1[4th] International Peat Congress

Extended abstract No. 379

STATUS AND CONSERVATION VALUE OF PEATLAND FORESTS IN ESTONIA

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SUMMARY

In 2007-2009 some 400 peatland forest sites were studied outside nature protection areas aimed to distinguish natural mire forests valuable by their state. Most of natural peatland forests are lost thorough extensive melioration in 20th century and only a small fraction (ca 10-15 %) of previously widely distributed mire forests are still on favorable conditions today. Larger portion of “well-looking” mire forests have secondary origin developed from open mires influenced by weak or moderate drainage. Previous pristine mire forests have degraded and transformed mostly to drained peatland forests.

KEY WORDS: peatland forest, mire, drainage, conservation value, Estonia.

INTRODUCTION

Complete inventories of vegetation in Estonia were made in the 1930s-1950s (Laasimer, 1965). This study reflects the state and distribution of mires before extensive mechanized drainage of mires in second half of 20th century. Up to 1950 the area of mire peatland forest was some 435 000 ha of which 136 000 ha belonged to bog woodlands (bog pine forests), 151 800 ha to transitional (mixotrophic) mire forests, 107 000 ha to minerotrophic swamp forests with stagnant water and 40 000 ha to minerotrophic swamp forest with moving water. Present estimations of natural and near-natural mire forests total area is ca 68 000 ha. Consequently, only the fraction (ca 15 %) of natural peatland forests initial area remains.

The state and conservation value can be understood through certain parameters of a forest community itself (structure and species composition of the stand and its understory). Alternatively, the state can be assessed through habitat parameters like water level depth, certain characteristics of soil and peat. Indicators of human impact and disturbances (density and depth of drainage ditches, historical data etc.) carry indirect information about probable state and ecological conditions of the sites. (Palo *et al*, 2011)

The aim of the inventory was to find maximum number of still natural peatland forest sites outside the earlier inventoried areas and nature protection areas network. The main task was to find larger undrained (with still natural water regime) and forested areas on peat soils where the age and spatial structure of tree stand are characteristic for natural forest. Withou direct data about natural state of these areas we combined several indirect indicators to search potentially valuable sites.

The objective of the paper was to assess the ecological state and conservational value of peatland forests on unprotected areas. We tried to reveal the relations with environmental and stand parameters and estimated the conservation value index. The representativity and usability of complex parameter “conservation value index” and main trends in peatland forests “human-mediated” succession are discussed.

MATERIAL AND METHODS

Search and selection of inventory sites

We used MapInfo Professional GIS software and combined Estonian Basic Map, hi-resolution aerial photographs, Estonian Soil Map, forest site type maps of Estonian Forest Registry, maps of protected areas, maps of previous inventories for the selection of potential sites. The first selection contained ca 2300 sites. Result to the following screening of preliminary selected sites some 1900 sites were eliminated and some 397 sites remained.

Field analyses and sampling

On every selected site height of tree layer, diameter and age structure of trees were recorded, also the abundance of deadwood registered. Natural state and intensity of human impacts estimated for the forest habitat using criteria like representativity, structure and functioning of habitat. Conservation value index as integral parameter composed on the base of these estimations of habitat natural state. Methods of inventory and assessment of Natura 2000 habitate types were used.

Piezometers were used for water level measurements and pore water sampling. Water samples were taken to the laboratory, kept at room temperature for 24 h, and pH and electric conductivity were measured. Peat samples for bulk density and ash, N and P content were taken from each reveal from the depth 2-7 cm (living moss layer previously removed, if this existed). Cylinder with volume 74,4 cm^2 were used for peat volumetric sampling. Peat type, degree of decomposition and botanical composition were roughly identified on the field.

RESULTS AND DISCUSSION

Distribution of types and state of inventoried peatland forests

Estonian mire forests are grouped into five site types (Paal, 1997) (Table 1). Of the selected 397 sites about 1/3 or 38 % by area belonged to heavily drained peatland forests. In undrained or less drained conditions was only 35 % (32 % of total area) of selected “presumably natural” areas of which the most common peatland forest types occurred to be ombrotrophic bog forests and minerotrophic swamp forests with stagnant water. Less frequent types were transitional mire forests and minerotrophic swamp forest with moving water. Distribution of the natural peatland forest types was rather presumable and reflects natural distribution of the types.

The smaller area of the minerotrophic mire forest sites point out that these are preserved as small fragments or located in specific geomorphologic and hydrologic conditions, like closed valleys, where drainage was difficult.

Table 1. Number and area (ha) of inventoried sites according peatland forest type.

	Ombrotrophic bog forest	**Transitional mire forest**	**Minerotrophic swamp forest with stagnant water**	**Minerotrophic swamp forest with moving water**	**Drained peatland forest**
No of sites	84	42	93	23	73
Total area, ha	2584	1225	1968	476	3768
Mean site area	30.8	29.2	21.2	20.7	51.6

Distribution of conservation value index between peatland forest types indicated lowest values for "drained peatland forests" and highest values for "minerotrophic swamp forests with mowing water" (Fig. 1). Other types varied according proportion of grades (A, B, C, D), but average value did not differ significantly.

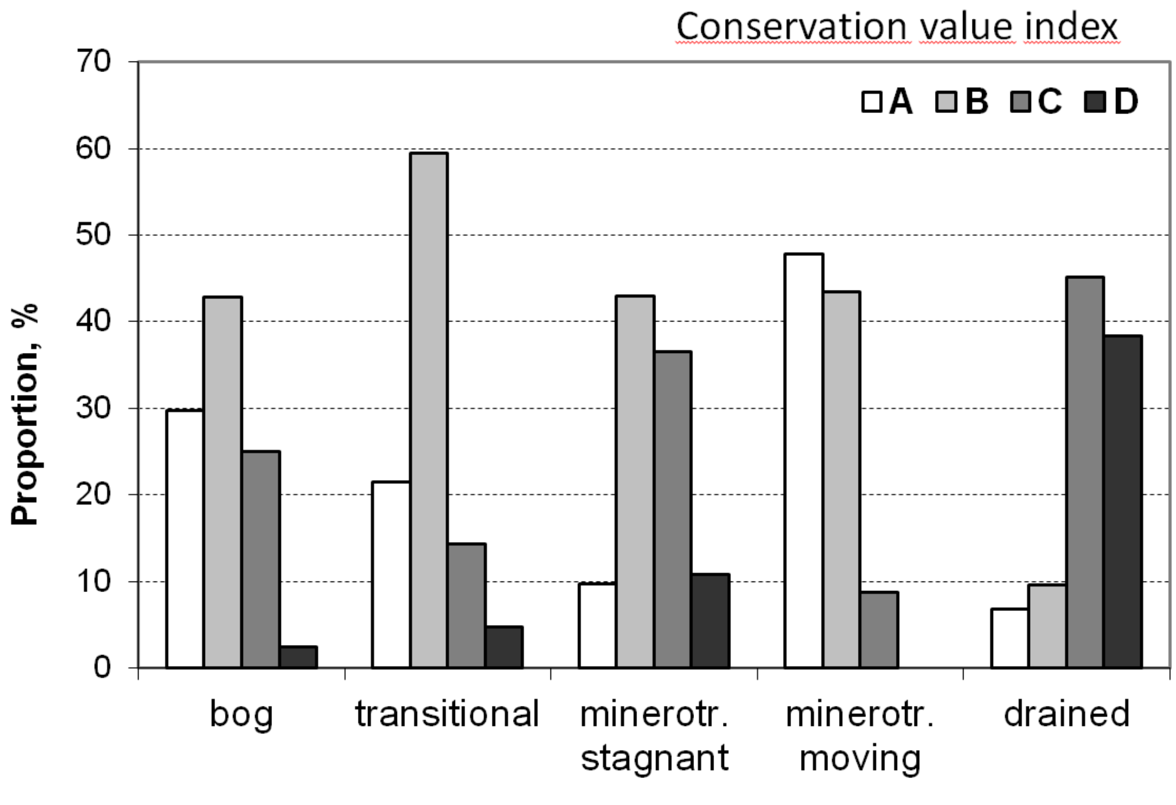

Figure 1. Distribution of peatland forest types (in % of 397 sites studied) by their conservation value index (A – very good, B – good, C – moderate or degrading, D – degraded).

Large proportion (30 %) of drained peatlands in the inventory selection indicates low predictability of mire ecosystems state and human impacts strength through the indirect indicators (maps, orthophoto). Results from the field work revealed that natural state and conservation value from the map information were often overestimated and human impacts were often underestimated. The results indicate site specific character of the range of drainage impact. Another reason of the low predictability is poor map information – older handcut ditches are often not shown in the current Estonian Base Map. Therefore many areas that expected to be undrained were actually drained. It appeared that forest cover (tree layer density) is a valuable remote indicator for natural state of the mire forest sites. Most natural and valuable sites have tree cover 30-40 %. Tree cover over 50% reflects in most cases impact of drainage. Exception of this is the alder swamp forests which have naturally denser tree cover.

Peat characteristics

The quality of mire water (water level depth, pH and electric conductivity) in different mire forests types was weakly related with their conservation value index. Peat physical characteristics like degree of decomposition and bulk density were related to ecological state index and reflected the drainage intensity and state of communities. Deep and long lasting drainage resulted in water table drawdown, inhibition of peat accumulation, accelerated organic matter decomposition and compaction of peat soil. The outcome is highly decomposed peat soil and higher bulk density (Paavilainen *et al*, 1995; Laine *et al*., 2006). Peat bulk density and ash, nitrogen and phosphorus volumetric content were among natural types highest in minerotrophic swamp forests with moving water, followed by swamp forests with stagnant water. Lowest values had ombrotrophic bog forests. The results were expected and to the trophic gradient. High values of the parameters in drained peatland forests are probably caused by secondary decomposition and mineralization processes in drained peat (Paavilainen *et al*, 1995; Laine *et al*., 2006).

Table 2. Characteristics of peat in peatland forest types.

	Ombrotrophic bog forest	**Transitional mire forest**	**Minerotrophic swamp forest with stagnant water**	**Minerotrophic swamp forest with moving water**	**Drained peatland forest**
Bulk density	0.099	0.103	0.119	0.166	0.156
Ash content	3.90	6.68	13.66	18.80	18.89
N %, volume	0.093	0.141	0.282	0.338	0.249
P %, volume	0.0046	0.0062	0.0120	0.0154	0.0182

The uppermost (0-20 cm) layer of peat deposit reflects the recent history of the studied peatland sites. In many minerotrophic mire forest sites with stagnant water and bog forest sites the topmost peat belonged to sedge or *Sphagnum* type respectively. Most part of mire forests in good state are of secondary origin, expanding on earlier open bog or fen sites, promoted by moderate drainage and ceased mowing and grazing. In drained peatland forests the peat deposit was formed by woody peat indicating that these sites were mire forests already before intensive human impacts (Fig 2).

It may be concluding that some 20-30% of all remained mire forest types are still in pristine or near-natural state. Particularly, less than 10% of minerotrophic swamp forests and transitional bog forests are in near-natural state.

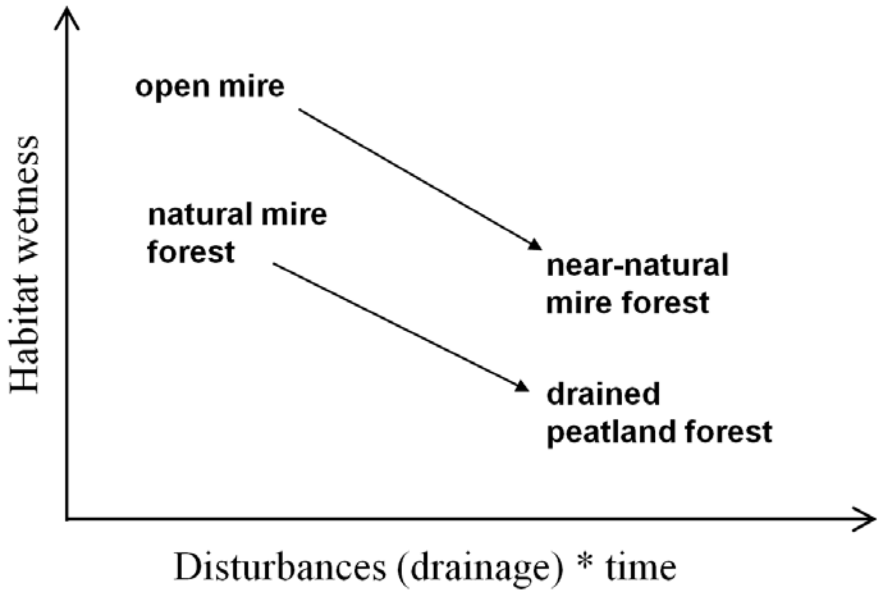

Fig 2. Principal scheme of human mediated succession of mire communities

The conservation value index used for estimation of natural state of peatland forest does not reflect the value of certain environmental and community parameters very well. The index rather reflects the "imagination of expert how much the site represents pristine community" and takes into account various measured or estimated parameters: composition of plant and moss cover, presence of characteristic and indicator species, stand structure, tree growth and form, old forest indicators, moisture conditions, presence of various disturbances etc. Conservation value index is useful as a simple indicator for inventories and management planning, but does not allow for deeper ecological conclusions.

REFERENCES

Laasimer, L. (1965). Eesti NSV taimkate (Vegetation of Estonian Soviet Republic). Valgus, Tallinn.

Laine, J., Laiho, R., Minkkinen, K. and Vasander, H. (2006). *Forestry and boreal peatlands. Boreal Peatland Ecosystems, Ecological Studies* **188**, 331-357.

Paal, J. 1997. Eesti taimkatte kasvukohatüüpide klassifikatsioon (Classification of Estonian vegetation site types). Keskkonnaministeeriumi Info- ja Tehnokeskus, Tallinn. 297 p.

Paavilainen, E. and Päivänen, J. (1995). Peatland Forestry*:* Ecology and Principles. *Ecological. Studies* **111**. Spriger-Verlag, Bedin Heidelberg, Germany, 248 pp.

Palo, A., Hoder, D., Liira, J. (2011). Re-evaluation of stand indicators for the assessment of the representativity status of the Natura 2000 habitat type forests. *Estonian Journal of Ecology* **60**, 3, 209-224.