A TYPE OF PEATLAND RECULTIVATION: RENATURALISATION

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Renaturalisation — a set of activities for recultivation the characteristic vegetation of the mire after the completion of peat extraction, promoting the restoration of the mire's ecosystem. The main purpose of renaturalisation is to restore the functioning of the mire ecosystem, the hydrological regime and vegetation characteristic to the mire.

Renaturalisation is the most appropriate form of recultivation of a peat extraction site if a decision is made on restoring the habitat of the mire and the habitats of the humid-loving plant species that make it.

Renaturalisation as the most appropriate type of recultivation should be considered and implemented as a priority in cases where the peat extraction site is directly adjacent to the relevant habitat type in a specially protected nature area.

There must be a water body (pond, fire pools, lake) in or near the recultivation area in order to have access to the necessary amount of water to ensure the humidity regime for the growth of the bog plants.

Table 1 **Conditions under which the recultivation scenario is possible**

The type of the top peat layer	Restrictive criterion depending on what type of mire recultivation is planned, because raised bog type vegetation can be restored on raised bog peat, fen type grasses on fen peat, etc.
Thickness of the remaining peat layer	0.50m for raised bog renaturatosation, ≥0.3m for fen renaturatisation.
pH values of the top peat layer used	Restrictive criterion depending on the type of peatland type planned for recultivation. Raised bog vegetation (sphagnum, etc.) requires pH ≤ 5. If restoring fens, then pH≥ 5.
Average groundwater level	0.00m or 0.15m during the summer, the area may occasionally be temporarily flooded.
Number of days per year when the area is flooded	Up to 90 days
Degree of peat decomposition	Not a restrictive criterion.

Figure 1 **Natural renaturalisation process in Lielsala peatland after 6 year from extraction completed. (J.Nusbaums)**

The renaturalisation scenario can be successfully implemented if water runoff is limited to such an extent that the water level rises to the surface of the peat extraction field or even above it by temporarily flooding it. In such cases, the effect is like in the purposefully renaturalised peat extraction fields, where the restoration of the mire ecosystem is possible in the long run. Mire plants under favorable conditions spread within a few years, but the vegetation structure and microrelief characteristic of the mire form only in decades.

An important condition for the retention of water is the type of sediment and the permeability of the water under the peat. If ditches reach mineral deposits, as is most often the case of extracted bogs, the result of raising the water level can be difficult to predict or even unsuccessful. In permeable sediments (sand, gravel), the surface water is filtered through the ditch base. Whereas, restoring water to a less water-permeable substrate (clay, dolomite) can be successful.

If the territory to be renaturalised is located directly next to a natural bog or the undeveloped part of the same bog, the bog restoration will be more successful – the donor territories of the mire plants will be closer.

The surface condition of the field to be restored is essential. The field must not be with slopes or hillsides. Otherwise, when the water level is raised, the lowest places will be flooded, but in the higher places the amount of water will be insufficient, and the humidity conditions will not be satisfactory.

If the peat extraction site has been left for decades, it does not have any economic activity and has not developed enough humidity, cotton-grass, heather, birch, pine can grow in it. Tree harvesting is planned in such places. In these types of areas, the top layer of peat is heavily mineralized, so it is advisable to remove it before the groundwater level is raised and level and loosen the surface, which will improve the possibilities of the bog plants being grown.

A The implementation of a renaturalisation scenario is planned without the reintroduction of mire-specific plants

If the water level is raised at the developed peat extraction site, the bog ecosystem can be restored without other targeted activities. The water level is increased by closing the ditches of the drainage system, creating dams or other water level control systems for water regulation.

When planning the renaturalisation of a peat extraction site, it is necessary to foresee the possibility to diversify the microrelief, i.e. to create the relief of the mounds and the lowlands. Monotonous environments hinder the development of species diversity due to the lack of ecological niches (i.e. diversity of conditions). (Priede 2017)

Figures 2 and 3 **Start of natural renaturalisation in Lielsala peatland (L.Kalniņa)**

Figures 4 and 5 **Sphagnum planting Ķemeri peatland for faster renaturalisation (LIFE REstore)**

B The implementation of a renaturalisation scenario is planned with the reintroduction of mire-specific plants

In order to achieve faster result of the recultivation of the mire's ecosystem, the introduction or reintroduction of the mire's plants is recommended. In Latvia's circumstances.

Cultivating plant species should be chosen according to the conditions — the remaining peat properties and the type of peat. For this purpose, one must choose frequently present, specific to the growth conditions mire plant species,It is not useful to try to achieve the introduction of sphagnum in neutral, alkaline or weakly acidic mires, where the remaining peat layer is formed by a grass mire type of peat. If it is decided that the plant regeneration will be promoted by the introduction of humidity tolerant plants, in such circumstances herbaceous plant species should be chosen – depending on the environment, species suitable for slightly acidic or alkaline pH conditions.

All work processes – the preparation of the area to be renaturalised, obtaining and sowing/planting of donor material, as well as the restoration of the hydrological regime must be carried out in a very short time, peat after the peat field has been prepared for restoration should not dry out. After dispersal of the donor material, the hydrological regime should be such that the water level is "0".

Completion of restoration works

The requirements and technical solutions (restoration work) included in the extraction project for mineral resources or the restoration plan have been implemented in the territory, the peat extraction site is prepared for the planned land use after the completion of peat extraction.

An act has been drawn up and signed in accordance with the procedures specified in regulatory enactments regarding completed restoration works.

By fulfilling these conditions, the peat extractor has, for its part, performed the tasks foreseen in the extraction project for mineral resources: to prepare the area for restoration. Further actions must be taken by the landowner.

Signs that recultivation is successful

There are signs of bog self-renewal, regardless of the type of renaturalisation of the area.

The regeneration of vegetation is indicated by the introduction and propagation of mire plants, which can be observed in the vegetation monitoring plots. The donor's material is alive, rooted and it reproduces independently. In hydrological monitoring, it can be stated that the groundwater level in the peatland is close to the "0" level and has stabilized but not lower than 0.15 m in the summer period. Over the course of five years, the degraded peatland is covered with green vegetation. In fact, there are no open peat areas.

Benefits

Climate change:

When restoring natural peatland vegetation in peat extraction sites, greenhouse gas emissions are reduced in the peatland area.

GHG emissions

The impact on GHG emissions has been assessed for a 30-year period following the implementation of the scenario, if the scenario is introduced in an area where peat extraction has been discontinued recently and ground vegetation has not yet emerged, but the topsoil is formed by raised bog peat. Following the implementation of the scenario, GHG emissions will increase by 2 tonnes CO_2 eq. ha^{-1} per year compared to the initial situation. Total GHG emissions in this scenario over the calculation period correspond to 8.2 tonnes of CO_2 eq. ha^{-1} per year.

According to IPCC guidelines, GHG emissions need not be counted from natural eco-systems, so despite the actual increase of GHG emissions in the renaturalisation scenario, this increase in emissions is not counted but assumes that GHG emission reductions are equivalent to GHG emissions, with the current status of 6.3 tonnes of CO_2 eq. ha^{-1} year.

Biological:

When hydrological regeneration occurs and the bog plants are introduced, rare and protected species of plants and animals can be introduced in renaturalisation areas. It can serve as an important habitat for birds.

Renaturalised areas will significantly increase biodiversity, and peat formation processes will resume.

Deficiencies

Latvia has not accumulated enough experience of renaturalisation with the reintroduction of mire plants, such a scenario is being implemented in separate test sites with an area not exceeding 0.2 ha.

Restoration of the hydrological regime of the territory to be renaturalised may be technically complicated, time consuming and require considerable financial resources in cases where the establishment of specialized hydrotechnical structures is necessary to regulate the necessary water level.

The introduction of a renaturalisation scenario may be difficult in large continuous areas that are more exposed to wind erosion, characterized by higher evaporation, lack of shaded areas that, at least fragmentarily, protect the peat from strong day-to-day temperature fluctuations, especially in the summer. The surface of the peat is dark, and in summer it is characterized by heavy heating, which significantly inhibits the survival of plants.

Descriesptions of peatland recultivation types have been elaborated within the framework of project "Sustainable and responsible management and re-use of degraded peatlands in Latvia" LIFE REstore, LIFE14 CCM/LV/001103).