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THE RESTORATION OF CUTOVER BOGS IN NORTHERN POLAND

Peatlands in Poland cover about 4% of the country area. The most wide-spread are fens which build up over 93% of the total area of Polish mires. Bogs are far less abundant. This type of peatlands is relatively frequent in the young, postglacial landscape of northern part of the country (Pomerania region). Within this area occurs mostly small kettle – hole bogs and larger (100 – 200 h) baltic bogs. Baltic bogs are classified as true raised bogs, ombrotrophic with minerotrophic lagg. Whereas kettle – hole bogs are mostly in natural state, baltic bogs have been affected by human impact for about 200 years. The main branch of human activity in baltic bogs is peat mining, preceded by drainage.

Drainage itself leads to deep changes in both habitat and vegetation. The network of draining ditches causes water outflow from bog expanse and lowering of water table. After desiccation the upper peat layer becomes more compact what limits the penetration of rain water. Increased aeration leads to peat mineralization and decession.

Lowering of water table and decrease of peat moisture affects firstly hollow species, especially peat mosses, which decline their cover. Simultaneously the invasion of *Eriophorum vaginatum*, *Ledum palustre* and *Calluna vulgaris* is observed. Fires, frequent in drained bogs, promote heath expansion. When the water level in drained bog is instable, the tussocks of *Molinia caerulea* develop, what leads to competitive exclusion of remaining cryptogamous species. The occurrence of *Molinia* indicates the mobilization P in available form. After lowering of water table to about 50 cm before bog surface, trees are able to establish. In baltic bogs the expansion of *Pinus sylvestris* and *Betula pubescens* is commonly observed. Transpiration process, especially in birch causes additional water “pumping out” from the ecosystem.

Drained bogs were used for peat harvesting. Since XVIIth to the first half of XXth century peat had been block-cut manually and used for heating of individual households. After II World War large peat industries were established in Northern Poland to extract *Sphagnum* peat for horticulture. Nowadays there are 28 big peat industries which explore area of 1200 ha using milling method.

Small, rectangular peat-pits remained after block-cutting are usually filled with water or at least wet, what affords possibilities to spontaneous revegetation. After peat milling ceasing remain large fields of dry, mineralized and powder-structured peat. Disturbed hydrological regime, moorshing process and wind spreading of upper soil layer seriously limit the revegetation process. According to the law regulations cutover areas have to be restored. There are no elaborated methods of successful restoration of bog ecosystems in Poland. In most of cases explored mires are afforested, used for *Vaccinium corymbosum* cultivation or abandoned without future activities. Contemporary most of about 70 Polish baltic bogs are seriously disturbed and in many of them peat accumulation process is inhibited.

One of the biggest and most important actions conducted recently in Polish mires was project entitled 'Conservation of Baltic raised bogs in Pomerania, Poland', carried out by Naturalists Club (Polish non-governmental organization aimed at nature conservation) since 2004 till 2007. It was supported mainly by Life-Nature fund and cooperators (Global Environment Facility – Small Grants Program, State Forests, regional nature conservation administration etc.). The project was held in northern Poland in 23 Baltic raised bogs, which were classified as "giving chance for maintaining or restoring".

The main purpose of the project was to maintain or restore the favourable conservation status of active raised bog and pine/birch bog forest within its complexes. The following operational aims were designed:

- to get detailed knowledge of ecology and hydrology of each raised bog for preparing good management plans
- to stop the process of draining
- to stop local threats for biodiversity, created by expansive species (as a result of desiccation)
- to propagate modern approach for raised bogs conservation, including appropriate active management techniques
- to build public awareness of Baltic raised bogs' value and their European importance, as well as their conservation needs.

The project realisation involved several actions:

- sites assessment, preparing management plans
- blocking drainage ditches by building sluices and dams (about 550 point-blockings and 2,5 km of ditches blocked by fulfilling)
- removing invasive birch, pine and spruce trees to lower evapotranspiration rate and improve water balance

- improving light condition for rare plants species (*Osmunda regalis*, *Myrica gale*, *Erica tetralix*)
- making facilities for public entrance in bogs
- arrangement of workshops for scientists, forest administration and officials, publication of “Handbook of Bogs Conservation”, publication of brochure, propagation of the project results on a website
- experiment on *Sphagnum* species transplantation in the post-exploitation area.

The last action is held in Czarne Bagno: medium–size raised bog, located in Łeba river valley (northern Poland). Contemporary the bog is covered by mosaic of vegetation, with small fragments of active bogs vegetation, acid pine and birch forests and small dystrophic lake. Within this object a post milling area of 13,47 ha is located. There is very scarce secondary succession of vegetation even though the peat extraction in this place stopped over 10 years ago.

At first the experimental plots were prepared. The ditches which drain the site were blocked and the ground water level is systematically monitored. Upper layer of moorsh was removed at 3 levels: -10, -30 and -50 cm. Polymeric sorbent (agrohydrogel) was added in some parts of the plot to improve moisture condition of soil. In each big plot the small subplot was established. Eight *Sphagnum* species were chosen for transplantation: *Sphagnum palustre*, *S. magellanicum*, *S. fallax*, *S. cuspidatum*, *S. russowii*, *S. rubellum*, *S. capillifolium*, *S. fuscum*.

In main plots *Sphagnum* diaspores (shoots) were spread in two periods: in autumn 2006 and in spring 2007. After spreading they were covered with straw.

In small plots diaspores were applied in autumn 2006 with two methods:

- we spread 100 shoots of each species in 2 replications
- mosses were also planted in small tufts of about 15 cm diameter in 3 replications.

Then the plots were covered with transparent fabric used in horticulture.

It’s hard to assess the effects of transplantation at this very early stage – after first vegetational season. However, it seems that in the main plots *Sphagnum* species are in quite good condition. *Sphagnum cuspidatum* is the species which reacted very well to this treatment. During several months it was able to create green carpets under the straw layer. After blocking the ditches and because of quite damp summer in this year some places within plots are flooded and *S. cuspidatum* enjoys this very much. The other “successful”

species in the experiment is *Sphagnum palustre*, which is also doing very well. Very high ground water level in some subplots seems not to disturb in its growth. We observed also appearance of several individuals of vascular plants within experimental area (*Drosera rotundifolia*, *Erica tetralix*, *Oxycoccus palustris*). They were probably brought to this place with *Sphagnum* diaspores.

In small experimental plots transplanted species are in differentiated condition. Generally it seems that the rate of survival is higher within individuals planted in tufts than among shoots spread in bare peat.

In subplots with tufts *Sphagnum capillifolium* and *S. rubellum* are the species which are in better condition than the others (for example *S. fallax*). On the other hand, examining subplots with shoots, one can see that species from section 'Palustria' seem to be more resistant to hard condition of transplantation than "thin" ones. The rate of survival within these subplots is highest in *Sphagnum palustre* and *S. magellanicum* cases.

The project has finished but we are going to continue our work. The nearest plans are:

1. to monitor sample plots and bog's hydrology
2. to extend the experiment to the post-exploitation area in neighbouring raised bog 'Krakulice'
3. to set the experiment with vascular plants transplantation
4. to make an attempt to farm bog species 'in vitro' (*Sphagnum fuscum*, *Carex limosa*) as it is hard to obtain big amounts of their diaspores from natural sites, especially that most of them is under law protection in Poland .