RENATURALIZATION (SPHAGNUM PLANTING) OF DEGRADED PEATLAND IN LIFE RESTORE DEMO SITE AT ĶEMERI NATIONAL PARK

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INTRODUCTION

Mire restoration in degraded peatlands can be ensured in several ways. The most commonly used is the water level elevation by blocking the drainage system. If wetland conditions are successfully restored, extracted peatlands will overgrow with moisture-loving plant species which later will decay and form the peat while also capturing the CO2. It should be taken into account that the restoration of the characteristic mire vegetation to the degree which is similar to the natural mire takes tens and even hundreds of years. Planting or re-introduction of mire plants is a new and a little tested solution in Latvia. It aims at accelerating the restoration of the characteristic mire vegetation in areas affected by peat extraction, which may speed up the restoration of a functioning wetland ecosystem.

In order to facilitate regeneration of the mire vegetation, in May 2018 experimental planting or reintroduction of sphagnum and other mire plants was carried out on a partially extracted peat field in the demo site of the project "Sustainable and responsible management and re-use of degraded peatlands in Latvia" (LIFE REstore, LIFE14 CCM/LV/001103).

AIM

To ascertain whether the reintroduction of the characteristic vegetation after peat extraction is possible, as well as to identify the most effective reintroduction method by planting various combinations of sphagnum and other mire plant species both on pre-prepared peat surface and without the surface preparation.

MATERIALS AND METHODS

The LIFE REstore project's renaturalization demo area is located on the northeastern edge of Kemeri mire (*Figure 1, 2)* Renovation by planting sphagnum and other high mire plants has been carried out at the site of peat extraction, but the vegetation of the mire has not been restored *(Figure 3)* for more than 30 years (since the beginning of the 1980s, when peat extraction was stopped).

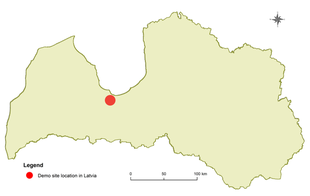

Figure 1. Demo site location in Latvia

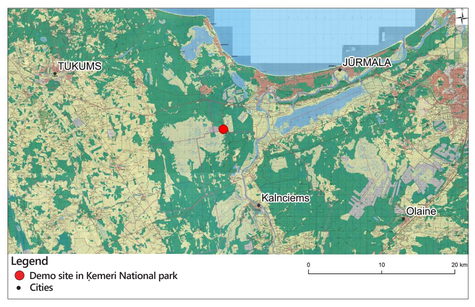

Figure 1. Demo site location. Map prepared by A. Rudusāne using the satellite map of Republic of Latvia on a scale of 1:50 000.
Map base: Ltvian Geospatial Information Agency.

Figure 3. Demo site before the renaturalisation in 2016. Photo: M. Pakalne.

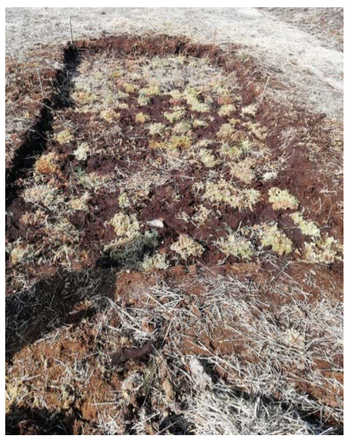

Figure 7. Sphagnum planting in autumn.

After the site selection and the development of re-cultivation plan, the creation of conditions suitable for mire vegetation restoration had to be created:

- Excessive vegetation was removed. Field ditch was blocked at the northern edge. Surface was levelled (till 8.60 m a.s.l.) towards northern and southern edges and trapezoidal berms were created. To prevent long-term waterlogging, two culverts (gradient 5%) were located in southern edge of field ditch.
- Demo site was divided into four 30 x 35 m experimental plots where Sphagnum moss were planted. In 3 of 4 plots peat surface was removed and surface was smoothened *(Figure 4)*.

Figure 6. Sphagnum planting. Photo: M. Pakalne.

Figure 7. Straw cover created after Sphagnum planting. Photo: M. Pakalne.

- Sphagnum planting material was harvested manually in adjacent Drabiņu Mire one day before planting. Vegetation was collected as clumps. The collected vegetation consisted of Sphagnum and other mire plants.
- On May 18, 2018, the mosses were planted with the help of 62 volunteers. In total, 2200 kg of Sphagnum were planted in an area of 3200 m2 *(Figure 5)*.
- Sphagnum was planted as clusters (5x5 cm) instead of scattering Sphagnum fragments. Sphagnum groups were evenly planted ~ 0.5 m from each other. In some places, individual mire plants were also spread, to see if they will start to grow.
- Fields were covered with straw *(Figure 6)*, in order to protect plants from direct Sun exposure and drying out. 1500 kg of straw were spread evenly across the area. The summer of 2018 was very dry, Sphagnum plantings were watered during the first vegetation season.

In autumn of 2018, Sphagnum planting experiment was supplemented with a small terrace-shape planting plot. Two 2 x 2 m experimental plots were established at various depths (0.30 m and 0.15 m) *(Figure 4, Figure 7)*, after removing the top layer of peat so that the surface to be planted was close to the groundwater table.

- Groundwater table was monitored. 8 groundwater observation wells were erected *(Figure 8)* in demo site and in its immediate vicinity. Hydrological measurements were undertaken manually with Electric Contact Meter Seba KLL Mini, 10m.
- In 2017, 13 permanent vegetation plots were established in the buffer zone of the demo site, before the Sphagnum planting. This will provide a possibility to compare the vegetation development in Sphagnum planting plot with the areas where peat surface was not removed and Sphagnum mosses were not planted.

Figure 4. Performed works, location of experimental plots and planted species in demo site. Map prepared by A. Rudusāne, using 5th cycle orthophoto map, 1:10 000.
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1	Territory where no works were carried out. Vegetation monitoring was started in 2017, and 13 vegetation sampling plots were established.
2	Buffer zone (20 m wide) where no works were carried out.
3	Buffer zone along the ditch with wet peat; border between the demo site and peat quarries. No works were performed.
4	Peat surface was removed and site smoothened. In may 2018, *Sphagnum* species of hummocks* and bog pools** were planted, and covered with straw.
5	Peat surface was removed and site smoothened. In may 2018, *Sphagnum* species of hummocks* were planted, and covered with straw.
6	Peat surface was removed and site smoothened. In may 2018, Sphagnum species of hummocks* were planted, together with other bog species (*Andromeda polifolia, Drosera spp., Sphagnum* species of bog pools **) (up to 30% of total cover), and covered with straw. In September 2018, in two 2 x 2 m plots additional plantings were created after removal of peat surface. Dam of peat and planks was constructed on adjacent field ditch.
7	Planting of unsorted Sphagnum mosses without the removal of peat surface. Covered with straw.

* *Sphagnum* species of hummocks: *Sphagnum magellanicum, S. fuscum, S. rubellum,*
** *Sphagnum* species of bog pools: *Sphagnum cuspidatum.*

Figure 8. Location of hydrological monitoring wells and vegetation plots in demo site, Ķemeri Mire.
Map prepared by A. Rudusāne using the 5th cycle orthophoto map, scale 1:10 000.
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An overview of all the work carried out in Ķemeri Mire demo site is shown in Figure 9

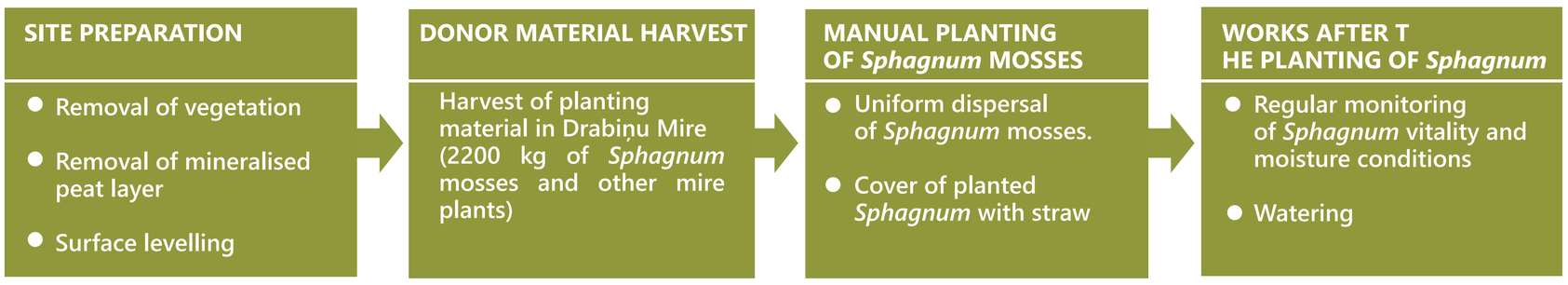

Figure 9. Works carried out in demo site in Ķemeri Mire.

RESULTS AND CONCLUSIONS

- In autumn 2018, it was observed that all species of *Sphagnum (Sphagnum magellanicum, S. fuscum, S. rubellum, S. cuspidatum)* have endured below the cover of straw, although in much smaller areas than they were planted *(Figure 10, 11)*. However, less than one year is not sufficient for the objective evaluation of the experiment results.
- Observations from the first year show *(Figure 12)* that groundwater table in demo site was not sufficient for the survival of planted Sphagnum mosses. No direct correlation with rainfall has been observed. The series of observations reflects a relatively short period of time, therefore a linear relationship was also not expected.

The experiment carried out in Ķemeri Mire is vital for the evaluation of the reintroduction possibilities of Sphagnum mosses and other mire plants in Latvian conditions. The renaturalisation of peat extraction sites requires work that can only be assessed in long term. This is an experiment whose success or failure will be measurable after several years, so a regular vegetation and groundwater table monitoring must continue.

Figure 10. Characteristic species of raised bogs, *Sphagnum magellanicum, Drosera rotundifolia, Oxycoccus palustre* established below the straw cover. September 2018. Photo: M. Pakalne.

Figure 11. *Sphagnum cuspidatum, S. rubellum, Drosera rotundifolia* in the lowest places in planting site. September 2018. Photo: M. Pakalne

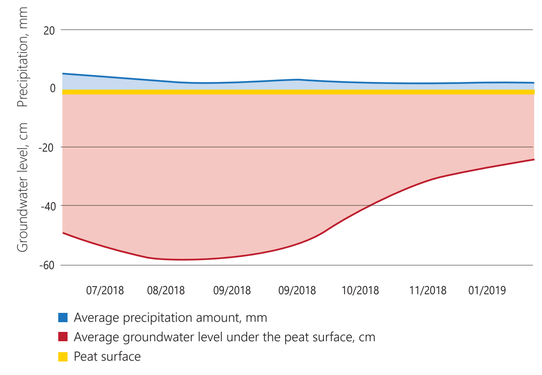

Figure 12. Average groundwater table in relation to average rainfall from July 2018 to February 2019. Authors: Agnese Priede, Agnese Rudusāne.

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