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AN INTRODUCTION TO THE NETHERLANDS

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Introduction

The papers in this volume will give the reader an impression of the investigations on the distribution of the invertebrate fauna of the Netherlands, carried out by both amateurs and professionals. Within the framework of the European Invertebrate Survey - Nederland a large number of data have been gathered in the last five years, and preliminary results can be presented now. In this introduction some data on the topography and the biotic as well as the abiotic environment are collected to enable the reader, especially from abroad, to locate the toponymes used and to follow the suggestions made about relations with abiotic environmental factors or man-induced changes in the environment.

A survey of the number of species of several groups is given in Table 1, to present the reader an outline of the invertebrate fauna of our country. It is assumed that in total c. 25,000 species of invertebrates are indigenous in the Netherlands.

Table 1

Survey of the number of Dutch species of several groups of invertebrates

Mollusca	292	(1)
Chelicerata	2,600	(2)
Plecoptera	28	(3)
Ephemeroptera	55	(4)
Odonata	68	(5)
Coleoptera	3,200	(6)
Hymenoptera	8,400	(7)
Lepidoptera	2,200	(8)
Trichoptera	177	(9)

(1) Janssen, A.W. (*Mededelingen Werkgroep Tertiaire en Kwartaire Geologie, 12 (1975): 115-170*) (2) L. van der Hammen & P.J. van Helsdingen, pers. comm. (3) Claessens, E.E.C.M. (*Nieuwsbrief European Invertebrate Survey-Nederland, 10 (1981): 73-77*) (4) Mol, A.W.M. (*Idem, 67-71*) (5) Tol, J. van & D.C. Geijskes (*Idem, 47-53*) (6) Brakman, P.J. (*Monographieen van de Nederlandsche Entomologische Vereeniging, 2: 1-219*) (7) C. van Achterberg, pers. comm. (8) Lempke, B.J. (*Naamlijst van de Nederlandse Lepidoptera, Amsterdam*). (9) Geijskes, D.C. & L.W.G. Higler (*Instrukties voor medewerkers EIS-Nederland, 5 (1980): 1-24*).

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Fig. 1

Topographical names referred to in this volume.

Topography and geology

The Netherlands (surface 37,000 km^2) (cf. Fig. 1 for localities used in this and other papers of this volume) are situated in the temperate zone. The average temperature in the middle of the country is 1.7 °C in January, and 17.0 °C in July. A map with the mean daily temperatures is given in Fig. 2. Yearly precipitation in the period 1931/1960 was 765 mm on average, falling on 216 days of each year. A map with the annual amount of precipitation is given in Fig. 3. Sunshine during the just mentioned period was 1572 hours per year.

From the geological point of view the Netherlands is a very young country. The holocene part (Fig. 4) was deposited during the last 10,000 years; most of the higher grounds are of pleistocene age, although it consists of tertiary sands for a considerable part. Older deposits are scarce. The southernmost part of the province of Limburg is mainly formed during the Upper-Cretaceous, while the Carboniferous is also locally present there on the surface. These old sediments usually lay at depths of a few hundred meters at least in the rest of the country, and are covered by the younger pleistocene or holocene deposits.

Due to the sedimentary status of the Netherlands it lays for the larger part only up to a few meters above the mean sea level. The highest point (321 m) is found in the lime-stone area of the province of Limburg. A considerable part of our country (40%) is even laying at or below the mean sea level.

Soils

Characteristic for the Netherlands are the clay and peat soils. Clay deposited by the sea is found in the southwestern and northern part (Fig. 5). In the western and middle part these deposits are somewhat older and covered by low-peat soils, which, however, were largely dug off (Fig. 6). The peat soils in the eastern and southern provinces (Fig. 6) consist of high-peat moor, and these soils have also largely been dug off.

Sand soils are found as younger, holocene deposits along the coast as sand dunes, and as older, pleistocene or tertiary sands in the southern and eastern provinces (Fig. 7). Along the rivers (Rhine, Meuse and their branches) and also along the lowland streams river clay is present (Fig. 8). Finally the presence of lime-stone in the southern part of the province of Limburg must be mentioned (Fig. 9).

Man

The presence of man is an important factor influencing the distribution patterns of invertebrates. More than 14 million people live in the Netherlands at the moment, and it is worthwhile to denote some trends in the man-induced changes of the environment, especially during the last century.

In 1900 the Netherlands were inhabited by c. 5.1 million man, and this number climbed from 8.9 million in 1940 to the just mentioned 14 million in 1980. The surface of land used for agriculture increased from 2.1 million ha in 1900 to 2.5 million ha in 1974, whereas the surface of natural areas decreased from 624,000 ha in 1900 to 171,000 ha in 1976 (cf also Table 2 and 3).

Table 2

Soil use in the Netherlands in 1976 (in 100 ha) (Source: CBS)

Built-up area	2 666
Industry etc.	386
Roads, railways etc.	741
Forests	3 075
Heathlands	803
Marshes and moorlands	56
Dunes, beaches, shifting sands	399
Salt-marshes	226
Reedlands	234
Waters, wider as 6 m	3 138
Cultivated area	25 224
Total	36 948

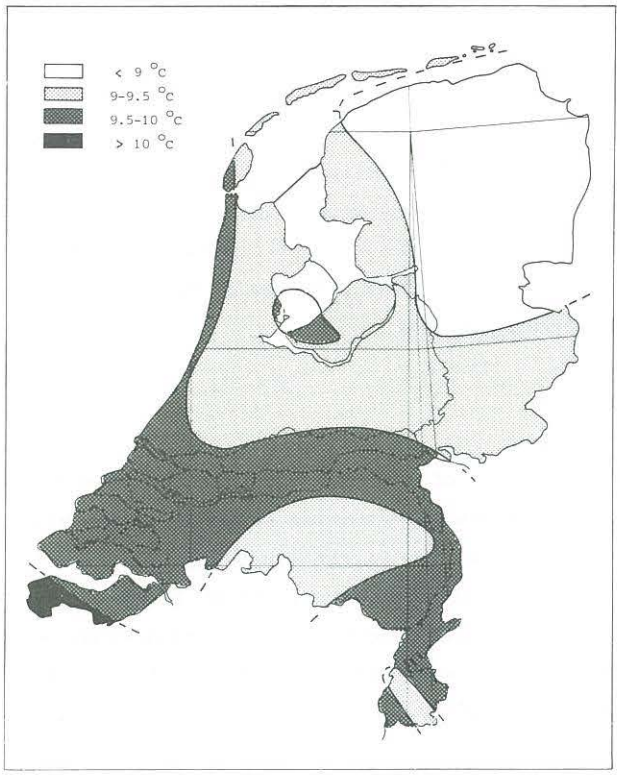


Fig. 2. Mean daily temperatures

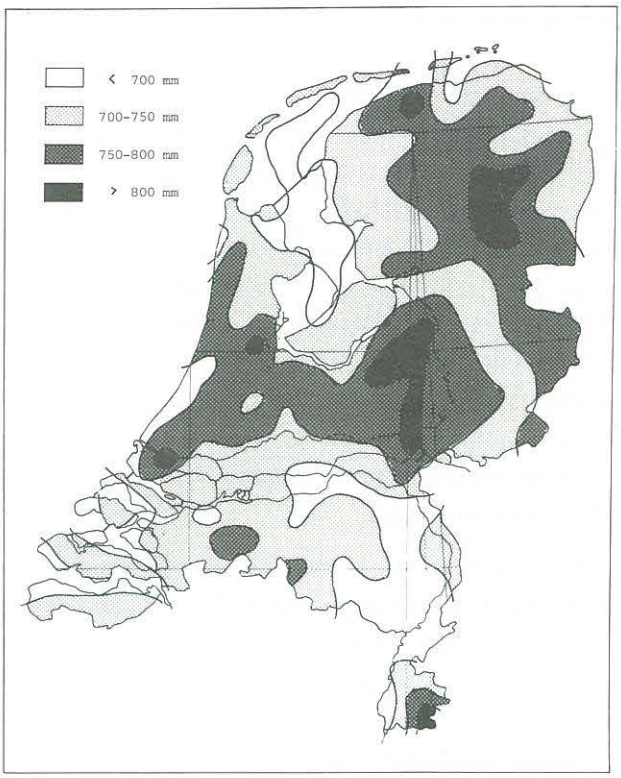


Fig. 3. Annual amount of precipitation

Fig. 4. Holocene and Pleistocene

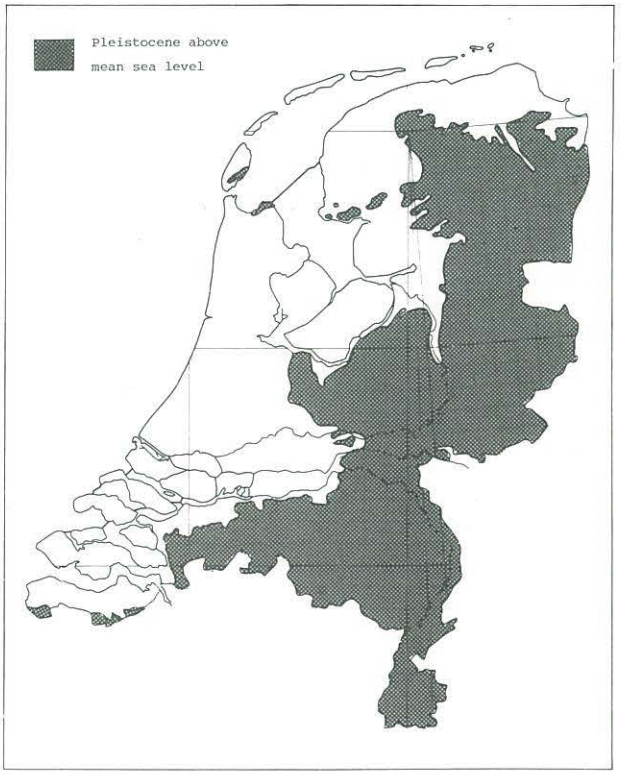
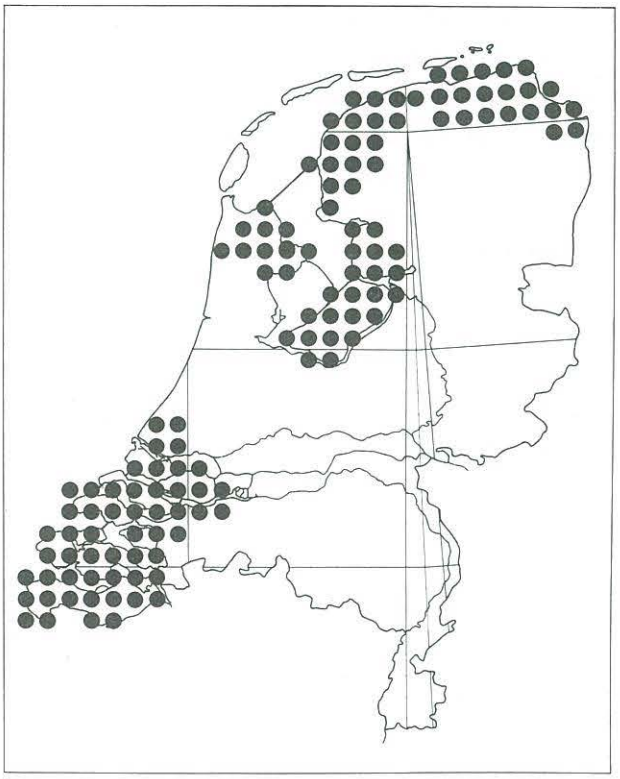


Fig. 5. Sea clay soils



The influence of man in the cultivated area, however, is much more important than one should be inclined to conclude from these data. Intensivation of agriculture has caused an enormous loss of semi-natural habitats. It was calculated (de Molenaar 1980) that the area of the characteristic grasslands poor in nutrients during the 19th century, the Cirsio-Molinietum, decreased with 99.9% during the last 75 years! This must have influenced the distribution of many invertebrates considerably, although precise data are not available at the moment. The deterioration of this vegetation type was induced by intensive draining programs as well as by the use of fertilizers (Table 3). The total amount of phosphate (as P_2O_5) from fertilizers as well as from livestock available per hectare increased from 84.9 kg per ha in 1950, via 85.1 kg per ha in 1960 to 106.0 kg per ha in 1970 and 120.0 kg per ha in 1974!

Other important man-made changes in the environment were e.g. road building, removing of line-elements (hedges etc.) in the landscape and scaling up of the landscape within the framework of land consolidation. Only very few quantitative data are available about this kind of changes, but it is known that from 1924 to 1974 558,910 ha of cultivated land was worked up as land consolidation area. It was also calculated that the surface of orchards of tall growth decreased from 7500 ha in 1967 to 3925 ha in 1971 and 2700 ha in 1974.

The aquatic environment also suffered much from side-effects of the affluent society. The use of fertilizers caused an important eutrophication of all watertypes, and the 'regulation', i.e. the canalization, of lowland rivers and brooks deteriorated the ecosystem of this habitat almost everywhere in our country. The chemical pollution of the large rivers is illustrated by the data of the chloride discharge of the river Rhine (Table 3); the amount rose from 65 kg/sec in 1900 to the fivefold 336 kg/sec in 1976.

The effects of these developments on the invertebrates are described in several articles in this volume (e.g. Claessens 1981, Mol 1981, van Tol & Geijskes 1981).

Some important types of landscape of the Netherlands

This can only be a short summing up of some quantitative or qualitative important landscapes of the Netherlands. An extensive description of the vegetation of our natural areas is given by Westhoff et al (1970, 1971, 1973).

The Wadden Sea with its Wadden or Frisian islands is of great importance for large numbers of birds. The mudflats have a characteristic fauna, poor in species, mainly consisting of molluscs, Annelida and Crustacea (e.g. *Corophium*). The vegetation is also poor in species. Some characteristic plant species are *Spartina* spp., *Salicornia* spp. and *Zostera* spp., growing on the mudflats or in the creeks. The sand dunes and salt-marshes are inhabited by many interesting organisms. Abundant plant species are e.g. *Suaeda maritima*, *Triglochin maritima* and *Limo-*

Table 3

Some data on the environment of the Netherlands (Source: CBS)

	1900	1920	1940	1960	1976
Population of man (1000)	5179	6865	8923	11556	13733
Agricultural land (1000 ha)	2116	2218	2324	2597	2522
Natural areas (1000 ha)	624	493	358	200	171
Consumption of fertilizers (10^6 kg)	0	25	95	224	435
Chloride discharge of the Rhine (kg Cl^-/sec)	65	118	155	270	336

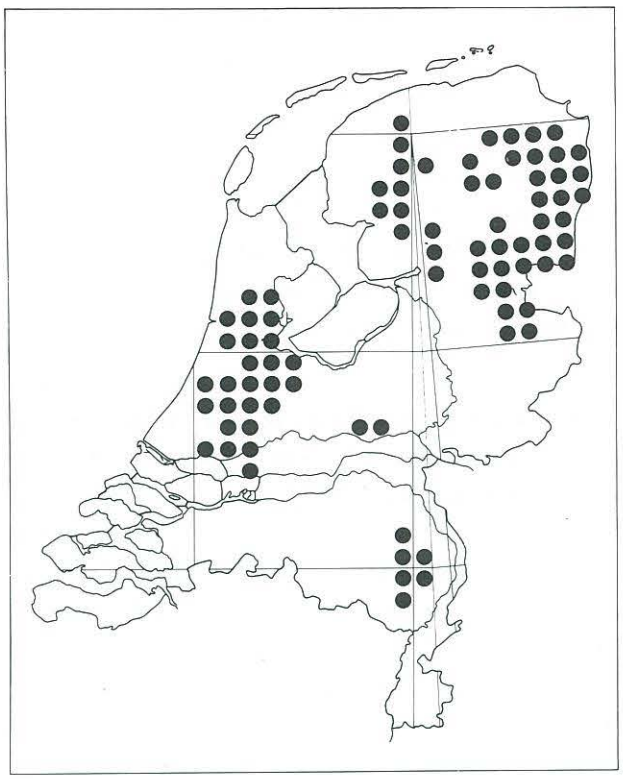


Fig. 6. Peat soils

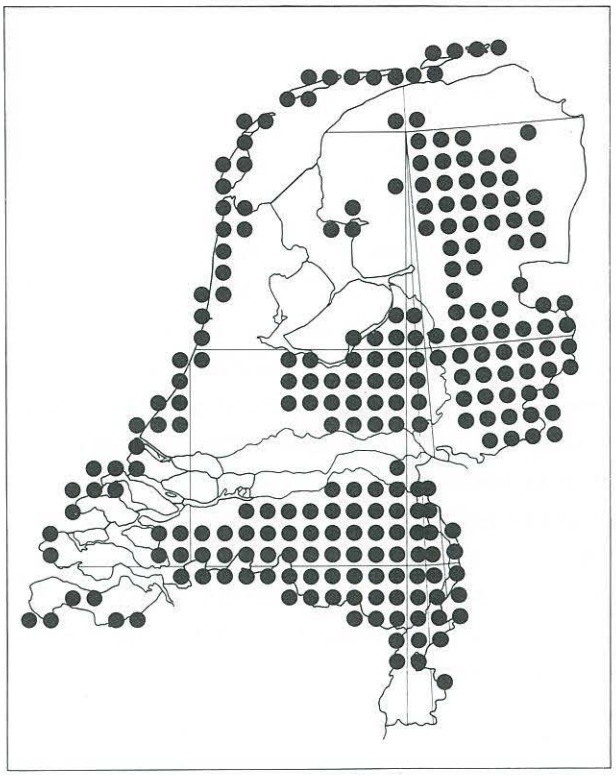


Fig. 7. Sand soils

Fig. 8. River clay soils

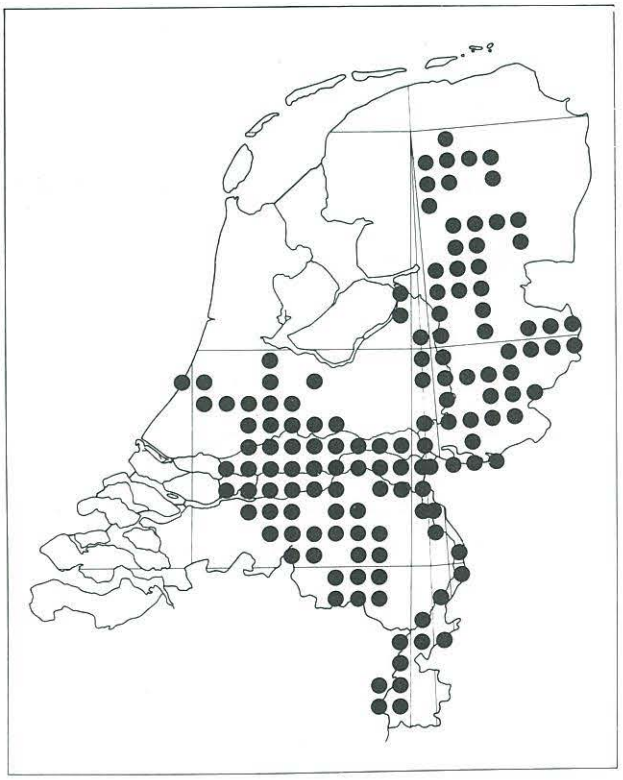
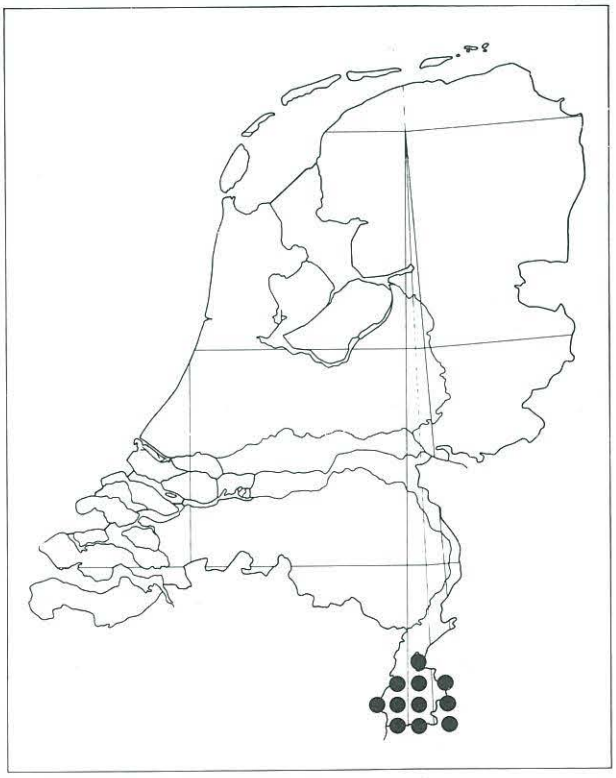


Fig. 9. Lime-stone



nium vulgare. Large parts of the dunes, having only small amounts of lime, are covered with heaths of *Calluna vulgaris* and *Erica* spp. The waters of the islands are of interest because of the considerable range of saline content present in different waters.

Along the coast of the mainland sand dunes are situated. The dunes north of the village of Bergen are poor in lime and so the vegetation is quite comparable with that of the Frisian islands. South of Bergen the sand of the dunes is rich in lime and so heaths are absent in the coastal area from the Belgian border to Bergen. There exists an interesting cline of landscapes and vegetations from the sea to the polders behind the dunes, with moving sands, lichen-heaths, brushwoods (*Ligustrum*, *Crataegus*, *Evonymus* and *Hippophae*) and forests, to the grasslands and bulb fields in the polders.

In the southwestern part the flora and fauna of the contact zone of sea and rivers, formerly in a relatively undisturbed state, are now threatened by the Delta works, making dams between the estuarine islands to protect them against overflooding by the sea. Here salt marshes with a vegetation of *Salicornia* and *Spartina* are present too.

The surface of the so-called 'veenweidegebieden', i.e. grasslands on low-peat moor, is very large and of great economic importance for cattle breeding. The meadow-bird fauna living here is of world-wide importance, although the most vulnerable species (*Philomachus pugnax*, *Tringa totanus*) are now threatened by the intensivation of the grassland culture. These grasslands are almost monocultures of *Lolium perenne* now. Investigations on the invertebrate fauna of this landscape have seldom been carried out up to now, but it is at least at the moment probably only of minor qualitative importance. This applies also to the fauna of the waters, especially the ditches in this landscape. Only on some isolated places where eutrophication did not lead to hypertrophic situations an interesting fauna is still present.

The low-peat moor has been dug off since many centuries. Now a landscape of broads with narrow strips of land (formerly used for drying of the peat) is of great biological interest, because oligotrophic and more eutrophic conditions succeed each other on a very small scale. Interesting communities of invertebrates inhabit the species-rich reedlands (with e.g. *Lysimachia thyrsiflora*, *Comarum palustre*, *Menyanthes trifoliata* and *Dryopteris thelypteris*) and the floating vegetations of the 'Cicuto-Caricetum pseudocyperus' association.

Other areas with an extensive area of grassland are situated on the clay soils in the provinces of Zeeland, Noord-Holland, Friesland and Groningen. The clay soils are further used as fields for the culture of e.g. potatoes and sugarbeets.

The situation on the sand soils is much more complicated. Up to historical times extensive forests of oak (*Quercus*) and beech (*Fagus*) were present, but due to the activities of man natural forests do no longer occur in the Netherlands. They were all cut and burned down for shifting cultivation. This had greatly diminished the surface of woods at the end of the 19th century, but during the end of the 19th and the beginning of the 20th century large new forests, mainly of pine, were planted. The fauna of these is rather well investigated because of its economic importance.

As may be expected several man-made landscapes are or were present on these soils. Of great biological importance are the heathlands (*Calluna*, *Erica*), used for farming of low intensity since many centuries. Wheat, barley and buckweat were cultivated here up to the 1940's. Most of these landscapes on soils poor in nutrients have changed now, because the use of fertilizers and the draining of former moisty soils allow the growing of high-productive grasses and -since a few years- also of maize. This is used as food for cattle in the so-called bio-industry.

From the original *Sphagnum* peat-bogs in the southern and eastern provinces only small areas are left and the peat-moor still present suffers much from eutrophication and drying out. Some characteristic and remarkable plant species were *Eriophorum* spp., *Arnica montana* and, in the

bogs, species as *Narthecium ossifragum* and *Scheuchzeria palustris*. Nevertheless the remaining parts are still of great interest, also for the invertebrates.

The southern part of the Netherlands with its lime-stone soils and hilly structure, is of local interest by its deviating flora and fauna, and since many years much collecting is carried out in this area.

Of interest, also on a European scale, are the lowland brooks and rivers of the eastern and southern provinces. They were inhabited by a characteristic fauna, which is now left in only a fragmentary status. The surroundings of these waters were of great botanical, and probably also of faunistic, importance, before the brooks were canalized and the moisty grasslands along these waters brought into culture after draining.

Other aquatic habitats have also suffered and still suffer much from intensivation of the agriculture or changes in hydrological situation, e.g. the cattle drinking pools, the springs and brooklets of the Veluwe (largely dried out now in the upper reaches), and the freshwater tide area in the former Biesbosch, which has lost its value by the Delta works preventing the tides to intrude so far.

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