
The Biebrza National Park protects the biggest and the best preserved in the European Union complex of peatland of marshy, lowland river valley. It covers 59 223 ha, and it is the largest national park in Poland. The very unique diversity of plant and animal species and almost natural ecosystems managed to survive in the Biebrza River valley. Here 280 species of birds have been recorded; among them 178 breed in the Biebrza wetlands. 48 mammal species with the biggest population of Elk (about 600 individuals) in Poland as well as more than 1000 vascular plants species have been observed in the area. Not any other region in Poland has larger population of Lady's Slipper orchid.


It is an important breeding, feeding and stop over site for many waterfowl and wetland birds. According to Bird Life International, it is the birds' refuge of global significance. The Biebrza National Park was added to the RAMSAR Convention list in 1995, as one of the most important world wetland sites. The Biebrza Valley was also incorporated into the European Ecological Natura 2000 Network, which protects the most valuable nature ecosystems in the European Union. As the result many species of flora and fauna including: birds - Spotted Eagle, Black Grouse, Great Snipe, Aquatic Warbler, mammals - Beaver, Otter, Wolf as well as plants - Fen Orchid, Marsh Saxifrage and Eastern Pasque Flower are particularly protected at the Biebrza River.

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All photographs courtesy of Romuald Mikusek, Piotr Tałałaj and Adam Dmoch


# Red Bog Project

Project ***Biodiversity protection of Red Bog (Czerwone Bagno) - relic of raised bogs in Central Europe - PL 0082***
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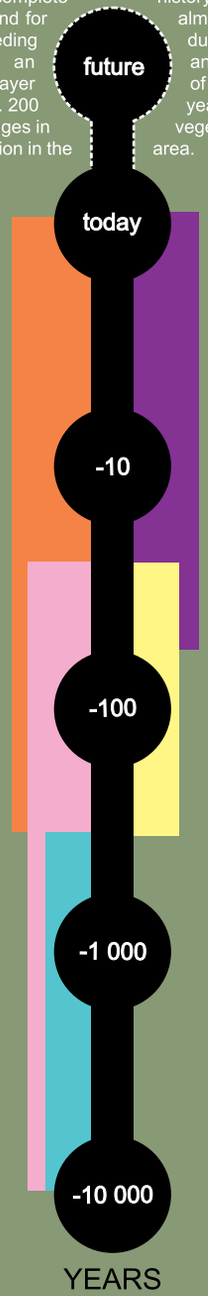
# Combining multiple methods to re-construct and interpret the past of a mire ecosystem: case study of the Red Bog

The Red Bog is one of the European oldest nature reserves, baring hardly any signs of direct human influence over the last 80 years. Combining different information sources we re-constructed almost complete history of the mire ecosystem, providing a basis for its interpretation. In short, the peatland started to grow c. 10.000 years ago and for almost the entire time developed as a groundwater-fed rich fen to finally evolve into a forested poor fen with marked rain water feeding during the recent 300-400 years only. Dendrochronological and cartographical analyses excluded the hypothesis of an anthropogenic origin of the forest, suggesting rather its gradual increase since the early 17th century. However, an apparent layer of highly degraded peat at shallow depths point at a heavy impact of the regional hydrological alterations that occurred c. 200 years ago, which have probably accelerated the acidification. The recent 50 years were characterised by quite distinct changes in vegetation and differentiated dynamics of the forest line, which points to importance of local factors maintaining open vegetation in the area.

The **Red Bog** reserve is the second biggest raised bog in Poland with regard to its area and probably the only big bog of this type preserved in natural state in the entire country. Due to wide-spread endanger of wetland habitats by eutrophication and drying up, investigation of ecological relationships on the relatively little transformed sites is getting a lot of importance and causes that the Red Bog is area of unique value on the European scale.


Regardless of non-questionable nature value and primary assessment and analysis of the scientific research results conducted in this area, the Red Bog reserve is not yet scientifically documented and mapped in methodological way. Moreover, we are not able to ascertain, how stabile is this unique system (considerable development of Alder buckthorn (*Frangula alnus*) and pine forest may indicate some significant changes in water recharge mechanism of the bog). Therefore, the **direct aim** of the project is the recognition of ecological relationships that decide about biodiversity of raised and transitional bogs. Description of relationships between water and soil (including soil-forming processes) conditions and plant communities and relationships between ungulates herbivorous and large predators will enable for formulating of raised and transitional bogs protection and restoration principles. At the European scale, elaboration of efficient restoration and protection methods of raised bogs priority habitats of EU is the need of the moment.

Proposed activities of the project implementation cover three main themes: (1) recognition and documentation of existing state of the system, (2) formulation of protection strategy, (3) study on ecological relations. Those tasks will be implemented by seven research teams which are specialized in the following fields: hydrology and hydrogeology, meteorology, hydrogenic sites and peat soils, botany - forest and non forest plants, mammals, birds and insects. The additional team will be responsible for GIS and data bases documentation.


### DENDROCHRONOLOGY

Most of the peatland is covered with scots pine *(Pinus sylvestris)* forest. Cores were obtained from 246 randomly selected trees. Year rings were counted and measured in the laboratory. We proved the multi-aged structure of the stand, with most of the trees between 100 and 200 years. Age of the oldest pine – 371 years at breast hight – suggests that development of the stand had started not later than 400 years BP.

### PALAEOBOTANICAL INFORMATION

**Analysis of peat remnants** allowed to reconstruct the succession of plant communities in the mire. We documented that the Red Bog started its development as a shallow lake and quickly entered the phase of soligenic fen. It existed as a percolation mire with different stages of fen vegetation for almost 10.000 years to undergo a sudden change into a groundwater-influenced poor fen / bog system during the last 3 centuries only. **Palynological analysis** provides additional information on the surrounding landscape and its possible influence on the peatland development.

### $C^{14}$ DATING

is used to position certain changes in mire development on the time scale; it can only work well in the deeper layer of little-decomposed peat and for records older that 1000 years

### VEGETATION CHANGE OVER THE LAST 50 YEARS

The most recent changes in vegetation composition and patterns are analysed by comparing historical vegetation maps and phytosociological relevees to currently collected data. We digitised vegetation maps from 1975 and 1999 and produced a new map with help of GPS system and satelite images. Present-day releves are compared to the historical ones. This part of analyses is still in progress.

### REMOTE SENSING OF FOREST & SCRUB DYNAMIC

Using archive aerial photographs and present satelite images we were able to analyse forest and scrub cover in four time clusters between 1960 and 2008. The revealed differences in scrub and forest dynamics between different zones point to the importance of past management and herbivory in controlling vegetation succession.

### HISTORICAL CARTOGRAPHIC SOURCES

Historical maps serve as a useful source for information on the ladscape and potential human penetration in the area. Information about forest coverage was locally confirmed by dendrochronological methods.

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### The Red Bog strict protection zone

It is one of the oldest and the most famous protected area in Poland. It is probably named after red colour of water observed between tussocks of sedge and moss. The Red Bog forest reserve was established in 1925 with the area of 2.179 ha. According to prof.. Władysław Szafer (1932) "the bog pine forest with transition to the birch forest" covered the area. Its aim was to protect the one of the last Elk (Alces alces) refuge in Poland. It is a spot where Elk, in number of several individuals, survived the World War II. Thoughtful care allowed successful rebuilding of Polish population of that species.

This reserve, with adjoining Grzędy reserve, were made into one nature reserve with the total area of about 12,000 ha and was named Red Bog (Czerwone Bagno) in 1981. It become part of the Biebrza National Park, in the year of establishment (1993).

The Red Bog strict protection zone covers about 3000 ha according to the data from 2007. Only indispensable scientific researches are carried out here. Neither the economic activities nor the tourist traffic take place in the zone. Nevertheless, the educational trail along the boardwalk leading to the observation platform allows seeing fragments of this precious area.