



Revegetation processes in abandoned peat production fields in Estonia

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Summary

About 100 abandoned peat production fields for a total area of 10 000 ha are in need of after-use management in Estonia. Just a very small part of this area has been afforested or is used for growing berries. Due to an unfavourable water regime, natural revegetation processes are generally very slow. Effective measures have to be taken therefore to reclaim these fields, beginning with regulation of the water level. In the course of the inventory of the abandoned milled peat fields, several moss species new or rare in Estonia were identified (*Polia elongata*, *Ephemerum serratum*, *Campylopus introflexus*).

Key index words: abandoned peat production fields, revegetation, peat resources, Estonia

Introduction

Peat extraction is a long tradition in Estonia. At the end of the 18th century when most forests had been depleted, peat started to be used more extensively as fuel by industrial enterprises and households. Around the middle of the 19th century, peat began to be used as litter. For this purpose, 14 000 ha of mires were rented out to cooperatives and farmers before World War II. Peat was extracted in open fields largely by hand, but after the war, the work was gradually mechanized. In the 1950s, peat milling extraction method was introduced, which has by now become the main extraction process used in peat production. The area of milled peat fields grew rapidly, reaching about 25 000 ha in 1971. The peat production amounted to 2 to 2.5 million tonnes per year. With time, the peat fields became gradually exhausted and by the beginning of the 1990s the area of milled peat fields stabilized at about 15 000 ha. The annual average peat production was then 1 to 1.2 million tonnes. In recent years the area of peat fields rented out by the state has increased to almost 20 000 ha, but the production volume has not grown.

As a result of the processes described above, nearly 100 abandoned milled peat fields with a total area of about 10 000 ha are found in Estonia. Almost all of these fields are located on state-owned land and therefore the Ministry of the Environment of Estonia has initiated an inventory to evaluate their present conditions.

The aims of the inventory are:

- registration of all abandoned peat production fields;
- assessment of the state of vegetation, peat deposit, water regime and the drainage system;
- making recommendations for further use of these fields.

Methods

The inventory started in 2005 and is planned to be completed in four years. During the first three years the work was completed in 12 counties of Estonia; in 2008 the remaining three counties of South-east Estonia will be covered. Prior to fieldwork, the data available on the geological structure, hydrological conditions, properties of the peat deposit, mining period and production volume of the abandoned milled peat fields located in the study areas were examined. In the course of fieldwork, the surveyed milled peat fields are photographed, the vegetation of different parts is described (coverage by different layers, species composition), plant samples are collected for later identification, and the state of the drainage system and surface water level are assessed. At single points (on average one point in 10 ha), the thickness of the peat deposit is measured and the botanical composition and decomposition degree of peat are determined visually. Samples for general analysis of peat (botanical composition, decomposition degree, ash content, acidity, moisture content) are taken at 0.5 m intervals at one point in each homogeneous area. The boundaries of the areas are detailed using the GPS and a map.

During these field surveys and by recommendation of the Ministry of the Environment, the peat fields located on the territory of the operating mines are also checked, to evaluate the state of occurrence of near exhausted peat fields.

Results

The results of the inventory show that the abandoned peat production fields of Estonia differ considerably in term of thickness of the peat deposit, hydrological regime and vegetation. The area of the former litter peat production fields ranges from a few tens to 200 hectares and the average



thickness of the residual deposit is 1.5 to 2 m. The upper part of the deposit usually contains a 0.5 to 1 m thick layer of poorly decomposed bog peat. The fields where peat is extracted for making briquettes are much larger and the peat layer is on average 0.5 to 1 m thick.

Peat is treated in Estonia as a renewable mineral resource, with the annual production quota of 2.652 million tonnes. This quota is already wholly covered with mining permits and therefore the issue of new permits has been stopped. One aim of the inventory is to find out which of the abandoned milled peat fields are best suited for restarting mining and to estimate the peat reserves that could be distributed to mining enterprises in addition to the present quota. According to preliminary results, the resources of Estonian abandoned peat fields make up 13 million tonnes for an area covering 10 000 ha. Considering economic, technological and environmental aspects, 8 million tonnes (2.5 million tonnes of poorly and 5.5 million tonnes of well decomposed peat) on 2000 ha would be suited for mining. This is a small amount in comparison with the reserves of 79 million tonnes of the presently operating mines. Before possible extraction of the new reserves, geological investigations and assessment of the environmental impact of mining have to be performed. It may turn out that actually the area suitable for restarting mining is even smaller.

Most of the peat production fields were abandoned 20 to 30 years ago in the Soviet period. At that time there was no legal obligation for mining enterprises to reclaim the areas destroyed by mining, therefore only a very small part of the exhausted peat fields has been restored (in earlier years by afforestation, recently also by growing berries). Restoration of wetlands has been a topical issue only during the last two years and just a few attempts have been made in this direction. Thus, the revegetation of Estonian abandoned peat production fields is mostly the result of natural processes. In addition to such factors as the thickness of the peat deposit, properties of the upper peat layer, and size and topography of the area, the water regime is of primary importance in influencing the outcome of spontaneous regeneration. The optimum condition is permanently high (0.2 to 0.5 m below the ground surface) groundwater level, permitting successful revegetation of the fields within 10 or even less years.

The vegetation of these areas is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*); the tree layer is weakly developed. Shrubs (heather, bog whortleberry, crowberry) occur mostly in the vicinity of ditches. Peat mosses (*Sphagnum cuspidatum*, *S. balticum*, *S. rubellum*, *S. majus*) grow practically only in ditches. Single clumps are found in depressions where surface water level is 0.1 to 0.3 m below the ground level. Some abandoned peat fields have turned into heath-like areas with heather coverage of 40 to 60%. There the average groundwater level is 0.5 m below the ground surface during the growing season and only relatively small part of poorly decomposed bog peat has been extracted.

In most of the Estonian abandoned peat production fields, water table lies at 0.5 to 1.0 m from the ground level. In the vicinity of large ditches and roads used for peat

transport, it is even deeper. Such conditions are not very favourable for the growth of plants and thus several areas practically lack vegetation even 20 years after the mining has stopped. Still, sparse vegetation covering 10–20% of the area has developed in the majority of fields. The tree layer is represented mainly by birch (*Betula pubescens*), which first grows in strips on the slopes of ditches but afterwards spreads all over the area. Later birch is supplemented by pine (*Pinus silvestris*). The grass layer is generally dominated by hare's-tail cottongrass, whose frequency usually diminishes with the development of the tree layer. This results from deterioration of light conditions and lowering of surface water level on account of the water transpired by trees. In several abandoned peat production fields there are found large clumps of common cottongrass (*Eriophorum angustifolium*). The areas with a thin peat deposit are often lacking the poorly decomposed peat layers which then favor the establishment of grasses (*Calamagrostis canescens*, *Calamagrostis epigejos* and *Festuca rubra* and at moister sites *Phragmites communi* and *Molinia caerulea*). The moss layer is usually thicker in the areas with higher topography and near ditches. The most abundant moss species in abandoned peat fields is *Polytrichum strictum*, typical are also *Polytrichum juniperinum*, *Pohlia nutans*, *Pleurozium schreberi* and *Bryum caespiticium*. The most common lichens are *Cladonia deformis*, *Cladonia fimbriata*, *Cladonia chlorophaea* and *Cladonia coniocraea*. Peat mosses are very rare in the fields, but locally rather common at the bottoms of ditches (*Sphagnum cuspidatum*, *S. capillifolium*, *S. majus*). *Warnstorfia fluitans* is the most frequent moss species growing in ditches. In addition to hare's-tail cottongrass, flowering plants are represented by sedges (*Carex rostrata*, *Carex pseudocyperus*), rushes (*Juncus articulatus*, *Juncus bufonius*), marsh arrowgrass (*Triglochin palustre*), broadleaf cattail (*Typha latifolia*) and reeds.

Former peat production fields that are sparsely revegetated appear best suited for the growth of several moss species, as they cannot inhabit areas already occupied by other species. This is evidenced by several interesting findings made during the inventory. In 2005, a second locality of *Polia elongata* was reported for western Estonia. In 2006, *Ephemerum serratum*, last found in Estonia in the middle of the 19th century, was identified in central Estonia. In 2007, *Campylopus introflexus*, unknown in Estonia, was identified in the material collected from two localities.

Conclusions

Nearly 10 000 ha of abandoned peat production fields, with the peat resources of about 13 million tonnes, are found in Estonia. Of that amount, about 2000 ha, with the resources of about 8 million tonnes, would be suited for restarting peat mining. The revegetation rate of exhausted peat fields depends first of all on the water regime, being promoted by permanently high (0.2 to 0.5 m below the ground surface) groundwater level. Most of the Estonian abandoned peat extraction fields have a water regime unfavourable for revegetation and thus do not develop into functioning mire ecosystems even in the course of many years. Effective



measures have to be applied to reclaim these areas, first of all preventing water outflow with dams for regulation of the water level. If necessary, cutting of the invasive trees should be considered in order to improve the water regime and favour the development of an understorey vegetation. The vegetation of abandoned peat production fields of Estonia, first of all mosses, needs to be studied by specialists, because several new or rare species of our flora have found there a suitable habitat.

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