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Abstract

Wetlands are distributed throughout Greenland and occur in the lowlands. They include lakes, ponds, fens, grasslands and salt marshes. The vascular plant species diversity varies among the vegetation types and declines with increasing latitude. Fens on rich soils have the highest diversity and aquatic habitats in northernmost Greenland have only a few vascular plant species. The wetlands are dominated by graminoids from the plant families Poaceae, Cyperaceae, and Juncaceae. A continuous moss cover occurs in many habitats. Salt marshes occur on silty soil along protected coastlines and include only a few species. Selected wetlands have been designated for inclusion in the Ramsar list of Wetlands of International Importance. All wetlands in the National Park in North and Northeast Greenland are protected under the UNESCO Man and Biosphere program.

Keywords

Vascular plants · Biodiversity · Low arctic · High arctic · Habitat protection

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Introduction

Wetlands are known from all the bioclimatic zones of Greenland except from the polar desert zone (Bay 1997), i.e., they are distributed from the subarctic areas in the continental fjord region of South Greenland to the continental zone in high arctic Greenland. Greenland has the longest extent of all the Arctic countries, which give rise to a variation of the species composition of the plant communities. The wetlands are mostly found in the lowlands and are classified according to the Ramsar Convention into inland wetlands: lakes, ponds, fens, grasslands, and marine wetlands, i.e., salt marshes along coasts.

Lakes and ponds are found in most parts of Greenland and play a major role in the landscape of the northern part of Greenland, e.g., in Jameson Land and Hochstetter Forland in East Greenland, Lersletten, and southern Svartenhuk in West Greenland. The submerged vegetation in shallow water is dominated by *Sparganium* spp., *Potamogeton* spp., *Callitriche* spp., and *Myriophyllum* spp. Other important common species in ponds and along edges of the lakes are *Hippuris lanceolata*, *Menyanthes trifoliata*, and *Carex* spp. Characteristic for the aquatic species is that they have their main distribution outside the Arctic (Hultén 1968).

Fens occur on wet or damp soils that never dry out during the growing season. They are common along lake and pond shores, rivers and in proximity of snow banks, and in depressions in dwarf shrub heaths. The soil is not influenced by solifluction (a gradual down slope movement of surficial material related to freeze-thaw activity), which is one of the characteristic geomorphological features of the Arctic. All types are dominated by low graminoids belonging to the plant families Cyperaceae, Poaceae, and Juncaceae. A continuous moss cover occurs in many of the types.

Grasslands are dominated by species of Poaceae and *Kobresia myosuroides* and dry out during the last part of the growing season, and they have another species composition compared to fens. They are common in continental parts of West and East Greenland.

Salt marshes occur on silty soils along protected coastlines in most parts of Greenland except in the northernmost polar desert zone (Bay 1997) and cover locally only few hundred square meters. A distinct zonation is found in all parts of Greenland determined by the influence of the salty water. The outer zone is characterized by *Puccinellia phryganodes*, which is followed on less salty soil by zones dominated by *Carex subspathacea* and *Stellaria humifusa*, respectively, and the inner zone least influenced by the salty water is dominated by *Festuca rubra*.

Wetland Type Diversity

The fresh water wetlands are subdivided into a number according to their species composition and structure. The number of species varies and is dependent on the nutrients in the soil. Generally, the species diversity is reduced, when moving to the north (Fredskild 1992). Only a few aquatic species are known from lakes and ponds



Fig. 1 Low arctic fen dominated by *Carex saxatilis* with a pond covered by *Sparganium hyperboreum* in the background. Godthåbsfjorden, West Greenland (Photo credit: Christian Bay © Rights remain with the author)

in North Greenland. In addition to the widely distributed species *Ranunculus confervoides* and *Hippuris lanceolata*, *Pleuropogon sabinei*, the only high arctic aquatic plant species, occurs in fens and ponds in the northern part of Greenland.

Fens on nutrient poor soils occur mostly on acidic soils in southern parts, whereas another type occurs on basaltic and sedimentary soils in northern Greenland (Figs. 1 and 2). Characteristic species in the low arctic southern half of Greenland are *Eriophorum angustifolium*, *Carex rariflora*, *C. saxatilis*, and *Juncus biglumis* on poor soils, whereas *C. stans*, *E. triste*, and *J. castaneus* are more common to the north. In the most nutrient rich type the species diversity is higher and characterized by *Kobresia simpliciuscula*, *C. microglochin*, and *J. triglumis*. The only woody species in the fens are *Oxycoccus palustris* and *Salix arctophila*.

Conservation Status and Management

Twelve areas have been designated for inclusion in the Ramsar list of Wetlands of International Importance (Egevang and Boertmann 2001; Ramsar 2012). The National Park in North and East Greenland is protected under the UNESCO Man and Biosphere program and includes many wetland areas. The wetland areas in



Fig. 2 *Eriophorum scheuchzeri* dominated fen in the lowland, Zackenberg, Northeast Greenland (Photo credit: Christian Bay © Rights remain with the author)

North and East Greenland are in remote areas and are presently not under the influence of humans although mining activities are expected to occur in the future, whereas some of the wetland areas in West Greenland are threatened by human activities focusing on exploiting the natural resources. The local population in West Greenland does not use the wetlands directly, but as they hunt caribou *Rangifer tarandus groenlandicus* and muskoxen *Ovibus moschatus*, they are indirectly using the wetlands. These habitats constitute important foraging areas for mammals and birds. Waders and geese are dependent on the wetlands for feeding and nesting sites during their stay in the arctic summer; ducks and divers nest in close proximity to open water in the wetlands.

Threats

Exploitation of natural resource during the last decades of the 1990s and continuing into the 2000s is a potential threat to the wetlands. Environmental investigations conducted prior to mining and oil exploitation activity have focused on locating vulnerable habitats, rare, red-listed, and endemic vascular plant species and assessing the threats to the habitats. Traffic is acknowledged to impact wetland



Fig. 3 Wetlands on the west side of Jameson Land, central East Greenland (Photo credit: David Boertmann © Rights remain with the author)

wildlife, and guidelines are outlined to minimize the impact to wetlands and other vulnerable habitats by human activities connected with exploitation of natural resources.

A decline in the population size of waders in two of Greenland's Ramsar Sites due to human impacts has been recorded (Egevang and Boertmann 2001).

The large wetland in the lowlands of Jameson Land is potentially threatened (Fig. 3) by future oil exploration. It is of utmost importance that investigations in connection with Environmental Impact Assessments are carried out prior to exploitation and are focusing on the distribution and the use of the wetlands.

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