Ecohydrological studies as a base for alkaline fens conservation planning in Poland

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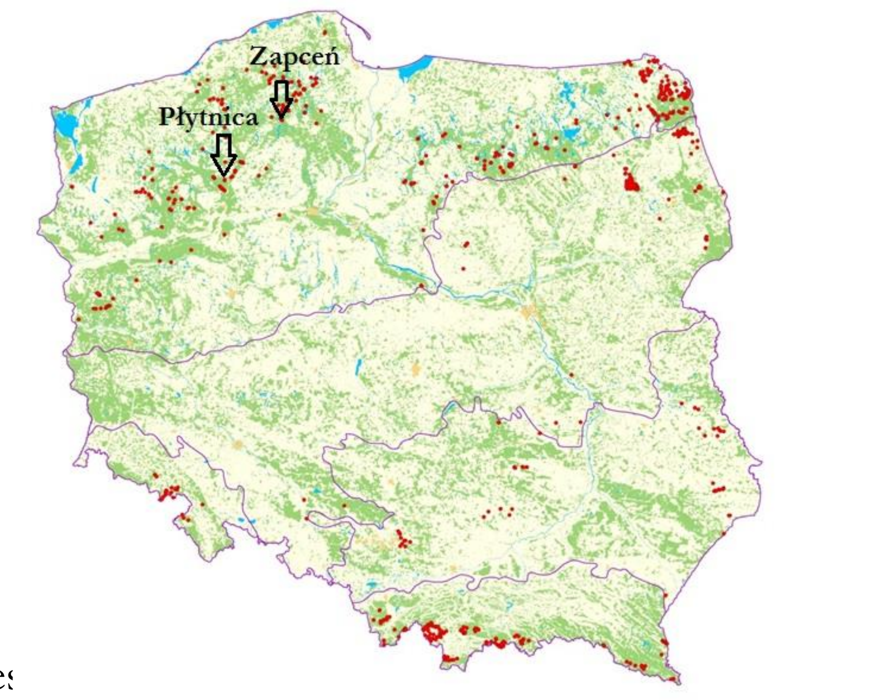

Fig. 1 Distribution of alkaline fen habitats in Poland

Introduction

The introduction of ecohydrological methods into the study of Polish alkaline fens have resulted in a much better understanding of processes governing the development, current ecological state and restoration prospects of several valuable mires. During the last 30 years numerous Polish fen systems have been studies by international teams of Dutch, Polish, German and Belgian scientists and students. The results of these studies often had a direct applicability in identifying and establishing the protected areas and proposing the protection and restoration measures for such sites.

Photo. 1. Student working in the fields

The ecohydrological approach

The ecohydrological approach to study and analyze mire systems is multidisciplinary; it combines (classical research in soil stratification, ecological research on vegetation distribution and hydrological research on occurrence of water flows. Field data are supplemented with results of laboratory analyses on water and soil samples. The results are all interpreted in a wider landscape context and also different aspects of human induced changes in space and time are taken into consideration. Figure 2 shows an ecohydrological model of the Myratz Valley in the Drawa National Park, in which the results of hydrological research is shown as arrows and where the peat degradation in time has been depicted on different spatial scales.

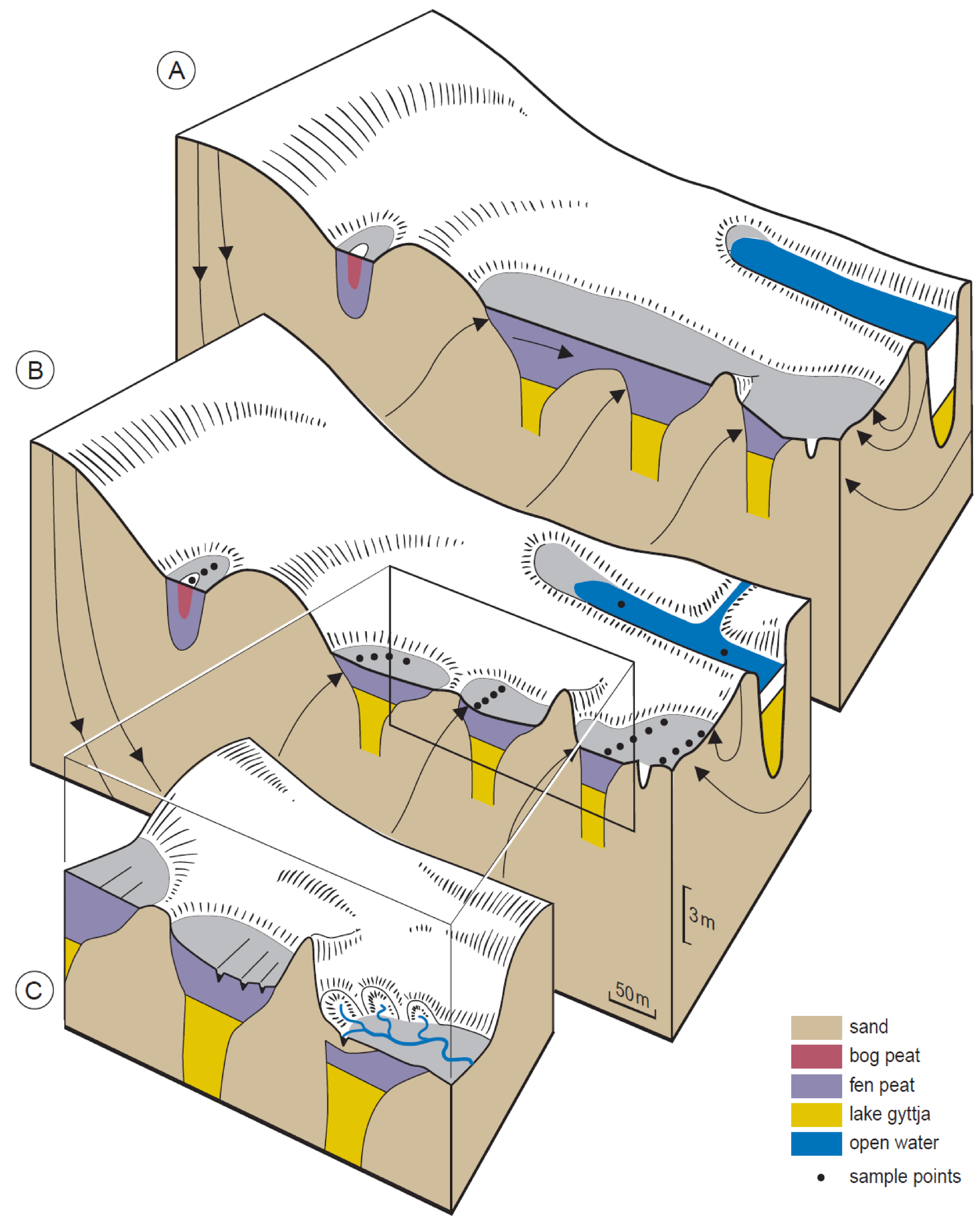

Fig. 2. Transformation of ecological conditions in the "Miradz" mire complex. A – original situation (reconstructed). B & C – present situation at different spacial scales (after Grootjans & van Diggelen 2009).

Results

Comparison of two case studies; Zapceń and Płytnica

We compared two case studies to understand why some ecological gradients had many red-list species, while others had not. We used temperature measurement in the profile, calcium – and sulphate content of the groundwater as indicators for different groundwater flows

Zapceń

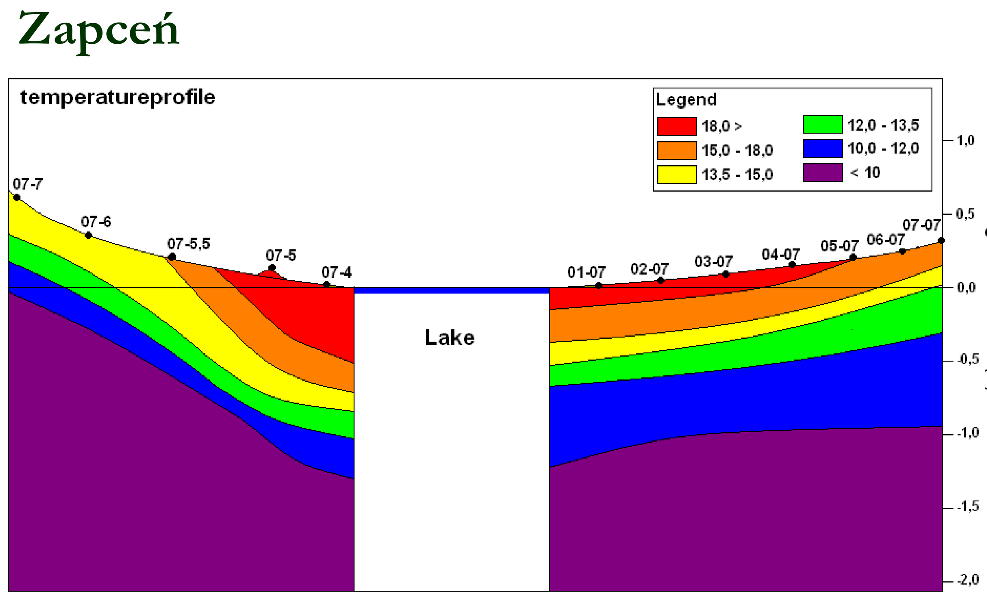

Fig. On the left side of the lake cold groundwater is getting high into the profile. On the right side of the lake there is no upward seepage of cold groundwater visible.

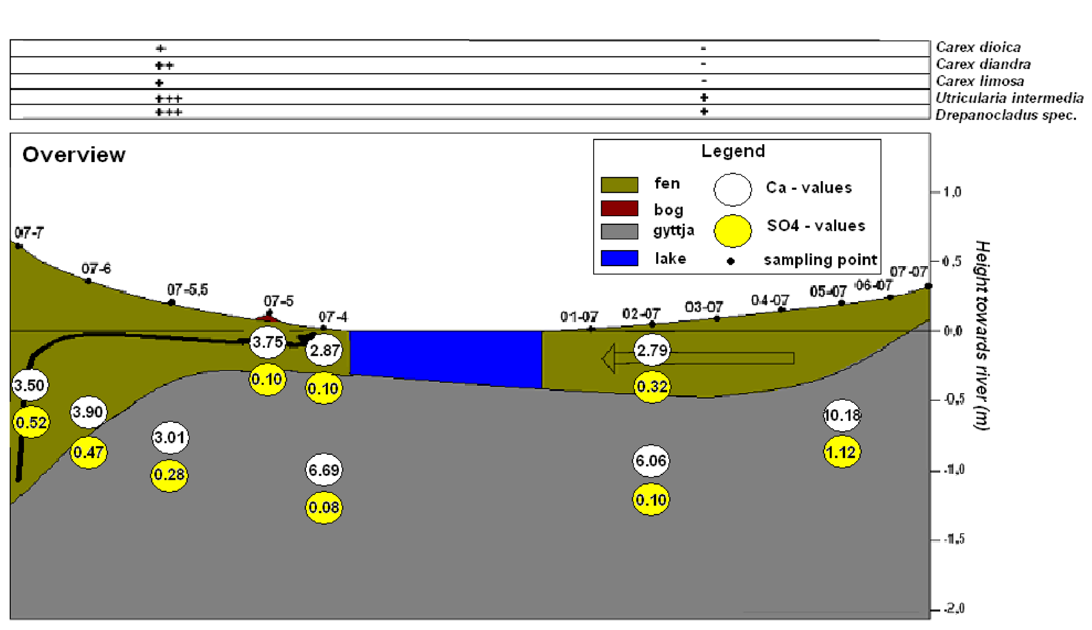

Fig. The black arrow is the strong and constant groundwater flow. This groundwater flow dilutes the sulfate concentration in it's way to the lake. The open arrow is a very weak groundwater flow that depends on the amount of precipitation.

Płytnica

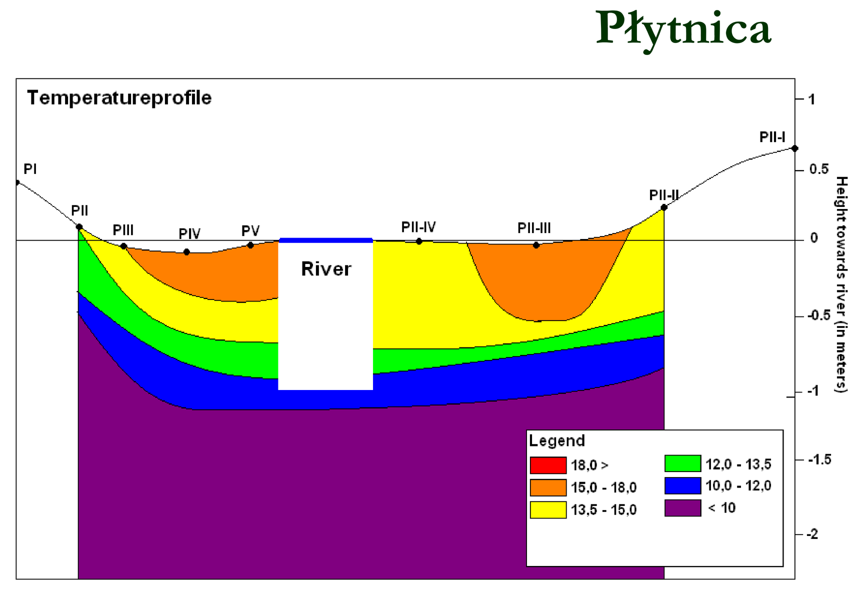

Fig. In this temperature profile there is also a strong upward seepage on the left side. A weaker upward seepage on the right side is caused by a smaller hydrological system. This idea is supported by the EC profile

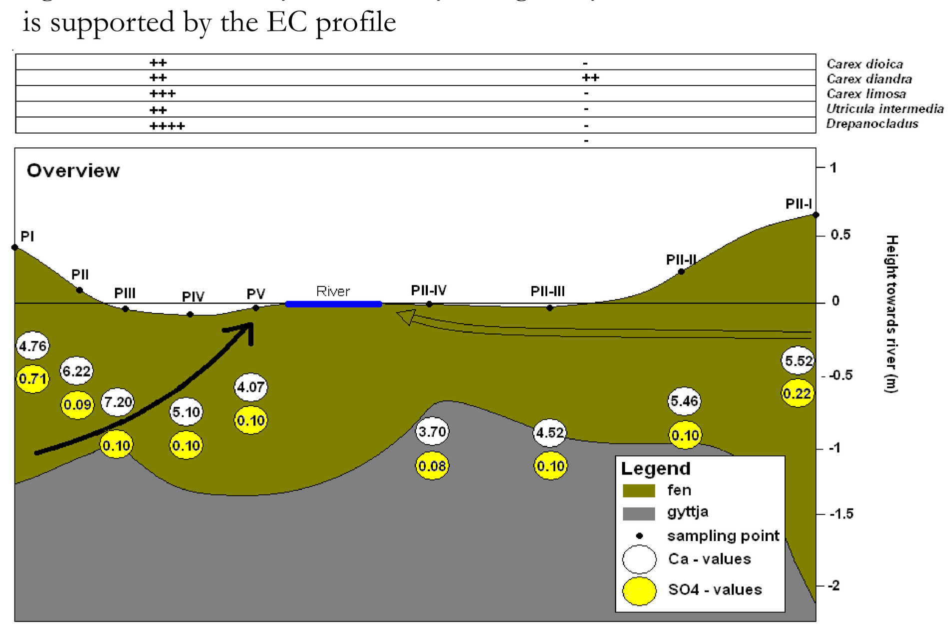

Fig. Here the black arrow represents a stable and therefore strong groundwater flow and the open arrow is a less constant water flow from a smaller hydrological system. Here the sulfate concentration is also diluted by the groundwater

Discussion

When comparing the two study areas Zapceń and Płytnica, the general conclusion is: red-list species occur under conditions with rainwater lenses in combination with a constant discharge of calcareous groundwater, with low sulfate concentrations and medium to high calcium concentrations.

The abovementioned hypothesis on the hydrological conditions that support the occurrence of some red list species needs much more detailed research to understand the ecological or hydrological mechanisms behind the relationships found. For instance, the occurrence of a constant discharge of relatively calcareous rich groundwater cannot support certain types of rich fen vegetation if the hydrological systems have slightly changed.

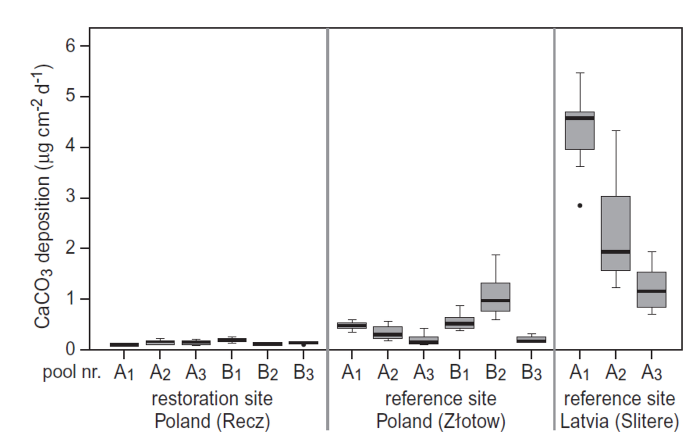

Fig. Box plots of $CaCO_3$ deposition in µg Ca2+ cm2·d−1.measured on microscope slides (n = 8 per pool) in experimental pools in Polish and Latvian spring mires.(from Grootjans et al 2015)

This was reported by Grootjans et al. 2015 in a study aimed at restoring an extremely rich fens in Recz, western Poland. They found that the restoration of the spring mire had become impossible due to a change in groundwater flow pattern. The discharging groundwater was no longer supersaturated for calciumcarbonate (the concentration of calcium and CO_2 was not high enough) to allow $CaCO_3$ deposition on the surface of the mire. This condition was required for the occurrence of certain rich fen species, such as *Primula farinosa* and *Eriophorum latifolium* that still occur in some protected reference areas in Poland and Latvia.

Literature

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