LIFE15 CCM/DE/000138

Reduction of CO_2 emissions by restoring degraded peatlands in Northern European Lowland
(LIFE15 CCM/DE/000138)

LIFE Peat Restore

Report on implementation of project action A3 in Poland

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In Poland within Action A3 – which refers to the 'Study and improvement of data on project sites' – all three project sites (Torfowisko Kluki, Ciemińskie Błota and Wielkie Bagno) were surveyed: hydrological and vegetation mapping.

Hydrological mapping was based on numerous measuring devices. First of all, it concerned the installation of piezometers with divers. The installation of self-recording devices was carried out in July 2017. A total of 80 devices were installed, including 63 piezometers with divers to monitor the water table and temperature, and 17 limnigraphs to monitor the surface water level and temperature (in ditches, canals and peat-cuts). They served as a basis to determine the water level and the dynamics of changes in time and space, as well as its quality before, during and after the introduction of active protection measures on peatlands, aimed at minimizing CO2 emissions to the atmosphere. Also as part of the project, 1 meteorological station was purchased, measuring air temperature, wind direction and speed, and atmospheric precipitation. The weather monitoring station was installed on the former field station of the Pomeranian Academy in Słupsk and is representative of all three sites.

Results obtained for groundwater allowed to perform in the ArcGis Pro program a map of the hydroizohypses distribution for individual peat bogs, with medium conditions and the assessment of the magnitude of the fluctuation amplitude in the measurement period, divided into seasons. Water level measurements were also performed on selected channels and drainage ditches as well as in peat-cuts, which aimed to determine the retention size and its changes over time (amplitude of fluctuations). While selecting the places of installation (especially divers), the mosaics of the internal peat structure (over-dried areas, heavily cut by a network of drainage ditches and patches with top layer of peat) was a decisive factor. At the same time, patches with the most valuable peat vegetation were taken into account.

The measurement network is designed in such a way that on each of the peatlands studied, the longitudinal and transversal cross-section of the groundwater table (from dome part to edge) is obtained. The meteo station was used to assess the vertical exchange on peat bogs and to perform calculations of the climatic water balance. The measurement of atmospheric precipitation is read directly from the station, while the amount of evaporation is calculated based on selected mathematical formulas (elements measured on the above stations, supplemented with data obtained from the Institute of Meteorology and Water Management at the station in Łeba).

Table 1. Number of self-recording devices for the level of surface and groundwater

Type of device	Site		
	Torfowisko Kluki	Ciemińskie Błota	Wielkie Bagno
piezometer	22	17	24
limnigraph	3	3	11
TOTAL	25	20	35

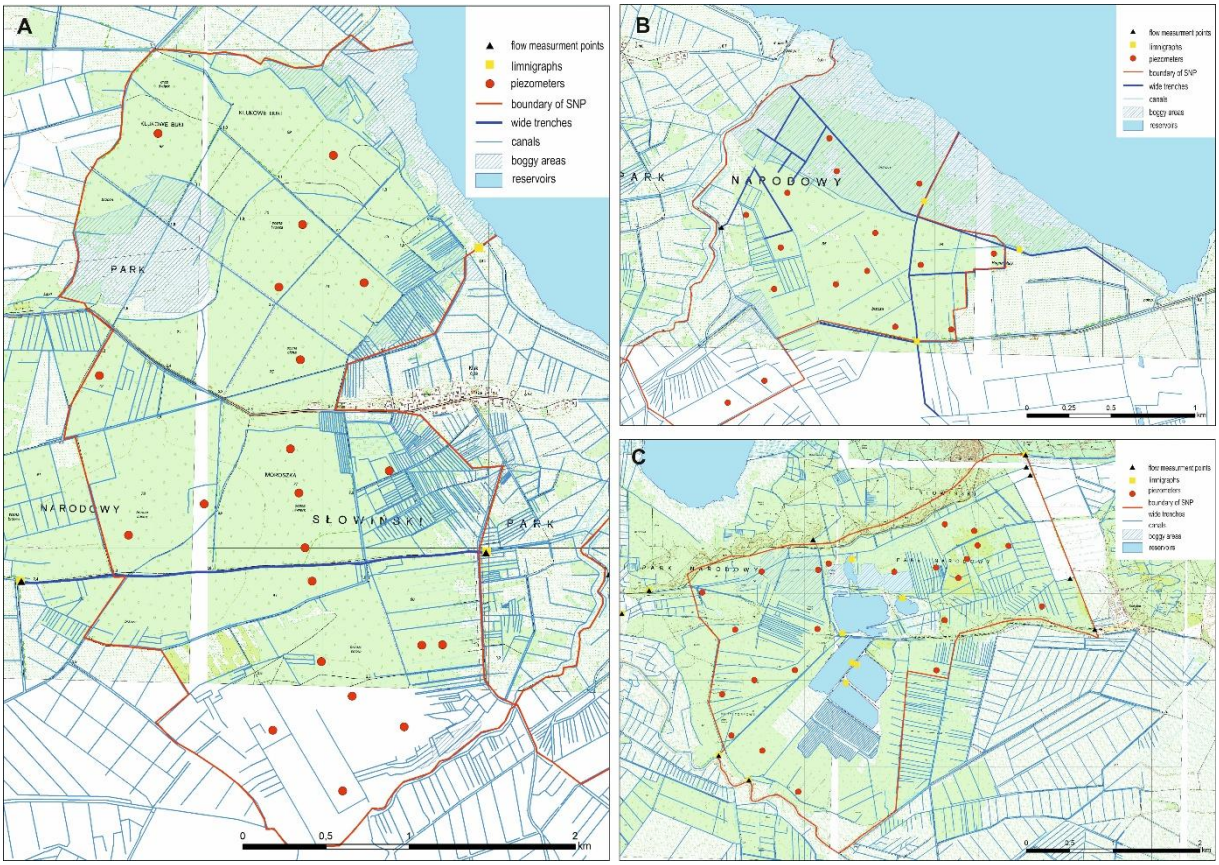

Fig. 1. Location of measurement points for water levels and flows on the studied peatlands A – Torfowisko Kluki, B – Ciemińskie Błota, C – Wielkie Bagno

During the fieldwork, a monthly inventory of surface water inflow and runoff routes was done and measurements of outflow volume with these routes were performed. These measurements allowed to estimate the amount of water surpluses or losses on the studied peatlands, through the inflow or escape of surface water.

Monthly measurements of simple physico-chemical features of surface and underground water were carried out in situ - water temperature, pH, oxygen content, electrolytic conductivity and suspension. In addition, surface and underground water samples were collected quarterly for further laboratory tests: chlorides, total nitrogen and total phosphorus. Once a year, determinations of bicarbonates, sulphates, sodium, potassium, calcium, magnesium, ammonia, nitrates and phosphates were carried out. In addition, a bathymetric measurement was carried out on the largest peat excavation site located on the Wielkie Bagno. Next, a bathymetric plan was drawn.

As part of the field work, numerous (up to 8 now) field mapping were performed, the task of which was to determine the retention status of the peatlands, in various hydrometeorological conditions. The mapping consisted of marking on the cartographic base areas of stagnation of surface water and places (including drainage ditches) having water or water deprived.

The mapping allowed to identify areas with high saturation of peat soil, even in the warm, dry season of the year. In 2018, after field measurements and reading data from installed piezometers along with data loggers, modelling of changes in groundwater level (as a result of building dams/partitions) was also performed. The groundwater model that was developed using the MODFLOW 2005 computational algorithm was used to evaluate changes.

Vegetation mapping was done during vegetation season 2017 and 2018 (actual vegetation) It was made by visiting patches on a problematic and / or inconclusive diagnosis in 2017. Work was also carried out in areas of particularly large phytocenotic diversity, for which, due to the possibility of changes after the implementation of conservation measures, it was justified to perform more detailed mapping. The works were carried out using the route method and the Juno SB GPS receiver. Their result is detailed actual vegetation maps (distribution of plant communities) in the project sites and the final version of GEST vegetation type maps for all three peat bogs.

8 monitoring plots was established for detailed monitoring of vegetation changes (Fig. 1, Photo 1). These areas were located in the area where removal of trees was/will be conducted and which will be affected by water damming, near piezometers recording the ground water level (hydrological monitoring). In 2019, it is planned to establish another dozen or so monitoring plots.

Each plot monitoring has a surface of 10 x 10 m and is permanently marked in the field. On each plot was determined by the summary cover of each vegetation layer (%), trees and shrubs layer height. summary cover of each vegetation layer (%), trees and shrubs layer height, each species coverage in % (by visual estimation on the whole plot, in Londo

scale). Moreover in each 10 x 10 m plot, 4 subplots 1 x 1 m (in corners; **Fehler! Verweisquelle konnte nicht gefunden werden.**) was created, for more detailed monitoring of herbs and mosses coverage changes (estimation - each species, in %).

Fig. 1. Distribution of the monitoring plots

Photo 1. Example of the monitoring plot (no 7)

Maps and description of vegetation of peat bogs are essential part of GEST analysis, calculations of CO2 emissions as well as establishing the baseline for vegetation monitoring (KPI monitoring and success of restoration measures). It is also essential for discussion on detail location of dams/partitions based on hydrological conditions surveyed by hydrologists.

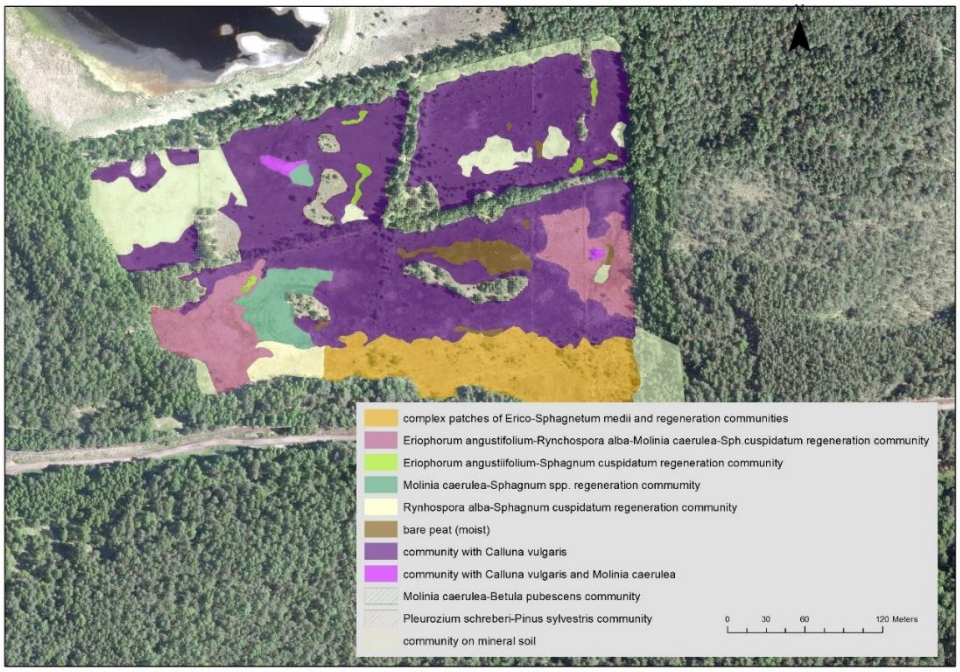

Fig.3. Exemplary results of detailed vegetation mapping in 2018 - area after exploitation of peat on Wielkie Bagno.