Restoration of bog hydrology in Latvia

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Aim of presentation

- Characterise mire habitat restoration in the LIFE projects
- Reveal problems in raised bog conservation
Mires cover 4,9% of the total land area.
Raised bogs
Human impact

• About half of Latvian mires have been influenced by various human activities, like drainage, peat extraction and fire

• Therefore, activities re-instating the mire hydrology are carried out

• Habitat and site hydrology monitoring was carried out before management actions.
Drainage consequences

- Change of the mire hydrological regime
- Degradation of mire vegetation
- Loss of the plant communities and species diversity
- Loss of raised bog structure (hummocks, hollows, pools)
- Decrease of the total area of the mires
- Changes in mire water quality
EC LIFE projects for raised bog management

- Kemeri Mire (2003-2008)
Teici Mire
Ramsar site
Kemeri Mire
LIFE project

*Sphagnum cuspidatum*
Restoration of raised bog habitats in Kemerri Mire
EC LIFE-Nature project
LIFE04NAT/LV/000196

- Project title: “Implementation of Mire Habitat Management Plan for Latvia”
- Duration: 2004 – 2008
Habitat diversity in Stikli Mires
Building of dams in Vasenieki Mire in May, 2007
Vasenieki Mire

2006

2007

2013
Fluctuation of groundwater level in Vasenieki Mire

The fluctuations of groundwater level in Vasenieki Mire

- Drained area (between the ditches 100 m)
- Drained area of bog pools (between the ditches 20 m)
- Drained area (between the ditches 20 m)
- The beginning of dam building
Estonian colleagues in Vasenieki Mire
Invasion of *Sphagnum cuspidatum* in the drainage ditches
EC LIFE+ project LIFE08 NAT/LV/000449
Restoration of Raised bog habitats in the Especially Protected Nature Areas of Latvia

- Project duration: 2010–2013
- Project sites: Rozu Mire, Aizkraukle Mire and forests, Aklais Mire and Melnais Lake Mire
Project sites
Field studies for the elaboration of Management Plans
Monitoring and management actions

- Raising of water level by building dams on the drainage ditches to stop the degradation of raised bog habitats.
- Habitat and site hydrology monitoring before and after management actions.
Aizkraukle Mire and Forests
1532 ha
The natural runoff is directed to W, NW and SW from the bog, to Brasla and Maizite Streams and their tributaries.
Aklais Mire 2003 ha
• Surface runoff to the lakes and streams in the mire, to W, NE, SW.
• Semi-natural hydrological regime.
• Large lake – Znotinu – in the central part of the mire, and number of smaller lakes is located on the NW part of the mire.
Melnais Lake Mire
317 ha
Melnais Lake
Mire
Previous peat extraction fields
Melnais Lake Mire

- The surface runoff from the mire is directed to two main directions:
  - to the north and northwest in the NW part of the site,
  - to the surrounding drainage ditches in the south and southeast in the central and SE part of the site.

- Peat extraction activities close to the site in 1950-1960-ties, and in the NW part of the site in 1980-ties, before the protected area is established there.

- First ditches dug in 1930-ties
- Main drainage ditches (width 3-5 m, depth 2-3 m), smaller drainage ditches, peat field ditches.
Development of fen vegetation

Eriophorum angustifolium

Carex vesicaria
Rozu Mire

991 ha
• The mire is surrounded by esker type hills limiting surface runoff in these directions. There is elongated hill peninsula reaching from the SE and dividing the mire in two parts.
• The main direction of surface runoff is to NE, where the land surface is the lowest, and to the SW as well due to the number of ditches that are dug there, thus draining the SW corner of the mire.
• Mainly natural hydrological regime, most of the ditches dug in 1980-ties, just few are before that time.

Rozu Mire
Measures for restoration of hydrological regime

• There are 156 dams constructed in the bogs: 59 dams in Rozu Mire, 54 dams in Melnais Lake Mire, 29 dams in Aizkraukle Mire and 14 dams in Aklais Mire.
Management actions in Melnais Lake Mire
Building of dams in Melnais Lake Mire in winter 2012
Building of dams on drainage ditches
Peat dams in Melnais Lake Mire in spring 2012
Melnais Lake Mire
Rozu Mire
Rozu Mire

Before

2010

After

2013
Hydrology and habitat monitoring
Hydrological monitoring

• Groundwater monitoring wells are located in several profiles, so that the GW table changes in the natural and disturbed parts of the bogs could be observed.

• Location of the wells:
  – Wells are located in the most representative parts of the bogs near the planned dam locations;
  – Wells are located in profiles, perpendicular to the ditches, where dams will be / are constructed;
  – Several profiles are installed in the bogs, where ditches differ (dimensions, regime);
  – Wells in each profile are located so that closer to the ditch the distance between wells is smaller, and it increases further away from the ditch: 1 m, 5 m, 10 m, 25 m, 50 m, 100 m, 250 m, 500 m. Length of the profile is 250-500 m depending on the particular site.

• There are 9 profiles with 63 wells in total.
Groundwater table observations

- Manual measurements twice per month
- Elevation (in m amsl) determined for each well, based on that GW table (in m amsl) calculated.
- Data collected and analysed based on ditch type, dam construction period and meteorological data (information from LEGMC)
Effects of the restoration measures

- GW table in the vicinity of ditch depends on type of ditch
- Several types of ditches are recognised in the project sites:
  1. deep (3-5 m) ditches, partially filled with water (Ak1, M2, A3, ~M1)
  2. deep (~3 m), wide (3-5 m) ditches, completely filled with water (A1, R)
  3. small (width 0.2-0.5 m), shallow (0.2-0.5 m) ditches (A2)
  4. wide (2-3 m) ditches, partially or completely overgrown with *Sphagnum* species and other plants (Ak2)
Deep ditches, partially filled with water

- Sharper seasonal GWT fluctuations
- Range of GWT fluctuations up to 0.5-1.2 m in the wells near the ditch (5-10 m)
- After the dams construction:
  - Sharp rise of GWT for ~0.3 m near the ditch, slighter rise in the 25-100 m distance
  - Stabilisation of GWT (range 0.1-0.25 m)
Deep, wide ditches, completely filled with water

- Seasonal fluctuations of GWT not so sharp and steep
- Range of GWT fluctuations 0.3-0.8 m
- After the dams construction:
  - Sharp rise of GWT for ~0.3 m just next to the ditch (1 m flooded), slighter rise in the rest of the wells
  - Stabilisation of GWT (range 0.1-0.25 m)
Small, shallow ditches

- Fast response to precipitation changes in all wells, slighter in the furthest ones
- Range of GWT fluctuations 0.3-0.5 m

After the dams construction:
- Sharp rise of GWT for 0.2-0.3 m closer to the ditch (1-25 m), slighter rise in the rest of the wells
- Stabilization of GWT (range 0.15-0.25 m), but still some sharp changes
Wide ditches, partially or completely overgrown with *Sphagnum* species and other plants

- Slow response on precipitation events
- Similar response in all the wells, slightly less range for the furthest ones
- Range of GWT fluctuations about 0.25 m in all wells
- After the dams construction:
  - Slow and slight rise of GWT
  - Stabilisation of GWT (range 0.1-0.15 m)
Conclusions

• The restoration measures (dam construction on ditches) have improved the hydrological conditions in the mires, bringing them closer to the semi-natural state. The dams has caused the rise and stabilisation of groundwater table, providing more uniform moisture regime in the mire.

• Profiles near different ditches showed that restoration measures have the same significance both near the large ditches and small ones, either partially or completely filled with water. The less effect is obtained on overgrown ditches, where necessity of restoration measures should be studied in details in future.

• The direct impact of ditches is 10-25 m, but there is indirect impact, bound to the surface and subsurface structure of the mire, presence of pools, their interconnectivity, that could be observed also in distance of 250-500 m. This should be studied in future.
Raised bog vegetation monitoring

Aim – to follow the changes after raising of the water level
Releves in intact and degraded raised bog areas
Results: Eastern part of Melnais Lake Mire

Change of the coverage of Calluna vulgaris
Results: Eastern part of Melnais Lake Mire

2011

0,5 m from the ditch

2012
Results: Eastern part of Melnais Lake Mire

Calluna ir dying out
Results: central part of Melnais Lake Mire

Change of *Sphagnum* cover
Results: Eastern part of Melnais Lake Mire

Change of the proportions in *Sphagnum* coverage

*Sphagnum cuspidatum*

*Sphagnum magellanicum*

The coverage of species of more wet areas has increased

*Sphagnum fallax*
Results: Central part of Melnais Lake Mire

Change of coverage of *Eriohororum vaginatum*
Results: Central part of Melnais Lake Mire

In the ditches the increase of *Sphagnum* species is observed, as well increases the coverage of *Eriophorum vaginatum*. 
Conclusions

- The habitat monitoring results show a great difference in the coverage and species number of vascular plants and bryophytes in the intact and drained areas.

- The hydrological studies reveal that after the management actions was carried out, fast changes have taken place in the site hydrological regime.

- In Vasenieki Mire the raise the water level has raised in medium for 32.8 cm but there are places where it has raised for 52.1 cm.
Thanks for attention!