Project LIFE 08NAT/LV/000449

„Restoration of Raised Bog Habitats in the Especially Protected Nature Areas of Latvia”

Monitoring of mire management success

Report

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Summary
The aim of the study was to evaluate the impact on vegetation of dams built to decrease the water level fluctuation in the drained bog. Annual study of bog vegetation in permanent plots was chosen as appropriate method to detect changes in bog vegetation. 49 sample plots were established in 2010/2011, before the dam building in spring 2012 and revisited in late summer/autumn 2012. Sample plots were established in the north-eastern part, central part of the nature reserve and in the non-flooded area of cutover peat fields within the nature reserve. Already after six month significant increase of *Sphagnum* species and *Eriophorum vaginatum* cover was observed in majority of sample plots established in drainage influenced bog area. Small increase or establishment of *Rhynchospora alba* was recorded as well. *Calluna vulgaris* decrease was not recorded except the narrow zone along small ditches. In general, the closest to the ditch, the most expressed is the dam impact in terms of vegetation changes. However, local site microtopography and degree of previous drainage impact plays important role as well. The most striking feature now is the one meter wide zone of dead *Calluna vulgaris* along the narrowest ditches with dams in Melnais Lake Mire. Slight impact on bog vegetation has been recorded even in a 100 m distance from the ditch in the north-eastern part of the mire. In the non-flooded area of cutover peat fields slight increase of *Eriophorum vaginatum* cover was recorded which may indicate wetter soil conditions as well. *Sphagnum* and *Eriophorum vaginatum* cover in ditches where dams have been built has increased. To sum up, the construction of dams and consequently decrease in water level fluctuations in Melnais Lake Mire has positive effect on drainage influenced bog vegetation. The observed vegetation changes indicate that the area has become wetter. Species cover of many bog plant species now is more similar to that one of undisturbed raised bog than it was before the dam construction.

The aim of the study is to evaluate the effectiveness of dams built to decrease the water level fluctuations in the drained bog. We assume that after the rising the water level in the bog there will be dying back of *Calluna vulgaris* and *Pinus sylvestris* and *Sphagnum* cover will increase.

Methods

Annual study of bog vegetation in permanent plots was chosen as appropriate method to detect changes in bog vegetation. Sample plots were established in 2010, before the dam building.

Selection of sample plots
Sample plots in Melnais Lake Mire were established:

1) on ditches where dam building was proposed ;
2) in the bog area most likely influenced by dam building;
3) in remnants of non-flooded cutover peat fields;
4) in untouched areas of raised bog.

Sample plots were established along with the water level monitoring points and were arranged perpendicularly to ditches where applicable. Each sample plot is a 4 m^2 circle plot and they are located in a five sample plots` row using 6m distance between the circle centres (Figure 1). Sample plots on ditches were 2x2 m. Photo of each sample plot was taken. Centres of sample plots or the left side (on ditches) were marked with the ribbon attached to the tree.

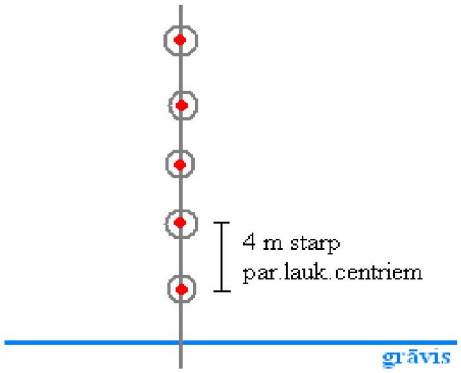

Figure 1. Design of the sample plots` arrangement in Melnais Lake Mire.

Vegetation sampling

All plant species were counted in sample plots and species cover in percentage as well as bare peat, litter cover and open water were evaluated.

Nomenclature: vascular plants (Gavrilova, Šulcs 1999), bryophytes – (Āboliņa 2001), lichens – (Piterāns 2001).

Results and discussion

Sample plot design

Seven sample plots on ditches, 15 sample plots in a drainage influenced raised bog and 17 sample plots on non-flooded cutover peat field were established in Melnais Lake Mire in 2010. In 2011 six more sample plots were established in north-eastern part of the mire and four – in non-flooded cutover fields. Melnais Lake Mire management efficiency was monitored in 49 sample plots in total in 2011, but in 2012 – in 48 as one sample plot (MG4) was destroyed during the dam construction works.

A. North-eastern part

Maximal groundwater (GW) table rise is obtained next to the ditch, and it is 38 cm in the well M2-1. The GW table rise decreases with the increase of the distance from the ditch, thus the maximal GW table rise in well M2-2 was 22 cm, 15 cm in well M2-3, 10 cm in well M2-4, 7 cm in well M2-5, 12 cm in well M2-6 and 0 cm in well M2-7 (Dēliņa 2012).

Mainly changes in *Calluna vulgaris, Eriophorum vaginatum, Rhynchospora alba* and *Sphagnum* cover was observed six month after the dam construction. Total *Sphagnum* and *Eriophorum vaginatum* cover has increased, but *Calluna vulgaris* cover – decreased. Cover of *Sphagnum angustifolium, Sphagnum cuspidatum* and *Sphagnum rubellum* has increased, but that of *Sphagnum magellanicum* – decreased. Total *Sphagnum* cover has also increased in ditch. On the left side of the ditch positive changes in terms of mire restoration success were more expressed than on the right side of the ditch (Figures 2 - 10). The differences between the right side and left

side may be explained by original differences in drainage impact on both sides. There were more *Sphagnum* hollows and lawns as well as fewer trees on the left side of the ditch than on the right side of the ditch.

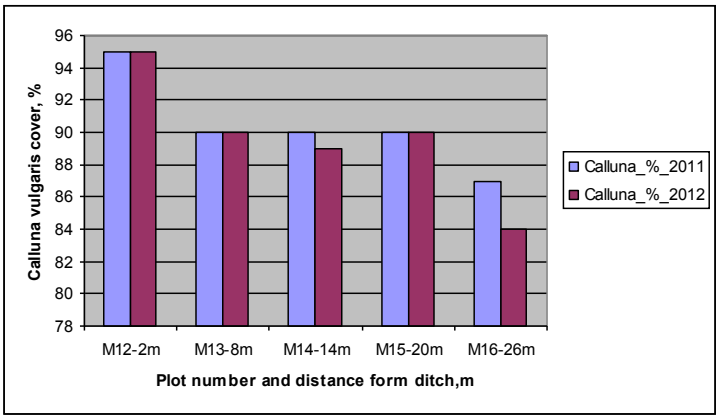

Figure 2. Changes in *Calluna vulgaris* cover, %, in the north-eastern part of Melnais Lake Mire; right side of the ditch (M12-M16).

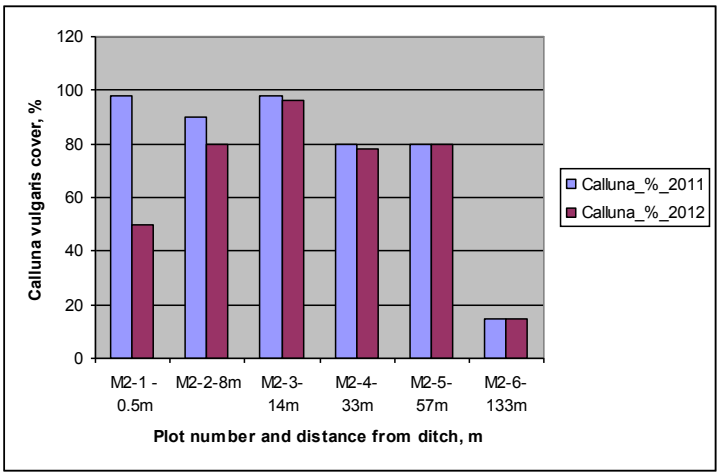

Figure 3. Changes in *Calluna vulgaris* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch along the groundwater level wells.

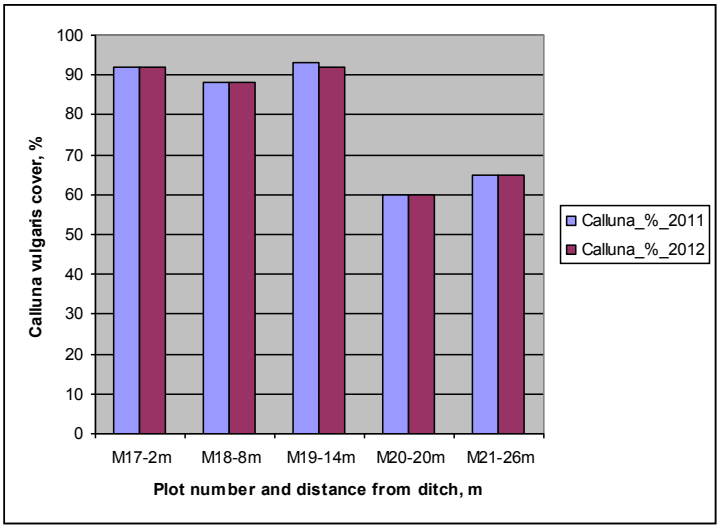

Figure 4. Changes in *Calluna vulgaris* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch (M17-M21).

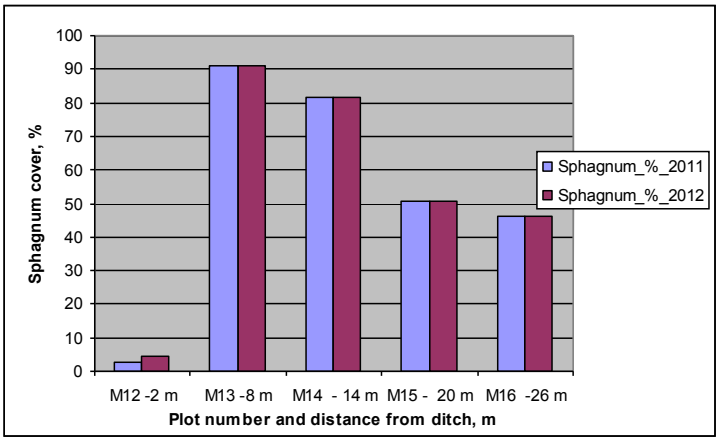

Figure 5. Changes in total *Sphagnum* cover, %, in the north-eastern part of Melnais Lake Mire; right side of the ditch (M12-M16).

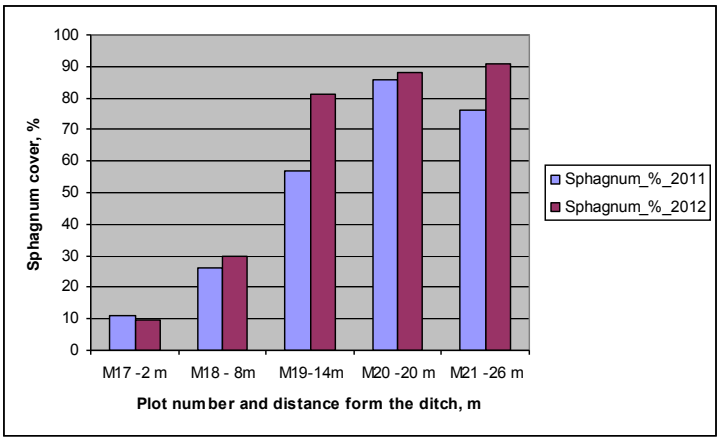

Figure 6. Changes in total *Sphagnum* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch (M17-M21).

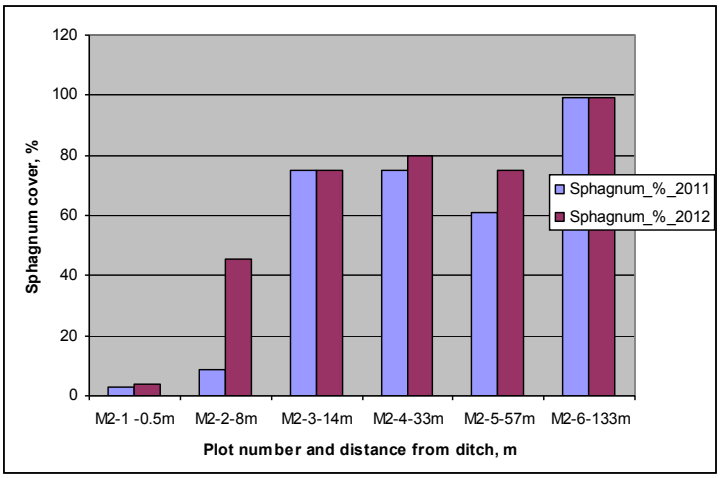

Figure 7. Changes in total *Sphagnum* cover, %, in the north-eastern part of Melnais Lake Mire; right side of the ditch along water level pipes.

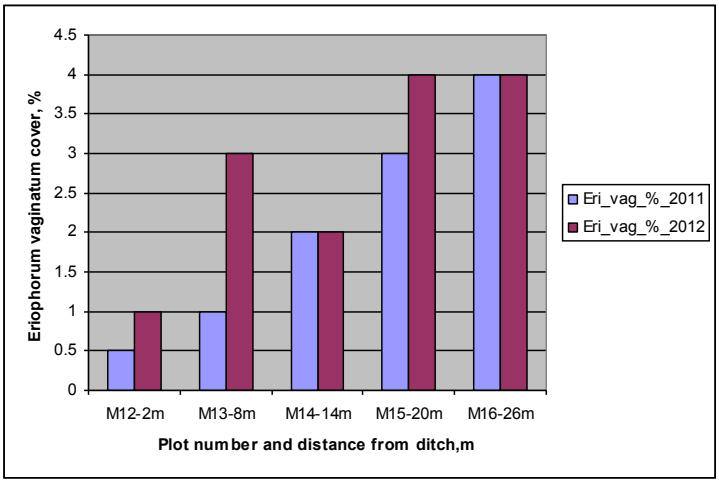

Figure 8. Changes in *Eriophorum vaginatum* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch (M12-M16).

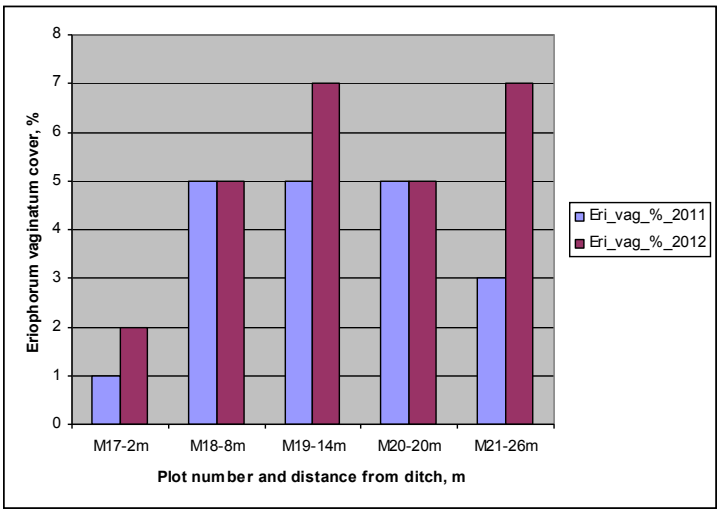

Figure 9. Changes in *Eriophorum vaginatum* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch (M17-M21).

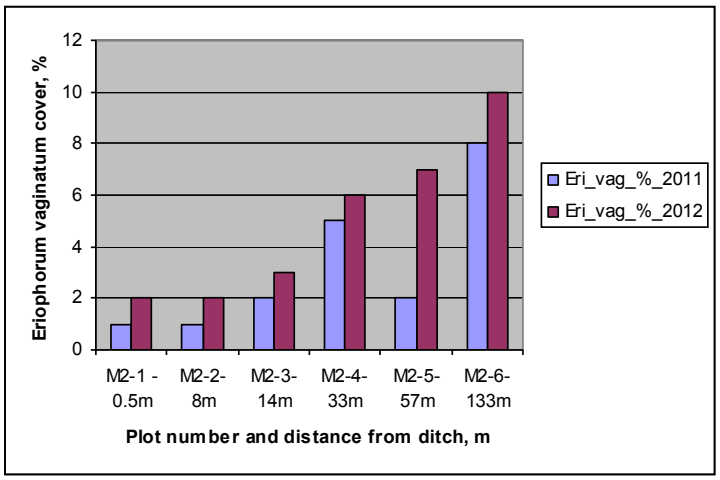

Figure 10. Changes in *Eriophorum vaginatum* cover, %, in the north-eastern part of Melnais Lake Mire; left side of the ditch, along water level pipes.

Rhynchospora alba cover has increased in sample plots on the left side of the ditch or it was found for the first time there. Changes were recorded only in sample plots with *Sphagnum* lawns or hollows (Figure 11).

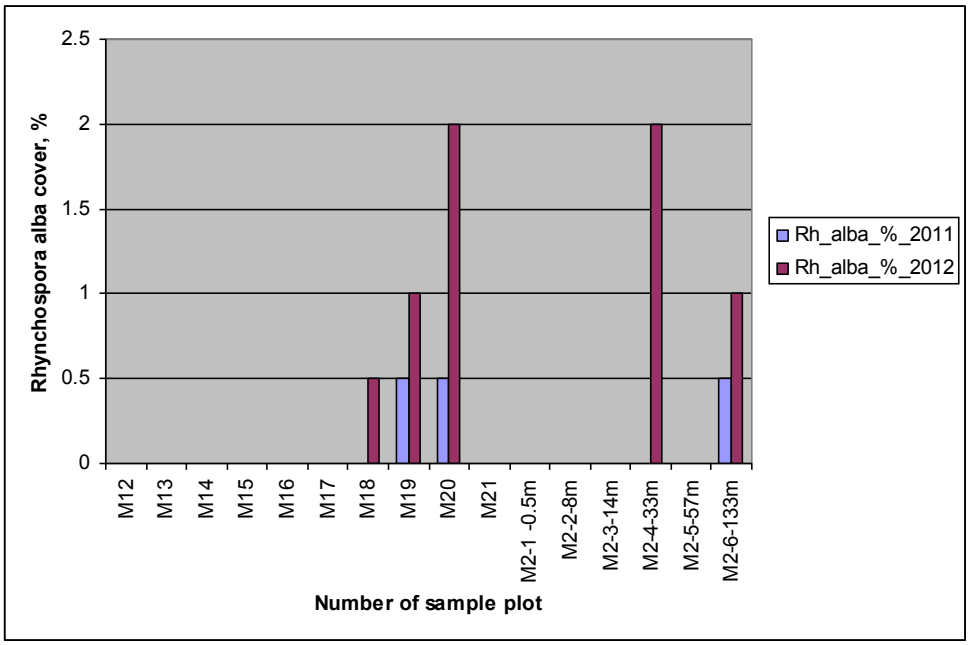

Figure 11. Changes in *Rhynchospora alba* cover, %, in the north-eastern part of Melnais Lake Mire (M12-M16 left side; M17-M21, M2-1-M2-6, right side of the ditch).

To sum up, the most significant vegetation changes were observed in 1-2 m wide zone along the ditch where dead *Calluna* were observed (Figure 12). Slight vegetation changes were registered even at 100 m distance from a ditch, however they may be caused by favourable climate conditions in 2012, not by dam construction. However, there are no linear relationship between the distance from the ditch and magnitude of vegetation changes.

Figure 12. Zone of dead *Calluna vulgaris* along ditch in the north-eastern part of Melnais Lake Mire in autumn 2012.

B. Central part of the mire

Sample plots are located close to the ditch where dams were built in winter 2012 (Annex 1). Vegetation changes in central part of Melnais Lake Mire were similar to those in north-eastern part – total *Sphagnum* and *Eriophorum vaginatum* cover has increased in all sample plots. However, *Calluna vulgaris* cover did not change (Figure 13-15). Total *Sphagnum* cover has increased also in the ditch where dams have been built (Figure 16).

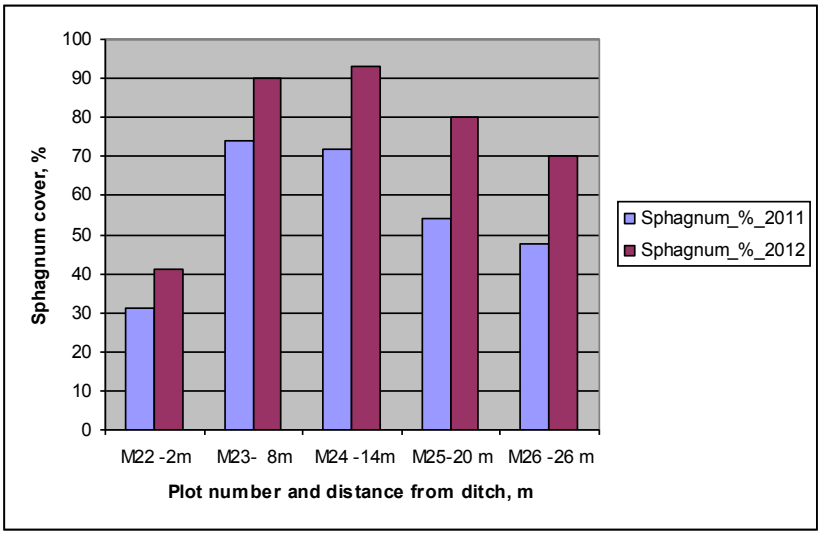

Figure 13. Changes in total *Sphagnum* cover, %, in the central part of Melnais Lake Mire.

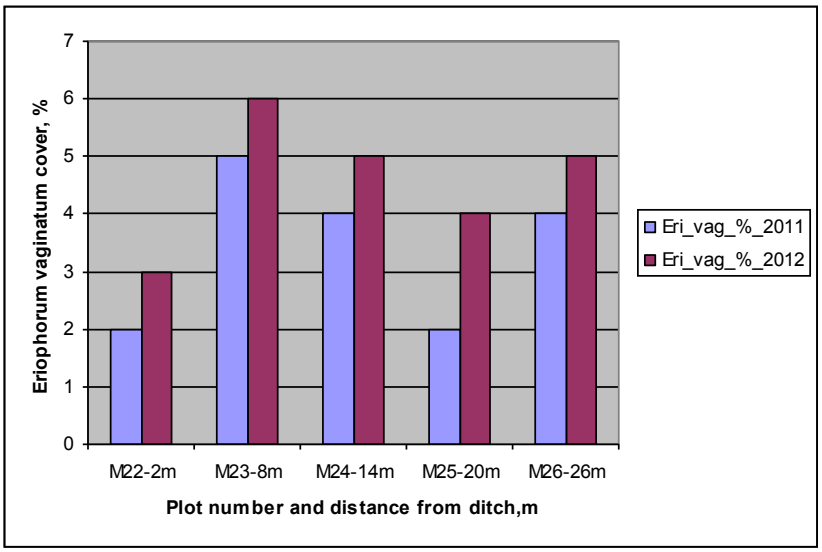

Figure 14. Changes in *Eriophorum vaginatum* cover, %, in the central part of Melnais Lake Mire.

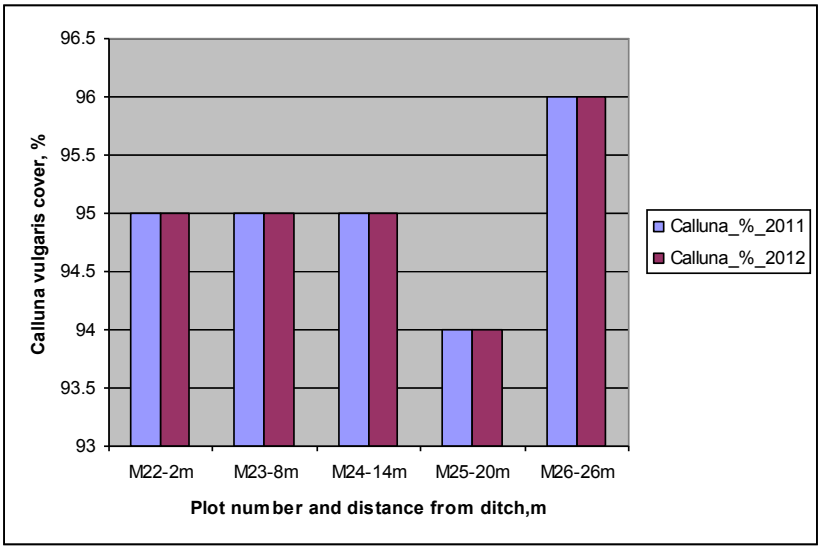

Figure 15. Changes in *Calluna vulgaris* cover, %, in the central part of Melnais Lake Mire.

A

B

Figure 16. Changes in vegetation cover in the ditch (MG6) in central part of Melnais Lake Mire (A – before dam construction in 2010; B – after dam construction in 2012).

C. Non-flooded cutover peat fields

Dams were built in the ditch in northern part of peat fields (Annex 1).

Vegetation changes were observed only in the lowest places of cutover peat fields (M27-M32), where *Eriophorum vaginatum* cover has significantly increased. However, slight *Eriophorum* increase was found in other sample plots as well (Figures 17, 18). Despite the water level rise next to sample plots M6a and M6b located in forest, no vegetation changes were observed there. It may be explained by the low magnitude of water level rise – only 10 cm in well M1-3 and 4-6 cm in M1-4 (Dēliņa 2012) and high decomposition stage of peat.

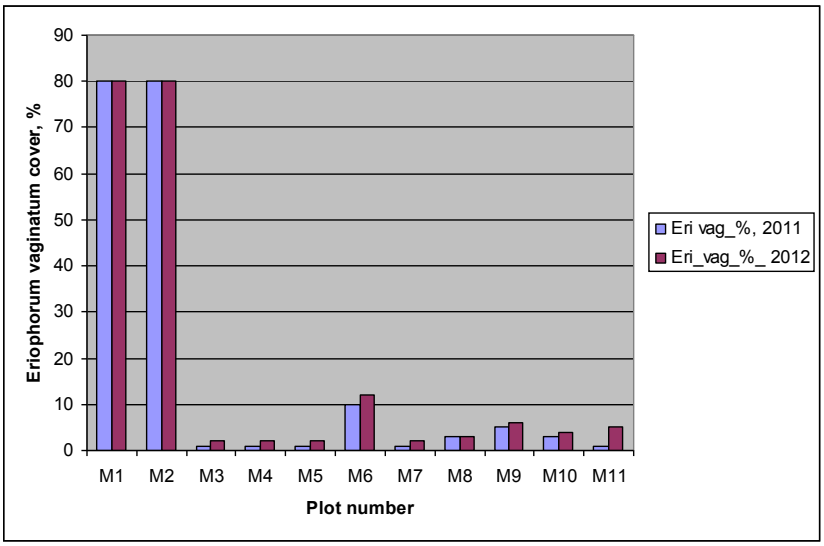

Figure 17. Changes in *Eriophorum vaginatum* cover, %, in the elevations of cutover peat fields of Melnais Lake Mire.

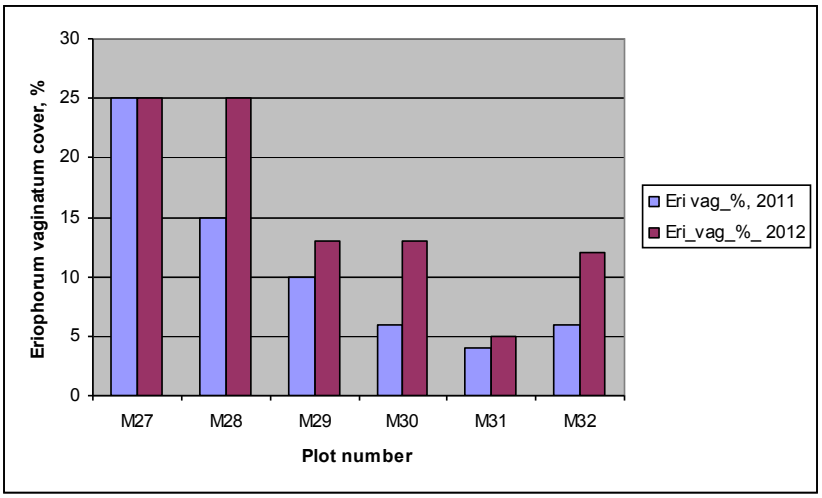

Figure 18
Changes in *Eriophorum vaginatum* cover, %, in the lowest places of cutover peat fields of Melnais Lake Mire.

Conclusions

1. Six month after dam construction in Melnā ezera Mire trends in mire vegetation changes can be considered as positive as *Eriophorum vaginatum, Rhynchospora alba* and total *Sphagnum* cover has increased indicating increased wetness in mire.

2. Development of *Sphagnum* mats were obsereved in ditches thus proving decrease of water outflow from raised bog.

3. The largest impact of dam construction in drainage influenced raised bog can be observed in 1-2 m zone along ditches where most significant vegetation changes occurr. However, vegation changes were observed even at a 100m distance from ditch. There were no clear linear relationships between the distance from a ditch and magnitude of vegetation changes. We assume, that the degree of impact depends on vegetation structure and species composition before dam construction, ground water regime after dam construction, as well as climate conditions, particularly precipitation.

4. Monitoring of vegetation changes must be continued as these studies reveal only initial vegetaion response to changes in groundwater level regime in Melnā ezera Mire.

20.12.2012.

/Liene Auniņa/

References

Āboliņa, A. 2001. Latvijas sūnaugu saraksts. *Latvijas Veģetācija*, **4**, 47 – 87.
Gavrilova, G., Šulcs, V. 1999. *Latvijas vaskulāro augu flora.* Zinātne, Rīga. 135 lpp.
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Other sources

Dēliņa A. 2012. Atskaite nr. 3 par hidroloģiskā režīma monitoringa novērojumiem DL „Aizkraukles purvs un meži"; DL „Aklais purvs"; DL „Melnā ezera purvs"; DL „Rožu purvs".

Annexes

Annex 1. Location of sample plots, dams and groundwater level wells in Melnais Lake Mire.
Annex 1. Field data forms for monitoring of vegetation changes in the Melnais Lake Mire Nature Reserve (on CD only).
Annex 2. Photos of the sample plots in the Melnais Lake Mire Nature Reserve (on CD only).