden belegt. Mit der Einführung der Plaggenwirtschaft im Mittelalter wuchsen die Heideflächen dann sehr stark. Der Beginn der Plaggenwirtschaft ist in Nordwestdeutschland und den Niederlanden jünger als bisher angenommen, da vor allem die ^{14}C-Daten nicht nur der Holzkohle, sondern auch der Huminsäurefraktion nicht zuverlässig sind. Neue pollenanalytische Untersuchungen sowie die kritische Auswertung zahlreicher siedlungsarchäologischer Befunde aus Niedersachsen, Drente und Twente haben gezeigt, daß die Einführung der Plaggenwirtschaft frühestens in der Mitte des 10.Jahrhunderts, in den meisten Fällen noch später erfolgte (vgl. BEHRE 1976, Neue Ausgrabungen u.Forschungen in Niedersachsen, Bd.10: 197-224). Dabei hat es keinen allmählichen Übergang von einer Wechselwirtschaft zur Eschkultur gegeben, sondern die Plaggenwirtschaft wurde gleichzeitig mit dem Winterroggenbau eingeführt und setzte sich schlagartig an die Stelle der bisherigen Wirtschaftsform. In Dumme (Ostfriesland) konnte gezeigt werden, daß dort in der Mitte des 10.Jhdts. gleichzeitig a) die Siedlungsweise völlig geändert wurde, indem man Kleinsiedlungen zu Dörfern zusammenlegte, b) die Flurform und wahrscheinlich auch die Flurverfassung ganz umgestellt und c) die neue Wirtschaftsweise: "ewiger" Winterroggenbau, verbunden mit der Plaggenwirtschaft, eingeführt wurde. Die Plaggenwirtschaft führte wegen des riesigen Bedarfs an Heidesoden zur starken Erweiterung der Heideflächen und damit zur Zurückdrängung des Waldes.- Dieser plötzliche Wechsel der gesamten Siedlungs- und Wirtschaftsweise läßt vermuten, daß diese Veränderung nicht spontan von den Bauern ausging, sondern von der damaligen Grundherrschaft veranlaßt worden ist.

W.MÜLLER-STOLL

Heiden im umfassenden Sinne des Volksgebrauchs sind heute viele Trockenwälder bis östlich an die polnische Grenze (Dresden) und bis in den Süden (München). Die trockenen Wälder wurden im frühen Mittelalter bis zur Separation durch Holzgewinnung und als Viehweide gleichzeitig genutzt. Gebietsweise, z.B. in der Nieder-Lausitz, haben sich große baumlose und baumarme Flächen gebildet, vorherrschend von *Calluna vulgaris* besiedelt, nur mit zahlreichen Schäfereien, die heute weitgehend verschwunden sind (KRAUSCH). Diese östlichen Heiden mit und ohne Wald haben nicht die typischen Bodenbildungen der eigentlichen Heiden (im Sinne der Botaniker). Außerhalb des spezifischen Sprachgebrauchs der Botaniker wird heute noch im Volksgebrauch trockener Wald darunter verstanden, noch in Verbindung mit einer geographischen Bezeichnung, z.B. "Dresdener Heide".

R.TÜXEN

Wir haben in Nordwestdeutschland 5 datierte neolithische Bodenprofile der Heide gefunden. Lackabzüge befinden sich in meiner Sammlung, die zur Zeit in Oldenburg im Museum ist.

F.MATTICK

Anschließend an eine Bemerkung von MÜLLER-STOLL, daß der Begriff "Heide" in vielen Gebieten Deutschlands in weiterem Sinne für ganz andersartige Wälder verwendet wird (z.B. die "Dresdner Heide", ein Kiefernwald auf Sandboden) weise ich darauf hin, daß sogar reine Kryptogamen-Gesellschaften als "Heiden" bezeichnet werden, so die von SANDSTEDE beschriebenen "Flechtenheiden" Nordwestdeutschlands oder die riesigen Flechtenheiden im norwegischen Hochgebirge, nur aus *Cladonien, Alectorien* und anderen Strauchflechten zusammengesetzt.

J.T.DE SMIDT

Die allmähliche Verarmung der Böden durch Brandkultur braucht nicht zur einer allmählichen Umschaltung in der Agrarwirtschaft zu führen. Wenn die Grenze der Möglichkeiten für die Brandkultur erreicht war und zu einer Notsituation führte, aus der die Entdeckung der Düngung einen Ausweg bot, ist eine schnelle Umschaltung anzunehmen. Eine übergeordnete Organisation wie der Adel wird in der Provinz Drente keine Rolle gespielt haben. Ausgedehnte Moore befanden sich ringsherum. Die Bauern sind immer unabhängig gewesen.

Die Bedeutung des Wortes Heide hat sich stark geändert im Laufe der Zeit. Die Arbeiten von KRAUSE (1892), F.GRAEBNER (in P. GRAEBNER 1925) MORTENSON (1941), TRIER (1949) und KRAUSCH (1969) zeigen folgende Entwicklung: Heide stammt vom indogermanischen *kei*, das wurde im Germanischen *caitjo*, und im Gotischen *haithi*. Die indogermanische Bedeutung war: Kreis, Gemeinschaft, das heißt ungefähr Allmende. Auch die gemeinschaftlichen Äcker und Wälder gehörten dazu. Nur das eigene Haus und der eigene Hof waren davon ausgeschlossen. Im Mittelalter wurden die Äcker von der Heide abgetrennt. Heide wird dann ein Rechtsbegriff zur Unterscheidung des gemeinschaftlichen vom privaten Besitz. Als die Fürstenhäuser aufkamen, wurde der Forst abgetrennt, den sie für ihre Jagd reservierten. Zuletzt wurde die Heide beschränkt auf Weidegrund, als Waldweide, Grasheide und Zwergstrauchheide. Die letzte Bedeutung hat die Überhand bekommen durch die Literatur in Romantik u.a. von Hermann Löns. In der Vegetationskunde ist die letzte Bedeutung übernommen worden.