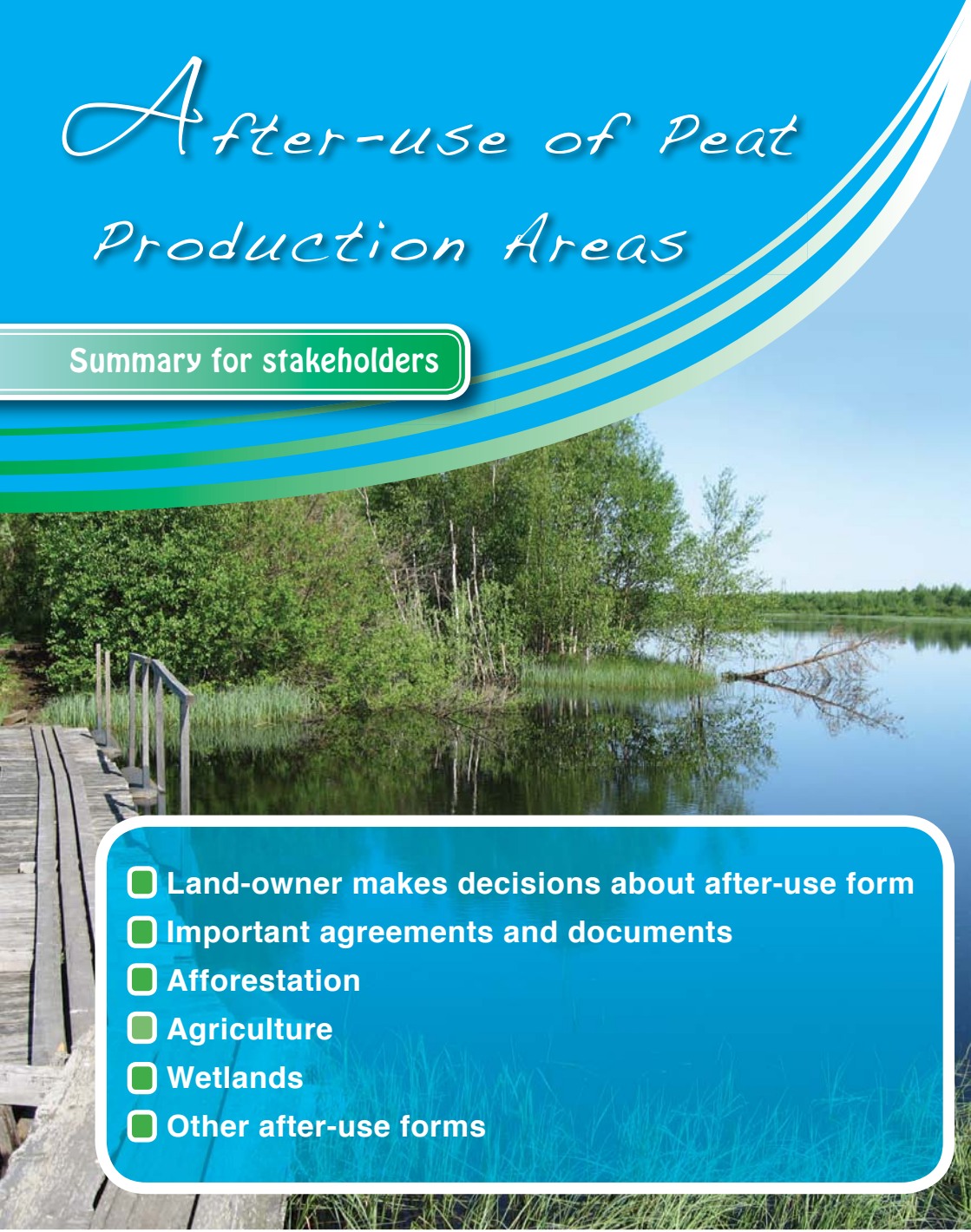
After-use of Peat Production Areas

Summary for stakeholders



- Land-owner makes decisions about after-use form
- Important agreements and documents
- Afforestation
- Agriculture
- Wetlands
- Other after-use forms

TURVETEOLLISUUSLIITTO
ASSOCIATION OF FINNISH PEAT INDUSTRIES

Introduction

Sustainable Land Use on Peatlands: from Peat Production to Various Forms of After-use

The Purpose of this Document

This document is a summary of a wider publication of “After-use of peat production areas” published in January 2008 by the Association of Finnish Peat Industries. The publication and its appendices can be downloaded free of charge at:
www.turveteollisuusliitto.fi.
There are also plenty of photos related to various forms of after-use at:
www.turveteollisuusliitto.fi/jalkikaytto/

The material was produced in 2007-08 as a part of a project called “The guide book of after-use in peatlands” in close cooperation with various stakeholders: peat production companies, the Central Union of Agricultural Producers and Forest Owners (MTK), the Association of Finnish Peat Industries as well as the environmental authorities.

The main purpose of this summary document is to help land owners in their decision making about the after-use on their cutaway peatlands. Since its publication, Finnish peat producers have delivered this leaflet to thousands of land-owners in several events organized during the final phases of peat production. The idea is to help and advise land-owners to plan and prepare for after-use early enough as a part of the life cycle of the peat production area. In most cases there are several after-use forms that can be considered, though it is always the land-owner that makes the final decision on this.

Private People – the Biggest Group of Land Owners

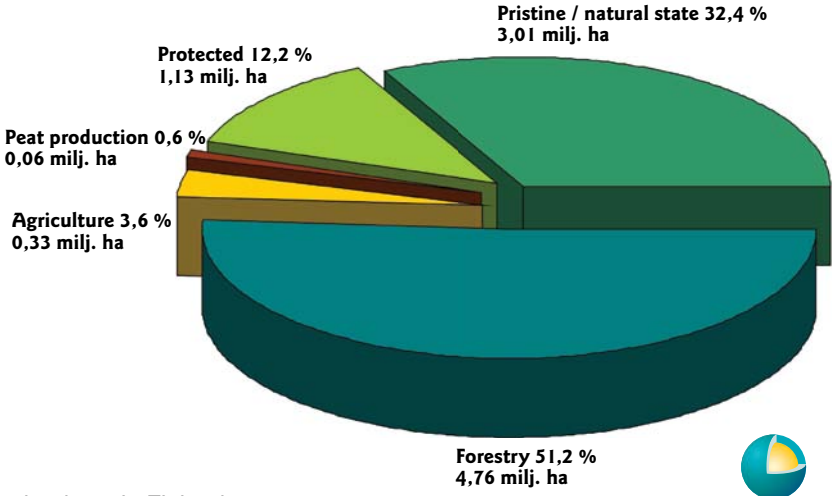
Most of the area of Finland (ca. 338 000 km2) is covered by forests. 72% of the land area of the country is classified as forest land, whereas in the whole European Union the share of forests is ca. 32%. The share of lakes and other inland waters in Finland is ca 10% and the share of agricultural land 9%. Almost one third (i.e. 9.4 million ha) of the land area of Finland is covered by peat. This means that mires form a diverse and abundant part of Finnish nature varying from forest mires and bogs to open aapa or palsa mire types.

About 65% of the land area and inland waters are owned by private people in Finland, whereas the share of state owned land and waters is ca. 25%. All landowners are key stakeholders for the peat industry in Finland.

Background of Finnish Peat Industry

The history of peat production in Finland goes back more than 125 years, whereas systematic research into the use of peat began in the 1940s when it was used as a fuel for operating trains during the war. Large-scale production nevertheless commenced only in the 1960s. Due to the oil crisis in the early 1970s, the peat industry expanded remarkably. However, a very small part of the peatlands in Finland are used in peat production.

In 2010 the area of active peat harvesting in Finland is about 62000 hectars. This is less than one percent (<1%) of the land area of peatlands in Finland. Most of Finnish peatlands are used for forestry purposes, and about 12% of the peatlands are protected by the law.



Peatland use in Finland

GTK

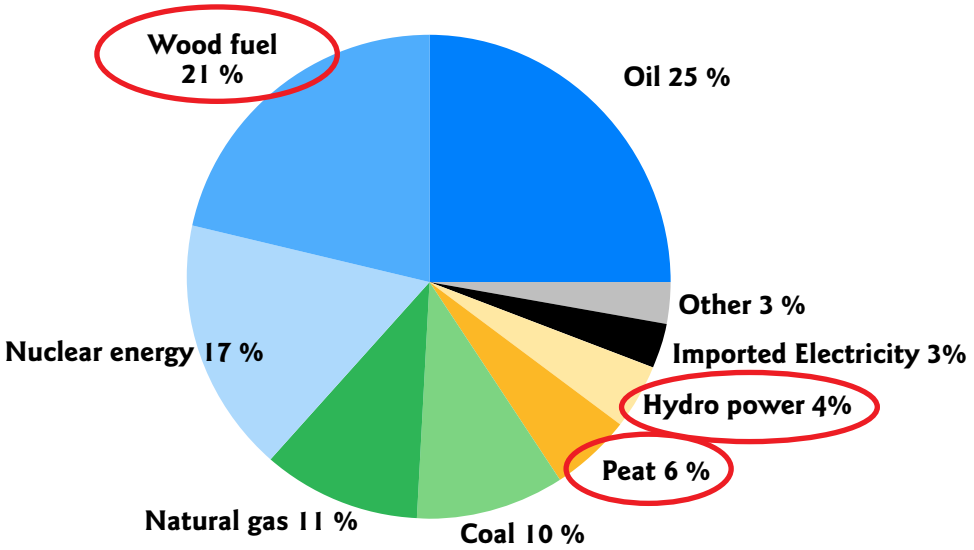
Peat is an Important Energy Resource in Finland

Finland is highly dependent on imported energy: the share of domestic energy sources is only 30%. In recent years the share of peat in the energy consumption in Finland has been 6-7%.

Peat together with wood fuels is being used in the district heating of ca. one million homes in Finland. District heat is mostly produced in combined and heat power plants with total energy efficiency of close to 90%. The economic and social impacts of the utilisation of peat are wider; the peat industry is an important employer especially in many rural areas providing direct and undirect job opportunities for more than 12 000 man years. Peat is also needed for the security of energy management in Finland.

In addition, peat is widely used as a natural growing medium in gardens and greenhouses. Peat products are also suitable for many other purposes: as animal litter or absorbent peat in environmental protection, composting peat, frost insulation, landfill structures and soil improvement.

In Finland energy import dependency is 69 %



After-use – a New Form of Land-use

By the end of year 2009 ca. 30000 ha of former peat production areas have already been transferred to new forms of land use for example by afforestation or cultivation activities or mire regeneration. It has been estimated that by year 2020 approximately 44000 ha of peat production sites will have been transferred to new land uses.

However, according to studies by VTT in Finland, the demand for peat is likely to increase in the next few years. This means that by the year 2020 ca. 58 000 ha of new peat harvesting areas will be needed to fulfill the demand of both energy and environmental peat.

Land-owner Makes Decision about After-use Form

Thousands of hectares of cutaway peatland are released form peat production every year, belonging to numerous land-owners. Part of this peat production area is owned by the producer and part rented from other land-owners. Economically low-value land may after peat production become land with many prospects. Suitable after-use form for each area can be selected from among many different scenarios

After-use Should Be Considered while Production is still Ongoing

When peat production and rental income on the area is about to end, the producer carries out the needed after-care actions. The purpose of after-care is controlled ending of peat production.

Peat producers are responsible for the after-care and land-owners for after-use. It is a benefit for both to transfer the area to a new use with vegetation cover, as soon as possible.

Several different land-use forms may take place in the same cutaway peatland, for example afforestation on the edges and mire regeneration in the middle. One after-use form is seldom suitable for the whole site.Preparation for planning and working the after-use forms should take place in the early stages of peat production.
Close contact between the land-owner and peat producer is important during the final years of production.

Photo: Hannu Salo

Reed canary grass and peat in production side by side in Höystösensuo.

After-use Steers the Final Phases of Peat Production

Peat producer applies for confirmation of the after-care phase actions from environmental authorities (within Regional State Administrative Agency). It is easier to apply the monitoring- and responsibility issues when the new land-use form and its possible permit requirement are known.

Peat production, after-care, phase and after-use in a peatland life cycle.

After-use Forms for Cutaway Peatlands

- **Forestry**
- **Agriculture:** energy crops, animal feed, cereal crops, vegetables, berries and herbs
- **Mire regeneration**
- **Reflooding:** bird sanctuaries and game reserves, fishing lakes
- **Other after-use form:**other after-use form: storage areas, handling sites for bioenergy and by-product materials, mineral soil extraction, tourism and recreation, sports and other hobbies

After-use Terminology

Peat production area: Area bordered with edge ditches, strip ditched, peatland area drained/ dried for peat production.
Cutaway peatland: Area, where peat production is exhausted. Area may function as a support area for remaining peat production or it is in the after-care phase or moved to after-use.
After-use of a peat production area: Following/new land-use of a cutaway peatland, for example forestry, bird sanctuary or agriculture. Other equal terminology: following land-use.
After-care of a peat production area: Conditioning the area after peat production, removal of structures that are no longer required and possible drainage. Usually a short term stage.
Cutaway peatland: The land base after the removal of the peat layer, area that is the object of the after-use planning.
Mineral subsoil: Mineral soil below the peat layer.
Mire regeneration: Vegetation development on a cutaway peatland through succession towards mire ecosystem. Mire regeneration requires an increase in moisture. Mire regeneration is especially favourable on areas, that required pump-draining during the peat production phase.
Reflooding: Forming a bird sanctuary or wetland or artificial lake area suitable for recreational use after peat production ends in the area.

Essential Agreements and Documents

Peat Producers are Tied by the Terms of Environmental Permits

The environmental permit for the final stages of peat production specifies cleaning, monitoring, runoff treatment, maintenance of runoff treatment structures and compensation in case of possible damages. The length of this after-treatment phase may vary due to how soon the actual after-use is established. Land-owners benefit by taking it to next land-use as soon as possible.

If the runoff of the area transferred to after-use cannot be separated from the runoff from the production area, it still loads the water purification structures of the peat production area. It is the peat producers responsibility to specify the loading coming from peat production so, that it can be recognized separately from the after-use loading.

The peat producers responsibility for the area is over when the measures ordered in the rental contract and in environmental permit are completed.

Also After-use May Require a Permit

In some cases land-owner must apply for a permit for the next land-use. Information of the need of environmental permit, water permit or permit for mineral soil extraction is available from the regional environmental agency (ELY) or the municipality´s environmental authority can give advice from the region where the planned activity is located.

Cutaway peatland being moved to the after-treatment phase in Kauhajoki.

Photo: Hannu Salo

Change in Circumstances Must be Taken into Consideration in Rental Contracts

Already, when a rental contract is being made, it is important to consider possible changes in circumstances and the terms of the last environmental permit. For example the producer must keep the runoff treatment structures under the peat producers management as long as the requirements set in the environmental permit define. The peat producer and land owner should already in the initial rental contract decide about the terms, how changes in future situations described above can be outlined to the contract. Only terms clearly written in the contract are committing.

The rental contract for the production area usually defines what kind of drainage status the area must be returned to the land-owner in. In some cases the term has been, that the drainage status must be suitable for forestry. If the producer finds out during the production phase that this drainage status won´t be possible at the end of production or the contract terms otherwise demand further specification, the producer must reach agreement on these issues with the land-owner with separate contracts.

If the production area had to be pump-drained, the area will become flooded at the end of the production phase and taking it to for example to agricultural use won´t be possible. It is to the benefit of all parties that also these kind of situations are handled with separately written contracts

Releasing areas from production may happen in phases, when parts already released from production can be returned to the owner but production still continues in some other part of the land-area. When this takes place, it is important to take care, that the runoff from the production can be separated from the runoff from the returned area.

Photo by Hannu Salo

Documentation of the Land Return is Important

It is to the benefit of both the peat producer and the land-owner to recognize the conditions of the land-area and accept the after-treatment when work is completed. The returning of the land phase can be documented, for example with photos that have relevance to the rental contract and environmental permit terms. The producer and land-owner can together go through the different details and take note of these details, for example according to the check list below.

Returning phase check list

1. Real-estate boundaries and land-owners
2. Field check and observations, maps, possible photos, notes and other material describing the returning phase
3. General description of the area´s status at the time of return
4. Responsibility of the structures and maintenance after the returning or removal of the structures before a certain date
5. Responsibility for road maintenance
6. Announcement to the court of ending the access and other rights related to the rental contract (peat producers responsibility)
7. Recognition of possible other contracts complementing the rental contract
8. Possible demand of environmental permit for planned after-use
9. Land-owners possible duties to declare, for example fertilizer application
10. Other issues

A peat producer and land-owners can together check the areas being returned and make notes of the procedure.

Planning the After-use

Planning the after-use of a peat production area can be carried out from the perspective of favouring the natural circumstances or from the perspective of the desired after-use form.

This opens up to the realities: what are the alternatives. It is helpful to evaluate the situation in the beginning from a wider perspective, because all the uses may not be suitable for the area. It is also beneficial to consult the bordering neighbours and it is good practice to remember their wishes and all the available resources.

There are Geological Survey reports for most of the peat production areas (each municipality has an own report). This report made before peat production includes usually the whole peatland area, not just the part that has been taken to peat production. Also the environmental permit includes a lot of information of the area´s nature and of man´s activities in the area (for example land-use, habitation, livelihoods).

Factors Affecting the After-use Choices

1. **Location of the area: surrounding land-use, needs of the nearby area´s people and businesses, road network and distance for example from a processing place for the planned product**
2. **Depth of the remaining peat layer, thickness of layer needed and quality**
3. **Characteristics of the cutaway peatland mineral subsoil: nutrient capacity, grain size distribution, is it cultivatable**
4. **Hydrological conditions, especially possible pump drainage**
5. **Topography, land forms**
6. **Environmental factors: water protection, landscape factors, providing certain ecological environments**
7. **Resources: finances, subsidies, human resources, time etc.**
8. **General beneficial factors: climate issues and floodplain functions**

Mineral Subsoil and the Depth of the Remaining Peat Layer

The mineral subsoil or rocks below the peat layer have a significant impact on the after-use. Geological study of the mineral subsoil improves the success possibilities of the after-use.

Exposed large stones, boulder content and surface forms of the land are natural planning keys for the area. Also mineral subsoil observations in the Geological Survey´s peat reports can be used.

When the peat layer during production gets thin enough, it is also possible to observe the mineral subsoil from the ditch sides. Possible different soil type zones can be studied and analysed separately. it is recommended to take always samples from at least three different soil types or subareas.

Photo by Lauri Ijäs

Basic analysis includes the pH, sulphur concentration and fine particle content. it is also recommendable to analyse calcium, magnesium and potassium. Soil analysis is available in many commercial laboratories, one sample costs approximately 50 – 80 euros.

Particle size distribution helps to predict forest growth and the success of different agricultural uses. Mire regeneration can be steered to places where the new peat layer growth will establish quickly, weed appearance will be low and adjustment of water table does not demand major structures.

High fertilizer demand and its environmental impact may be a reason not to use the area for agriculture or forestry, if the area has for example sulphide sediments or low nutrient capacity. Anyhow, in many cases some fertilizer application is necessary for the after-use.

Mineral subsoil samples are taken from 5-10 cm below the boundary of peat and mineral subsoil.

Geological Characteristics in After-use Planning

1. One after-use form seldom is suitable for the whole area.
2. Cutaway peatlands mineral subsoil zones and after use should be determined accordingly.
3. Sampling is best to take a little below the surface of the mineral sub soil, for example 5-10 below the peat layer´s base.
4. At least pH, sulphur and fine material concentration of the mineral subsoil should be studied (particles < 0,06 mm).
5. Boulder content and surface forms often limit the after-use.

Photo by Jorma Issakainen

Potassium deficiency in pine.

Land Value Improvement is a Possibility

Well planned and carried out after-use makes it possible to improve the value of the land. Low value land can be made productive. Cutaway peatland is often more suitable for various purposes than the area was before peat production began.

Dryer sites can be turned to forestry or agricultural land. Pump-drained areas are suitable for flooding and wetland use and provide possibilities for example for game reserves and tourism. Many land-owners are very interested in the economical possibilities related to the after-use.

Cover crop fields and wetlands can be a shared commitment between land-owner and the local hunting communities or other associations. Cooperation can offer possibilities also for applying for external financing. The terms are that planned project that supports rural development and regional employment. Rural area´s advisory and development organisations give advice in these matters.

After-use is Also a Cost

Costs must always be studied case by case. Costs are studied more carefully in each after-use forms chapter.

Soil sampling costs start from 150 euro's for three samples. Agricultural establishment costs are similar to ready cleared arable land starting costs, when the base drainage is suitable. Forestry costs are dependent for example of fertilizer requirements. It is good to study the costs of the plans together with a relevant advisory organisation.

Sometimes after-use may demand an environmental permit process and decision and continuous monitoring of the impacts. This means costs will vary due to the after-use form chosen.

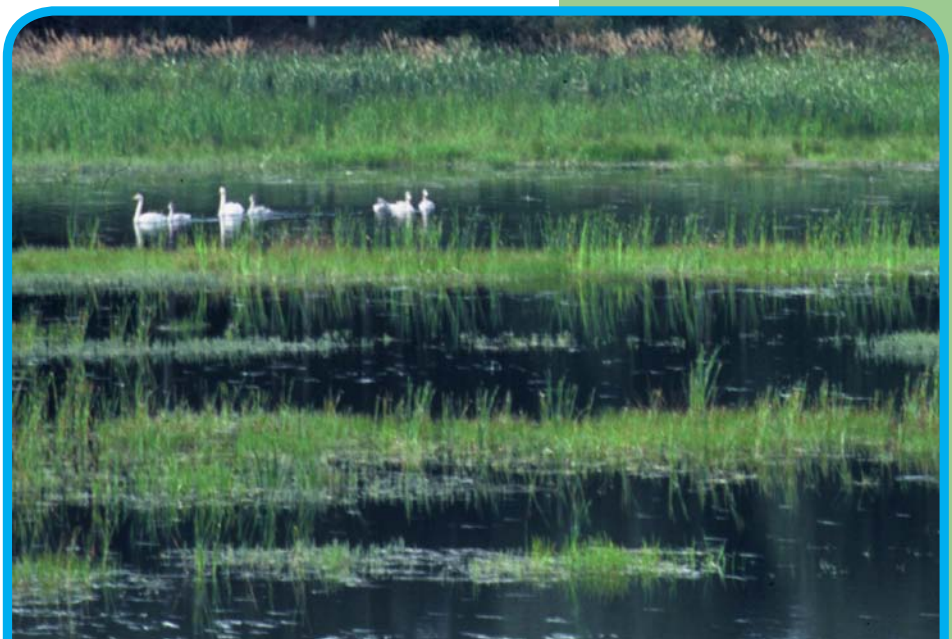


Photo by Hannu Salo

Forestry on Cutaway Peatlands

At the end of peat production sometimes plenty of tree remains and stump remains are found and this indicates the possibilities for forestry on the site. Approximately 60 % of the cutaway peatlands are in principle well suited for forestry.

In many cases low value forestry land may after 20-year's of peat production be suitable for afforestation. This means a clear rise in the land value. At its best the forest productivity on cut away peatland is the same as on mineral soil previously forested.

Conditions Needed for Afforestation

1. Suitable drainage level and balance in nutrient availability often in the case of afforestation it is important to maintain the condition of the drainage ditches leaving the peatland, keeping the ditches open and any necessary cultivation. The remaining peat layer should be at least 10-20 cm, to guarantee reasonable nitrogen storage for one tree generation, but allowing rapid root penetration to the mineral subsoil.

2. Suitable cultivation and fertiliser applications with phosphorus, potassium and boron-containing fertilizers.

The nutritional status on a cutaway peatland requires more attention than the nutritional status in general forests. Repeated fertilizer applications are often worth being prepared for.

Photo by Jorma issakainen

Autumn 1994 mounding carried out and next spring planted and spot dressed with fertilizer in the forest plantation (left) and growing young forest 13 years later (right).

Costs of Afforestation on Cutaway Peatlands

Different phases of forestry always include some costs. On cutaway peatlands sources of costs may be for example mineral subsoil studies, hydrological adjustments, fertilizer application and later trimming and thinning.
Forest Management Associations give information on subsidies and can organise the practical work and can make the necessary plans if needed.

The most natural and cheapest afforestation is the white birch natural establishment alternative. Planting silver birch may be an alternative, if quality birch lumber is wanted. Even pine´s natural renewal might be possible if the cultivation and fertilizer application is done properly and the side forest as seed source is near enough. Spreading the seed is a recommendable on larger sites, when the natural seed bank is not near enough.

Before the first thinning and first income 25 – 40 years later a repetition fertilizer application is likely to be needed. The costs of cutaway peatland based forest are some 300 – 600 euros/ha depending on the size and the location of the area.

Repeated applications of fertilizer are carried out, phosphorus, potassium and minor nutrients, for example 40 kg/ha phosphorus, 80 kg/ha potassium and also boron. Also using tree ash as fertilizer has given positive experiences. In moose winter grazing areas preparation for some young plant losses is needed and with this the fertilizer requirement may increase. If the land-owner also chooses to aim for biodiversity and active natural development, the land-owner may get subsidies to cover economical losses. especially important projects may be financed by government subsidies, the land-owner being the party applying with a specific plan

Without cultivation and PK-fertilizer application the land may be treeless still 25 years later, where none of the planted silver birch are left with a few naturally establishing pine plants here and there.

Photos by Lasse Aro

In Satamakeidas peatland in Honkajoki there was a plantation of pine on uncultivated cutaway peatland, spring 1988. Fertilizer application impact can be clearly seen. The front part without fertilizer in the photo is completely treeless and the part in the back with fertilizer presents well growing pine trees.

Articulture on Cutaway Peatlands

The suitability of cutaway peatland to agriculture is dependent on the peat layers thickness, quality and the mineral subsoil. The area may be very suitable for production with organic status without a transition period.

Normal agricultural subsidies can be applied for, if they are comparable to normal field production conditions. Local agricultural officer or regional agronomist can provide more information. Also the website of Agency for Rural Affairs includes information of farming subsidies.

Economy of Reed Canary Grass Production is Related to the Distance from the user

Reed canary Grass requires a proper establishment/foundation and uniform growing medium. Also some fertiliser application is needed for good harvests. Harvesting takes place in the spring right after snow melting. To avoid harvest losses the stubble length should be kept to a minimum. The most important factor for the economy is the distance to the user power plant.

Also effective harvesting and subsidies have an impact on the economics. Useful growing and harvesting instructions are found for example form the www-addresses on the back page of this document.

Growing Reed Canary Grass on Cutaway Peatlands

Growing reed canary grass has become more common recently. It is often an excellent alternative for cutaway peatlands., because

- it quickly transfers the landscape to look like green agricultural land

- can be quite flexibly changed to other plans or forms of agriculture

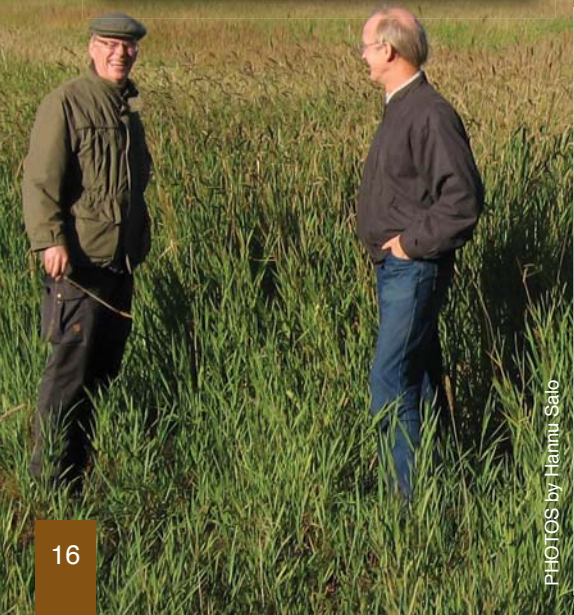
- tolerates well occasional higher water table, but also tolerates dry periods

- uses very effective and selective way nutrients from the soil

- does not usually require using pesticides

- is easy to deal with after proper preparation, one sowing gives 12 – 15 years of growth

- cost-effective to establish: approximately 560 euros /ha (approximately half of cereal crop fields foundation costs



PHOTOS by Hannu Salo

Animal feed and grazing

Animal fodder production and grazing are common after uses for cutaway peatlands, these make good grazing land. Large uniform areas are beneficial for making large scale operations. Picture is from ähtäri, from Riitasuo peatland, where 150 cows are grazing on a 90 hectare area.

Photo by Hannu Salo

Cereals

If the cutaway peatlands characteristics, hydrology and acidity are suitable, oat growing has been especially successful in different parts of the country.

Vegetables

Onion, swede, garlic, yellow onion, leek and carrot are suitable for production on cutaway peatlands. The benefits are, that base is clean, free of weeds and it is easy to arrange crop rotation.

Photo by Markus Muhonen

Herbs

Different ornamental, spice and herb plant growing has been tested with success. Here growing on cutaway peatlands is good for example for white horehound, lemon balm, chamomile and borage.

Also medical plants , like dark leaved willow and flowering plants for honey production are suitable for cutaway peatlands. Owing to their cleanness and aromatic content the herb and medical plants have excellent quality.

Berries

Berry plant growing trials have produced excellent results, for example with strawberry, blueberry (bush) cranberry, cloudberry and arctic raspberry. For example strawberries have done very well on cutaway peatlands. The picture here represents healthy strawberry young plant production in MTT in Läyniönsuo peatland.

Photo by Pirkko Selin

Natural cranberry availability and cheap imports have at the moment kept the production of cranberry unprofitable.

Wetlands

Low-lying peatlands get a high water table naturally, after the drainage pumps are turned off. When establishing a wetland there is an aim to create a larger open water area. If the aim is mire regeneration, then the aim is to recreate a peat accumulating mire ecosystem.

The previous peat production area appearance changes rapidly after raising the water table. Diverse mire vegetation returns to the area more slowly, in a few decades. Accumulation of the peat layer starts from Sphagnum and Carex remains accumulation on the site. The aim has to be clear, when flooding a cutaway peatland and the aim must be accompanied with a good plan. The aim may be a bird sanctuary, fish farming area, recreational use or purifying waters for the surrounding area. It also may be serving as a flood plain.

Natural Nutrition Fish Ponds

Water areas form on cutaway peatlands can be used in the same way as natural nutrition fish ponds. Natural nutrition ponds and other wetland nearby can benefit from each other. Birds can expand their territories and can feed from the new pond.

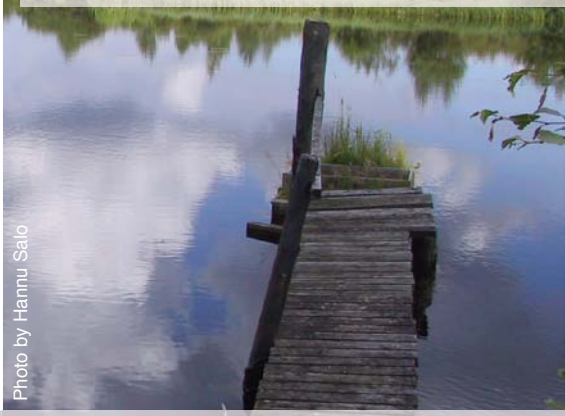


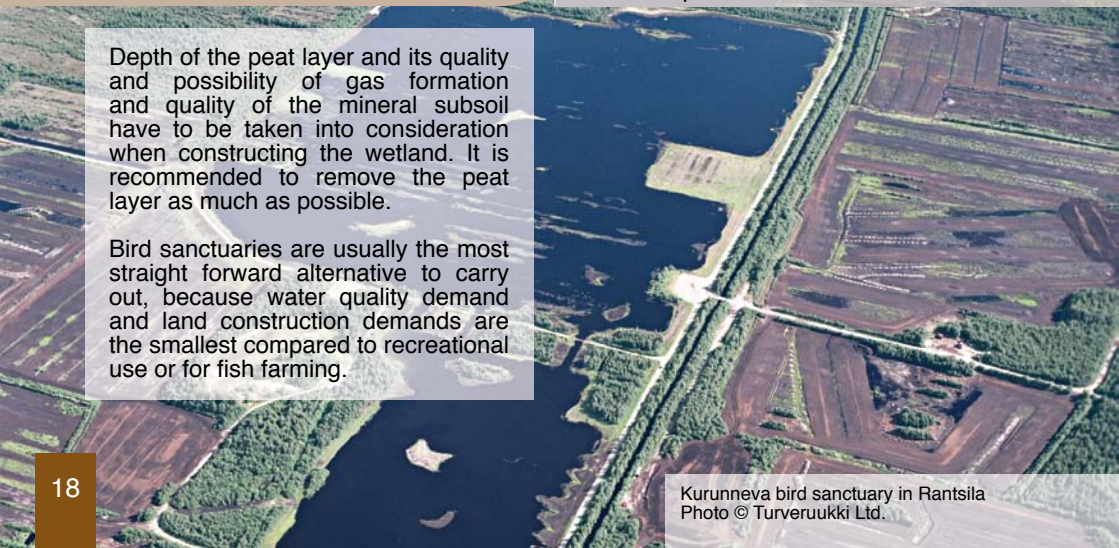
Photo by Hannu Salo

Entrepreneur Timo Korhonen has been farming pike-perch and trout in a pond established on a cutaway peatland in Riitasuo peatland in Ähtäri since 1997.

Bird Sanctuaries and Game Reserve Wetlands

Depth of the peat layer and its quality and possibility of gas formation and quality of the mineral subsoil have to be taken into consideration when constructing the wetland. It is recommended to remove the peat layer as much as possible.

Bird sanctuaries are usually the most straight forward alternative to carry out, because water quality demand and land construction demands are the smallest compared to recreational use or for fish farming.



Kurunneva bird sanctuary in Rantsila
Photo © Turveruukki Ltd.

Other Forms of After-use

Location of former peat production areas allows for, in some cases for noisier types of sport. On cutaway peatland it is possible to invest in a shooting range or other practice range requiring a flat area with good transport links. Tourism and other outdoor needs are restricted only by the site location. Reindeer herding areas on cutaway peatlands are possible if it is suitable for reindeer pasture or feed production.

Peat production sites road network may provide opportunities for wood processing and agro-biomass handling and storage. Peat production areas has ready proven logistics and are ideal to be exploited for such terminals, especially Eastern and Central Finland where the potential for the use of forestry residues is greatest.

Urban and agricultural waste water treatment may be located on former peat production area.
In the future an even greater need for waste disposal sites will exist, and ex peat production sites with their compact base may suit to such a purpose especially if it is located near a main road and far enough from urban development.

Agriculture and forestry drainage water treatment can be enhanced through the previous peat production areas water treatments facilities. In some areas cutaway peatlands wetlands may be of importance as a flood plain.

Promising but yet unrealised possibilities for endangered wetland species growing conditions with specific growing conditions and regulation. Hydrology adjustments are needed also for the growing of sphagnum “semi cultivation” for growing media.

Sometimes cutaway peatland sites are suitable for the extraction of soil, sand or aggregates for construction. Cut away peatland can also be used for disposal of power plant ashes. New forms of after use are continually being developed.

Peatland Höystösensuo is now an active paragliding site in Central Finland

Cutaway Peatlands Have Many Opportunities

This booklet explains the main issues in condensed form for the uses of cutaway peatlands. This booklet is compiled specifically for the land owners and includes basic information, guidance and good practice for the after-use of cutaway peatlands. This publication has been prepared in collaboration with peat producers and various authorities and research organisations.

For more detailed information you can visit our web site at www.turveteollisuusliitto.fi

- **Cutaway Peatlands afteruse decisions are made by the landowner**
- **A number of options are available for afteruse**
- **Well designed and implemented in a form used to increase the land value**
- **After-use planning should be done with cooperation between different parties**

For more information

Peat Research Reports
www.geo.fi/turvepaikka.html

Afforestation
www.mhy.fi and www.metsavastaa.net.
www.metla.fi

Agriculture
www.proagria.fi, www.mavi.fi

Reed Canary Grass
www.mtt.fi
www.vapo.fi
www.motiva.fi

Environment
www.environment.fi

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