Mires in Finland, their Utilization and Conservation

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Abstract: In Finland there has originally been 10.4 million ha of mires with a very high diversity in mire complex, mire site and species levels. Seven mire complex zones from south to north have been separated, and the vegetation has been divided into approximately 100 botanical site types using an original Finnish approach. Humid climate, flat topography and acidic bedrock and soils have favoured paludification. The Finnish mires have been very heavily utilized in forestry, agriculture and peat mining up to the Polar Circle. About 70 % of them have been destroyed as natural biotopes. 12 % of the mires in Finland have been protected as nature reserves since the 1950s, mainly in the north. In southern Finland the percentage of protected mires varies from 1 to 3 in different provinces. Recently about 12.000 ha of drained mires have been restored in nature reserves.

Key words: Finland, mire complex, utilization, vegetation.

General description of the nature in Finland

Finland is located in northern Europe between 60° and 70° northern latitude and between 20° and 31° eastern longitude. The total area of Finland is 338.000 km². 10% of the area is taken by 188.000 lakes. Of the land area forests take 60 %, mires 30 %, and cultivated areas and settlements 10 %.

The climate in Finland is oceanic-continental, clearly influenced by the Gulf stream. The mean annual temperature varies between + 5,5°C in the southwest and – 2°C in the northwesternmost tip of the country. In middle Finland the mean annual temperature is between + 1 and + 3°C centigrade. The warmest month is July with mean temperature between 14 and 18 degrees in most of the country. The coldest months are January and February with mean temperature between –4 degrees in the south and –15°C in Lapland. The duration of the growing season (+5°<>+5°C) varies between 180 days in the southwest and 100 in the northwest. The mean for the whole country is 145 days. The climate is humid. The mean annual rainfall varies between 450-500 mm in the western coast and northern Lapland, and 750 mm in the southern coast and hill areas in eastern middle Finland. The most rainy months are July and August while January, April and May are the driest. The mean duration of snow cover in open ground is 110 days in southwestern Finland and 220 days in northern Lapland. The mean for the country is 180 days. Ground frost depth in winter is about 0.5 m in western Finland, 10-20 cm in eastern Finland with a more thick snow cover, and up to 150 cm in Lapland. The soil freezes in October-November and the ground frost melts in May-June. There is only sporadic permafrost in palsa mires and the highest treeless fell tops in northern Lapland.

Phytogeographically Finland belongs to the boreal zone, which is subdivided into hemiboreal, southern, middle and northern boreal zones. In northern Lapland there are orohemiarctic areas in the fells above tree limit. Finland is also divided into ten phytogeographic regions: Archipelago on the coasts of the Baltic Sea, Oak zone, Southwestern Finland, Lake district, Southern Ostrobothnia, Ostrobothnia, Kainuu region, North Ostrobothnia, Forest Lapland and Fell Lapland.

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Fig. 1: Mire complex zones of Finland.

The Earth's crust in Finland consists mainly of Precambrian granites and metamorphic rocks. Their age is typically about 1.8 billion years. In eastern and northern Finland the bedrock is even older, 2.6-2.8 billion years. In southern Finland there are areas with younger rapakivi granite with age of 1.55-1.7 billion years. Sedimentary rocks, mainly sandstone, cover only small areas in western Finland. Their age is 1.3-1.4 billion years. Only in the northwesternmost tip of the country there is a very small area originating from Caledonic fracturing 400 million years ago. Most of the bedrock is acidic. Calcareous and ultramafic rocks take less than 1 % of Finland.

The bedrock is mainly covered by loose soils, with a mean thickness of 3-4 m. Most of the soils originate from the latest glaciation and the Holocene. The most common Quaternary deposits are glacial moraines. Eskers and other glaciofluvial formations cover some 5 % of the country, clay plains 10 %, and peat covers 30 %.

The terrain is relatively flat in Finland. The local altitude differences typically vary from 5 to 50 m. In southern Finland only in a couple of places they are up to 200 m. In the fell areas in northern Lapland there are up to 500 m local altitude differences. The maximum absolute height is 1.328 m a.s.l. in Halti fell in the northwesternmost tip of Finland. In the southern half of the country the maximum altitudes are 300-350 m. An exceptional feature is continuous land uplift up to 8 mm annually in the western coast of Finland. Because the terrain is very flat there, the shoreline continuously moves westwards causing primary paludification.

Characterization of mires, typology, terminology and classification

Due to the great number of different mires in Finland there are mires with different toponymes in landscape and in maps. In general, in Finnish language, and also in classification, the word *suo* means mire including also wet paludified forests.

The present Finnish classification of mires is based on the classical works of CAJANDER (1906, 1913). Later CAJANDER'S ideas were developed by BACKMAN (1919), AARIO (1932), PAASIO (1933) and LUMIALA (1937). TUOMIKOSKI (1942) developed the methodology of vegetation classification. The only attempts to apply Braun-Blanquet approach to Finnish mire vegetation classification were made by WARÉN (1926) and PAASIO (1941). After the II World War and the death of A.K. CAJANDER, his son A. KALELA continued the tradition of mire classification. His students RUUHIJÄRVI (1960), HAVAS (1961), EUROLA (1962) and VASARI (1962) laid the basis for the present ideas of mire classification. Also the works of HEIKURAINEN (1953) and TOLONEN (1967) added greatly to the knowledge of mire vegetation and complexes. The only rather recent works on mire classification dealt with rich fen vegetation in southern Finland (HEIKKILÄ 1987, 1991). TAHVANAINEN et al. (2002) have recently revised the concepts of mire ecology and hydrology in relation to vegetation.

Mire complexes

An individual mire or a distinct area of a larger mire area comprising a number of mire site types is called a mire complex. The original term mire complex (Moorkomplex) in the sense of CAJANDER (1913) denoted simply all the mire sites of a mire area. RUUHIJÄRVI (1983) has, however, a more narrow interpretation that mire complex is dependent upon climate and topography and this brings out very clearly the differences between the mire complexes. And more clearly, later mire complex has been determined to be a united part of the whole mire area (RUUHIJÄRVI 1988). That is equal to the term unit proposed by MOEN & SINGSAAS (1994)

In Finland there are seven zones of mire complex types from the south to the north (Fig. 1). Within each zone there is an additional east-west gradient due to the differences in the oceanity-continentality gradient (SOLANTIE 1986).

Concentric bogs

Plateau bogs form the southernmost mire complex zone in southern and southwestern coast Finland. They are typical raised bogs where the centre is elevated and

forms an even plateau with an irregular network of hummocks and hollows. The hummock ridges (kermis) and hollows form an irregular net in the plateau part of the bog. *Calluna vulgaris*, *Sphagnum fuscum* and *S. rubellum* are typical plants of hummock ridges (kermi in Finnish) and *S. balticum*, *S. cuspidatum* and *S. magellanicum* are typical plants of hollow level. Finnish plateau bogs are the nothernmost plateau bogs in Baltic area and thus they are not very typical. Many bogs are in fact partly plateau bogs and partly domed bogs (KORHOLA 1992).

Domed bogs are bogs of southern and southwestern inland of Finland. These bogs are domed in shape, and consequently, elongated hummocks and hollows surround the highest point of the bog in concentric circles (Fig. 2). The highest point can be in the middle or at the edge of the bog. Typically in some bog areas there are several concentric bog complexes/units in the same mire system. *Calluna vulgaris*, *Ledum palustre* and *Empetrum nigrum* with *Sphagnum fuscum*, *S. rubellum* and *S. magellanicum* are typical plants of hummocks and *Sphagnum majus*, *S. balticum* and *S. angustifolium* typical plants of hollows. There is also a transition zone between concetric and eccentric bogs (AARTOLAHTI 1965).

Eccentric bogs

North of the concentric bogs there is a zone of eccentric bogs or sloping bogs which have developed on a more or less sloping terrain. These bogs are mires of central part of southern Finland. Hummocks and hollows are arranged in rows perpendicular to the slope (EUROLA 1962, TOLONEN 1967) (Fig. 3). In this zone fairly dry pine-covered ***Sphagnum fuscum* bog** complexes without any regular structures are common on even terrain. Eccentric bogs are also locally found in northern Finland in the aapa mire zones in places where rivers and lakes effectively gather the spring flood waters. In addition to other dwarf shrubs, *Chamaedaphne calyculata* is a typical plant of eccentric bogs. In hollows *Sphagnum balticum*, *S. lindbergii* and *Trichophorum cespitosum* are typical.

Fig. 2: A concentric bog with large pools, Kauhaneva national park; western Finland. All photos by R. HEIKKILÄ.

Aapa mires

Aapa mire complexes are minerotrophic, and they have developed under following conditions: short summer, and long winter with abundant snow causing high and rather longlasting spring time flood from the drainage basin of the mire. This prevents the development to bog complex. This kind of conditions are typical for northern Finland, in regions where the terrain is rather flat. Some aapa mires can be found in southern Finland, too (TOLONEN & SEPPÄ 1994, HEIKKILÄ et al. 2001). Aapa mires have a string and flark pattern, where the strings are perpendicular to the slope (RUUHIJÄRVI 1960).

Fig. 3: Eccentric bogs are typical of central eastern Finland as well as the southern parts of Karelian Republic; Hyrsylä, Karelia in 1990.

Fig. 4: A southern aapamire Ritaneva in Toholampi, western Finland.

Sedge aapas

The southern aapa mire zone or sedge aapas are aapa mires of Ostrobothnia and Kainuu regions. They are relatively moist mires, where the intermediate level (lawn) predominates and sedge fens are covering the mire. *Carex rostrata*, *C. lasiocarpa*, *C. livida* and other sedges are typical. *Sphagnum papillosum*, *S. pulchrum* and *S. fallax* dominate in the ground layer. Also the low strings of these mire are sedge covered (Fig. 4). In the margins of sedge aapas, *Carex globularis* is abundant.

Flark aapas

The main aapa mires or flark aapas are aapa mires of Peräpohjola region around the Polar Circle, where aapa mires are most typical: flark fens are common and strings are high. Trees are often growing as narrow lines on strings (Fig. 5). Some of flark aapas are rather poor with *Molinia caerulea*, *Carex lasiocarpa* and *C. rostrata* with *Spagnum fallax* etc., but some are rich, with typical rich fen and flark fen vegetation. *Spagnum warnstorfii*, *S. teres*, *Loeskypnum badium*, *Sarmentypnum sarmentosum* and *Drepanocladus revolvens* are common. In Eastern Finland, where the climate is hygrically more oceanic, flark aapas have developed on hill slopes forming sloping mires. Thus sloping mires are a kind of flark aapas (HAVAS 1961), not a separate complex/unit and there is a continuous gradient between normal flark aapas and sloping aapas. Also some sedge aapas have a sloping character further in the south.

Fig. 5: An example of the main aapamire zone, Kustruotomanaapa in Sodankylä; central Lapland in the midnight sun in 1977.

Pounikko aapas

The Northern aapa mires or pounikko aapas are mires in Forest Lapland. The term pounikko means hummocks, which are treeless because of the long lasting ground frost. The ground frost also forms the shape of strings, which do not form continous lines. The high hummocks of pounikko have ombrotrophic characters. *Sphagnum fuscum* hummock vegetation is predominant. The

Fig. 6: A northern aapamire Saaravuoma in Enontekiö; Finnish Lapland.

strings form an irregular network in the centre of the mire complexes (Fig. 6).

Palsa mires

Palsa mires are the northernmost complex type within the aapa mire zone. Palsas are large peat mounds, up to 7 m high, containing sporadic permafrost. However, most of the area of mires are not palsas, but pounikko strings and aapa fens. Willows, *Salix lanata*, *S. lapponum and S. glauca* substitute the tree species on these mires (Fig. 7).

Orohemiarctic mires

Orohemiarctic and oroarctic mires are found in low alpine mountain regions. These mires have only a shallow peat layer. The vegetation consists typically of seepage flora. These mires belong to arctic mire complex / unit, which have developed outside arctic zone because of the elevation of Northern Fennoscandia fells, (in Finnish *tunturi* (compare to term *tundra*)). In the highest fell areas above 1.000 m a.s.l. there are also some polygon mires (Fig. 8).

Mire site types

Ecologically and botanically about 80 mire site types have been described in Finnish mires (eg. EUROLA et al. 1984, EUROLA et al. 1994). For the practical purposes of using mires, mainly for the draining for forestry, a simplified classification system is used (HEIKURAINEN 1986, LAINE & VASANDER 1990). The current Finnish mire-site type system, which has been developed further from the ideas of CAJANDER has been basically constructed on the basis of different ecological gradients (RUUHIJÄRVI 1983).

Mire sites have been divided according to their nutrient source into two groups: ombrotrophic and minerotrophic. Secondly, mire types are arranged in the classification system from the driest to the wettest (Fig. 9). The vast majority of the mire site types are minerotrophic. Some mire site types are between poor minerotrophy and ombrotrophy. In fact in some cases a site type can be minerotrophic or ombrotrophic. Minerotrophic sites are arranged from oligotrophic to mesotrophic and eutrophic (EUROLA et al. 1984), but because it is actually question about increasing base content and not nutrients like phosphorus or nitrogen in the gradient, we prefer using terms poor, intermediate and rich. Mire sites have been divided also according to mire margin effect, from forested marginal types to the treeless types of the mire expanse. The mire margin site types are ecologically one group (Fig.

Fig. 7: In the lowlands of northernmost Lapland there are palsa mires

Fig. 8: A meltwater mire with a very thin peat layer in Enontekiö; northern Lapland approximately 900

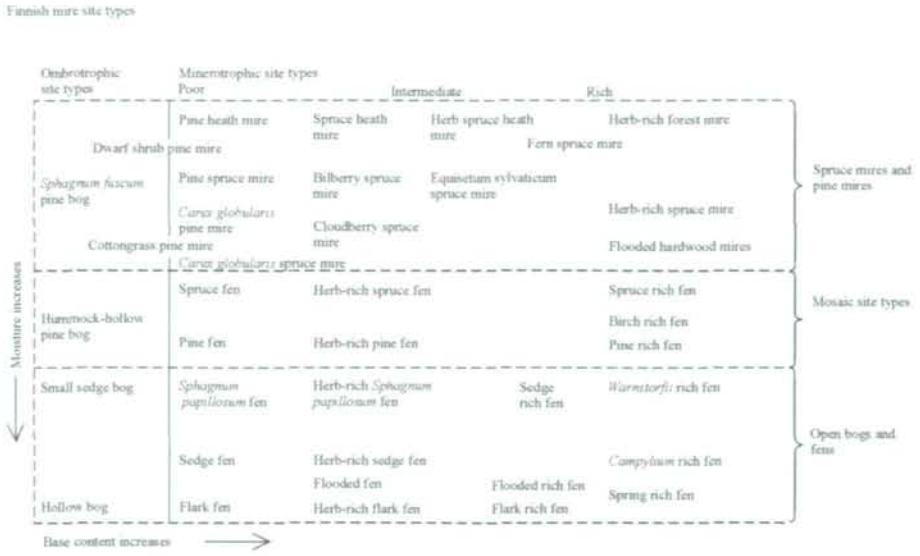

Fig. 9: The main Finnish mire site types in relation to moisture and pH.

Fig. 10: A *Rubus chamaemorus* spruce mire in Juortanansalo mire reserve in Kuhmo; eastern Finland.

Fig. 11: A rich birch fen in Kaakkurinneva mire, western Finland.

10) and the mire expanse types second group. The sparsely forested combination site types also form a considerable, but heterogenic, group (Fig. 11).

The extent of mires and their utilization

Finland's original mire area has covered a total of about 10.4 million ha (ILVESSALO 1956), representing about one third of the country's entire land area. The term mire covers here also all wooded, but paludified habitats. Thus some of the mires have been also forest with fairly good timber production and a greater deal of mires have been sparserly wooded with poor timber production and the rest of the mires have been open. In geological sense (> 20 ha > 0.3 m) the area of mires has been about 5 million ha (LAPPALAINEN & HÄNNINEN 1993). In northern Finland, in the northern and middle boreal forest zone there are areas where more than 60 % of the land area has been covered by mire vegatation, while in some southern parts of Finland the proportion of mires has been under 10 % of land area. Reasons to this are differences in both climate and topography of the landscape (RUUHIJÄRVI 1988).

In the 1950s, spruce mires have covered 26 %, pine mires 46 %, open bogs and fens 27 %, swamps 1% and rich fens 0.4 % of pristine mires (ILVESSALO 1956). In late 1980s the percentages were 18 % for spruce mires, 35 % for pine mires, 45 % for open bogs and fens, 2 % for swamps and 0.01 % for rich fens (EUROLA et al. 1991). Between these two studies about 50% of the mires were drained for forestry, and for example the amount of rich fens in late 1980s was only 5 % of the amount in early 1950s.

The first ways to use mires were hunting (Fig. 12) and picking berries (Fig. 13). Mires were also, especially in fertile sites, used as pastures for cattle (Fig. 14). Formerly many

Fig. 12: About half of Finland's 300.000 hunters shoot ducks in mires. Selkäsaarenneva mire; western Finland 1975.

Fig. 13: Professor Pekka Isoviita and students of Sphagnum field course picking cranberries in Lamminjärvi mire, southern Finland in 1981.

Fig. 14: Merlampi rich fen in eastern Finland in 1989. Cattle was still grazing in the mire, but now this kind of mire use has ceased.

Fig. 15: An old basis for a haypile in Näätäneva mire, western Finland in 1982. Up to 1950s more than 1 million ha of mires was used for haymaking, but this use ceased in the 1960s.

mires - particularly in northern Finland - have been used for collecting winter fodder for livestock. In many areas most of the open mires, growing sedges and grasses have been used as mire meadows (Fig. 15). This kind of activity is now history. The long tradition ceased in 1950s, as well as domestic peat harvesting for cattle litte (Fig. 16). This traditional use has not destroyed mires. Instead, there is evidence, that the management has favoured rich fen vegetation.

The modern utilization of mires has been has been much more intensive in Finland than in other northern regions in the world. Forestry, agriculture and peat harvesting have in general destroyed original mire habitats, and hence also the fauna and flora. Forestry is an important industrial sec-

Fig. 16: Traditional domestic litter peat uptake in Vesineva mire, western Finland in 1982. The last case documented in Finland.

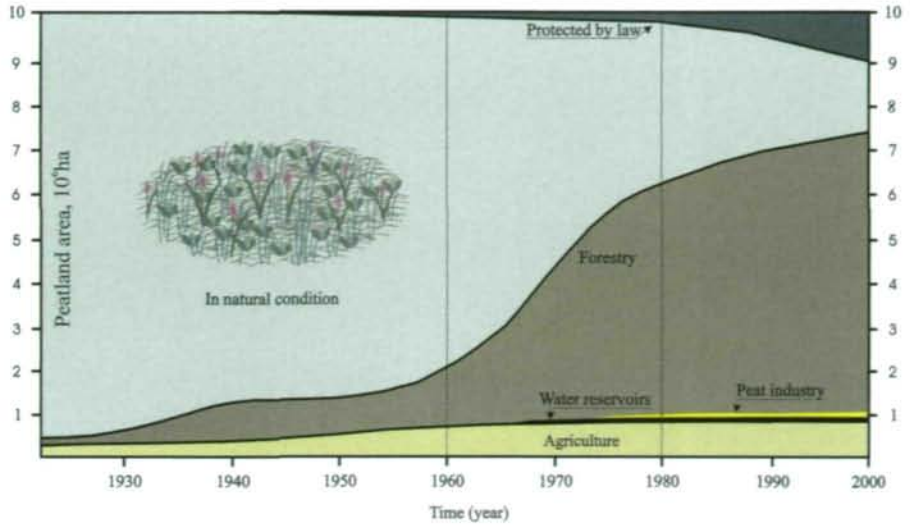

Fig. 17: Utilization of mires in Finland from the year 1920 to 2000.

Fig. 18: Forestry drainage in Karhukangas mire, western Finland in 1983 six years afted the ditching. Approximately 30% of mire drainage in Finland has been non-productive like in this case.

tor in Finland and pristine mires have been regarded as a valuable resource for forestry. Therefore, large areas of mires have been drained for forestry purposes, covering a total of 5.9 million ha of former mires (Fig. 17). Thus, Finland has carried out the most extensive programme of mire draining in the world, being most active in 1970 s, when almost 3.000 km^2 of mires were drained annually (Fig. 18, 19). Up till now, draining of pristine mires has almost ceased, and most activities are concentrated on the maintaining of ditches in peatland forests. As a part of peatland forestry, forestry roads have covered about 35.000 ha of mires (LAPPALAINEN & HÄNNINEN 1993). Forestry drainage has caused a major leaching of humic substances to watercourses, and in some cases in sandy soils also considerable erosion (Fig. 20).

The agricultural use of mires has reduced the mire area by about 1.2 million ha. Especially rich fens and fertile spruce mires, and their specialized fauna and flora have disappeared (HEIKKILÄ 1992). The activity of peatland agriculture was great in 1950s and 1960s. At present there are only few activities to establish new areas for peatland agriculture. Instead, some 85 % of these fields have been abandoned and some of them have been converted to peatland forests.

Peat mining is now increasing rapidly in central parts of the country. About 662.000 ha have been reserved for future peat mi-

Fig. 19: A monotonous pine stand in a mire 20 years after ditching for forestry. Olvassuo mire, central Finland. Nowadays restored.

Fig. 20: Erosion of sand in the esker Pohjankangas caused by the forestry ditching of an adjacent mire. Altogether 100.000 m? of sand was washed into a nearby lake.

Fig. 21: A peat mining area in Naattisuo mire; southern Finland.

ning, but at the moment some 100.000 ha have been taken in peat mining (LAPPALAINEN & HÄNNINEN 1993) (Fig. 21). Some large mire areas have been drowned in water reservoirs (60.000 ha).

At present, practically the only peat forming mires are those, which are in natural state. Forestry draining destroys the peat forming vegetation and the accumulation of organic material is the result of tree growth. At the same time surface peat decomposes. Nearly 70 % of Finnish mires have been used by forestry, peat harvesting, agriculture and as water reservoirs. Due to this, a great deal of mire site types are nowadays endagered and many species of plants, animals and fungi have disappeared from large areas (HEIKKILÄ 1990, RASSI et al. 1992, 2001) (Fig. 22).

The area covered by peat is still about 9 million ha. This includes pristine mires, peatland forests and fields on peat soil. About 1 million ha of mires have disappeared, to water reservoirs, to roads, and by transforming thin-peated mires to mineral soil fields and forest habitats after drainage.

Threats for mires

There are several rare mire vegetation types, e.g. remaining rich fens, which are in danger of being destroyed in the near future due to drying up because of ditchings in the surroundings. Mire margins are still generally threatened due to loggings in wooded sites, followed by soil treatment, which in many cases is ditching (Fig. 23). Many undrained, but still vulnerable, marginal site types, such as spruce mires are often valuable for many old forest species, which have also become endagered. These spruce mires are ecologically fire refugies (PÖNTYNEN 1929, SJÖBERG & ERICSON 1992) with special fauna and flora. The mosaic landscape of mires and forests has been characteristic for the Finnish nature. Most of that has been destroyed by forestry drainage. The re-

Fig. 22: Saxifraga hirculus is a rare protected plant of rich fens and springs in northern Finland.

Fig. 23: A threat for mire margins today is driving with heavy machines in connection with forest logging. Kuhmo; eastern Finland.

maining fragments of this kind of landscape mosaic should be protected. Also the value of successional series of land uplift mires has been realized only recently, and the remaining few sites are still threatened by forestry (HEIKKILÄ 1995).

There have been great changes in the ideology of forestry during the last few years (e.g. KORHONEN 1994). The drainage of pristine mires for forestry is not any more supported by the state, but still especially mire margins are in danger, because they are often destroyed in connection with the maintaining of old ditches of drained areas.

Peat mining is still growing in Finland, and new mires are needed. There have been agreements between environment administration and ministry of trade and industry about which mires should be protected, and which to be used for peat mining. By time the situation has changed, and a re-evaluation has been made in the 1990s. However, there are still a number of valuable mires for protection, threatened by peat mining.

Mire conservation

Rich fens and fertile spruce mires were rather early found to have decreased due to agriculture and forestry, and their protection was considered to be important to protect the diversity of plants (e.g. KUJALA 1939). ISOVIITA (1955) was the first to pay attention to the disappearing of pristine raised bogs, and to emphasize the protection of them. In 1956, strict nature reserves of Vaskijärvi, Häädetkeidas, Runkaus and Sompio were established to protect good examples of raised bogs and aapamires for scientific purposes.

The first mire conservation plans were made in the 1960s when forestry drainage of mires expanded enormously. The plans covered 180.000 ha of state-owned mires, mainly large mire complexes in northern Finland (HÄYRINEN & RUUHIJÄRVI 1966, 1969). Special attention was paid to mire complexes and bird fauna. During the work it became clear that especially in southern Finland also mires in private land must be protected to preserve the diversity of mire ecosystems.

In 1970s a plan for the development of the network of national parks and strict nature reserves, including many of the most valuable mires was prepared in the environment administration (TALLGREN et al. 1976). Simultaneously a nationwide mire conservation programme was compiled (HAAPANEN et al. 1977, 1980, RUUHIJÄRVI 1978). In these programmes, the goals were to preserve the diversity of mire complexes, mire site types, vascular plants and birds, as well as to form a comprehensive network of reserves. The bird fauna as well as representativity of mire complexes and number of site types were given scores to help choosing mires to be protected, but these values were not used quantitatively due to the unevenness of the huge material from over 2000 mires. The main idea was to protect typical and large examples of mire complexes, but attention was also paid to small mires, especially rich fens. The first lists of threatened mire site types and vascular plants in mires were also compiled (RUUHIJÄRVI 1978).

In 1990s many mires have been included in old-growth forest reserves. They are typically spruce mires and pine bogs forming a mosaic landscape with mineral soil forests. Almost all mires included in different conservation programmes have been included in the Natura 2000 programme of the European Union. In addition to that, 180 new mires were included, mainly rich fens and other fertile habitats, on the basis of a proposal by HEIKKILÄ (1995).

The estimated amount of existing pristine mires is about 3.5 million ha, most of this in northern Finland. The total area of protected mires is about 1,1 million ha (AAPALA et al. 1995). In southern Finland pristine mires can be found practically only in areas which are protected or planned to be protected.

The National Mire Protection Programme (NMPP), which the Government of Finland approved in 1979 and 1981, contains 600 sites proposed for preservation, covering a mire area of about 500.000 ha. The area proposed for preservation corresponds to about 5 % of the original mire area of the country. In addition, national parks and strict nature reserves contain some of the most noteworthy mire areas, and these nature reserves cover about 200.000 ha of protected mires.

The Wilderness Act approved in 1991 protects about 300.000 ha of mires in the northernmost part of Finland. Even though there was no direct threat to these mires, it is important that it is not allowed to construct roads in the wilderness areas, which is important for nesting birds.

The basic aim of the National Mire Protection Programme is to maintain and to preserve the original water table as well as the original flora and fauna. Public funds cannot be used to drain areas included in the programme. The fact that certain areas are included in the programme provides a safeguard against the planning and implementation of other government projects that might destroy or endanger the conservation of these areas.

The most suitable habitats for mire birds are extensive, wet and often unforested mires. Viable bird populations can only be retained if the protected areas are large enough and form a sufficiently dense network, allowing for the intermingling of different populations (LEIVO et al. 2002).

The state-owned mire areas are to be protected as mire reserves under the Nature Conservation Act (71/23) by specific acts or decrees, depending mainly on the sizes of the areas. At present, two acts and one decree stipulate the conservation of altogether 173 areas covering a total of 403.000 ha, of which about 300.000 ha is mire. The most important aapa mires and the most extensive state-owned mire areas have by now been protected in the northern part of Finland, if we take account into the national parks, as well.

The main method for protecting privately owned mires is to purchase these areas from the owners for nature conservation purposes. Some mire areas have also been acquired by means of expropriation, when optional acquisition has not brought about the results desired. Expropriation is sometimes preceded by prohibition to exploit the area. Sometimes it is possible to get private owners to protect voluntarily their mires. Thus county boards have at present protected by their own decision some 8.000 ha of the privately-owned mire areas included in the National Mire Protection Programme.

Altogether some 120.000 ha of mire areas included in the National Mire Protection Programme have been acquired by the state. This means that about two thirds of the required acquisitions have been implemented. The rate of implementation, however, is too slow in regard to conservation purposes as well as from the point of view of private landowners.

Present Forestry Act and Nature Conservation Act contain specially protected site types, which typically are small in area: springs, seepage areas, rich fens, fertile spruce mires and *Alnus glutinosa* swamps. In addition, if a site does not meet the demands of the above mentioned acts, but is however locally or regionally a valuable habitat, the forest owner should preserve its characters according to the guidelines of good forestry practices (MERILUOTO & SOININEN 1998).

Management problems

As the National Mire Protection Programme cannot be implemented with sufficient speed, the draining of privately owned mires to be conserved has been quite common. The restoration of the water table in the drained areas through damming and blocking ditches creates a great deal of work and increased expenditure. The development of the methods of mire restoration work has been started in many mires (HEIKKILÄ & LINDHOLM 1995). National guidelines for restoration have been prepared in a working group in 2002 (LINDHOLM 2002). So far, 12.000 ha of mires have been restored in nature reserves, largely with support from EU LIFE foundation (Fig. 24, 25).

The maintenance and use of mire reserves are also needed for specific activities. They include research on the areas and monitoring of their state. The regulations define the general principles to be applied and contain instructions on the drafting of regional plans for maintenance and use. Plans should also be tailored to special sites such as old forests required for conservation, bird nesting places, habitats of rare plants and so on. Moreover, the traditional rights of the local people to have reindeer husbandary, to fish, and to hunt, should be taken into account, to some extent. Some

Fig. 24: Löytösensuo rich fen in Sotkamo, eastern Finland. The mire was drained for forestry in 1976 and restored in 1996. In the snowmelt flood period one can see that the dams should be longer to spread the water evenly in the mire.

mires reserves are provided with information stands, nature paths, and observation towers for the general public to enjoy the mire nature. All mires in reserves are normally open to public to visit, with the exception of the nesting periods of mire birds and in the case of mires of strict nature reserves.

Zusammenfassung

Moore in Finnland, Nutzung und Naturschutz – Ursprünglich gab es in Finnland 10.4 Millionen ha Moore mit einem großen Reichtum an verschiedenen Moorkomplexen, Moortypen und Arten. Von Norden nach Süden wurden insgesamt wurden sieben Moorkomplexzonen ausgeschieden und unter Verwendung eines originär finnischen Ansatzes etwa 100 verschiedene botanische Standortstypen beschrieben. Grund für diesen Reichtum an Mooren ist ein humides Klima in Kombination mit der flachen Morphologie und saurem Untergrund, die alle eine Versumpfung fördern. Etwa 70 % der finnischen Moore wurden durch Entwässerung für die Landwirtschaft, Aufforstungen und Torfabbau weitestgehend zerstört, aber immerhin auch 12 % seit den 1950er Jahren unter Schutz gestellt. Allerdings bewegt sich der Anteil an geschützten Objekten im Süden Finnlands je nach Provinz nur zwischen ein und drei Prozent. In den verschiedenen Naturschutzgebieten wurden in jüngster Zeit etwa 12.000 ha Moorflächen regeneriert.

Fig. 25: A spruce mire drained for forestry in the 1960s and restored in 1996. Soukonkorpi mire, Liesjärvi national park; southern Finland.

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