

Grasslands of the mineral islands in the Biebrza National Park, Poland

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The Biebrza National Park is located in Northeast Poland (Fig. 1), in the basin of the river Biebrza. The park was established in 1993. It is the largest national park in Poland with a total area of 59,233 ha, of which 25,494 ha are wetlands. The Biebrza marshes, fens and wet meadows are famous particularly for their very diverse avifauna with many rare

species, such as aquatic warbler (*Acrocephalus paludicola*) and greater spotted eagle (*Clanga clanga*). The park was designated as a wetland site of global significance and is under the protection of the Ramsar Convention.

The park landscapes are not wild, but represent one of the last large remnants of semi-natural landscapes of river val-

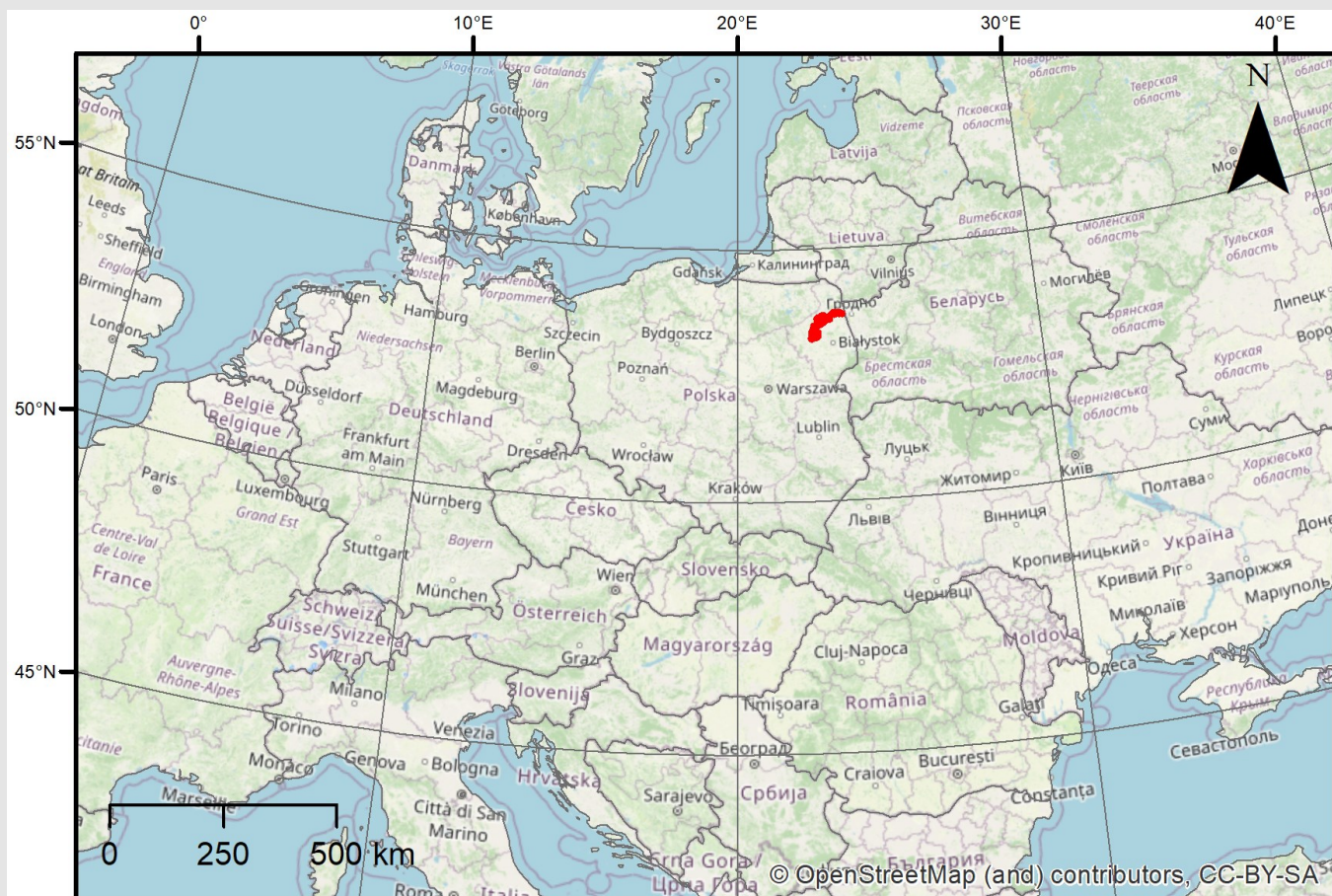


Fig. 1. Location of the Biebrza National Park (marked in red).

leys of lowland temperate Europe once stretching from Belgium and the Netherlands to the Polesia region in Belarus and Ukraine along the southern margins of the Pleistocene glaciation. However, the park and the valley are more than wetlands: embedded in the wet plains, there are small mineral islands with mesic or even dry habitats, isolated or arranged in distinct archipelagos. We call them 'mineral islands' as they are built mostly of sand in contrast to the organic soil of the surrounding wetlands. Those mineral islands are of various origins: mostly aeolian, being tops of dunes formed during the dry early Holocene, which then became largely submerged in the growing fen peat, but also fluvial or glaciofluvial. The size is variable (from just a few hundreds of square meters up to a few hectares) as well as their height above the wetlands (from nearly flat to about a dozen meters). Their sandy soils are drought-prone and are often quite calcium rich.

In the past, when the whole valley was used by local people mostly for cattle husbandry, also the mineral islands were used for grazing. The largest ones even had permanent settlements with small arable fields. Since the mid-20th century, traditional agriculture has successively disappeared from the valley but free-ranging cattle still roam some of the mineral islands. Others are slowly converting to oak-lime-hornbeam forests but a significant portion is still kept open by large populations of wild ungulates (wild boar, roe deer, red deer and the king of the wetland – the elk).

Mineral islands are known as biodiversity hotspots of the area. It is estimated that they support half of the national

park flora, although they cover only a small fraction of the park area. Some plant species of dry grassland and thermophilous forests occur here in isolated outposts, far from the main range (e.g. *Iris aphylla*, *Cimicifuga europaea* and *Gymnadenia conopsea*), and other, overall very rare, form numerous populations (*Cypripedium calceolus*, *Pulsatilla patens*, *Dracocephalum ruyschiana*, *Thesium ebracteatum*). The same applies for animals, especially insects, including *Phengaris (Maculinea) arion* and *Parnassius mnemosyne*. The vegetation of those hills generally comprises dry sandy grasslands (both acidic and calcareous), *Nardus* grasslands, mesic and litter meadows, thermophilous fringe communities and even communities close to meso-xeric dry grasslands (despite prevalence of sandy substrates). However, no in-depth phytosociological studies have so far been carried out.

Regardless of their acknowledged values, the mineral islands are not receiving much attention from the national park authorities with respect to their active conservation. The main focus in the park is on conservation of semi-natural wetland habitats and landscapes, and the dry hills are mostly left unmanaged or are managed only if they are in proximity of mown or grazed wetlands. Even though the pressure of ungulate browsers slows their succession towards forest, the lack of grazing, mowing and/or fire disturbance leads to deterioration of their habitats and dominance of strongly competitive grasses, such as *Calamagrostis epigeios*, *Molinia caerulea*, *Bromus inermis* or *Brachypodium pinnatum*.



Sign at the border of the Biebrza National Park near Dolistowo Stare. Behind it is the Biebrza river and typical landscape of the national park: vast plains dominated by marshes, fens and wet meadows. Photo: J. Dengler.



View of the Biebrza river from the bridge near Dolistowo Stare. Photo: J. Dengler.



Two elk (*Alces alces*) within fen vegetation (fruiting *Eriophorum angustifolium* in the foreground). The Biebrza basin is very important for conservation of this emblematic species: it contains the largest population of this species in Poland, estimated at 1,400 individuals. Elk are browsers, which can help to preserve open vegetation on mineral islands. Photo: Ł. Kozub.



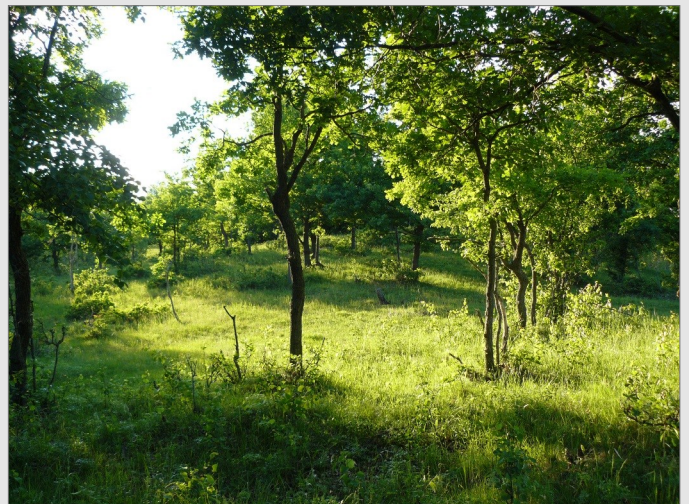
Top of the mineral island near Grzędy in the first half of July – a species rich patch of a dry grassland with flowering *Peucedanum oreoselinum*, *Dianthus carthusianorum*, *Hypericum perforatum* and *Veronica spicata*. Photo: I. Dembicz.



Dry grassland with *Corynephorus canescens*, *Hieracium pilosella* and *Helichrysum arenarium* on the top of a mineral island near Polkowo, at the national park border, surrounded by intensively used meadows on drained peat. Photo: J. Dengler.



Slope of large mineral Island covered by dry psammophytic grassland with *Thymus serpyllum*. Photo: I. Dembicz.



The most species-rich and valuable habitats of the mineral islands are light forests consisting mostly of birch *Betula pendula* (on the left) or oak *Quercus robur* (on the right) resembling forest-steppe mosaics of lowlands of Eastern Europe or even Western Siberia. Photos: I. Dembicz, Ł. Kozub.



In the southern part of the Biebrza National Park a few herds of free-ranging cattle are still present. Each morning they walk from their barn many kilometres into the fens on their own, often resting on the mineral islands, and return in the evening to their owner. Photo: I. Bobrowska.



Colourful dry grassland with blooming *Anthericum ramosum*, *Dianthus cathusianorum* and the grasses *Phleum phleoides* and *Koeleria grandis*. Photo: I. Dembicz.



Fringe community with *Melampyrum nemorosum*, *Convallaria majalis* and *Galium album*. Photo: J. Dengler.



During the exceptionally dry spring of 2020, a large fire has spread over large areas of the Biebrza National Park. The fire mostly burned reed and sedge beds but some of the mineral islands were also impacted. In summer 2020, mosses and lichens still were affected while *Thymus serpyllum* has regrown fast. Photo: I. Dembicz.



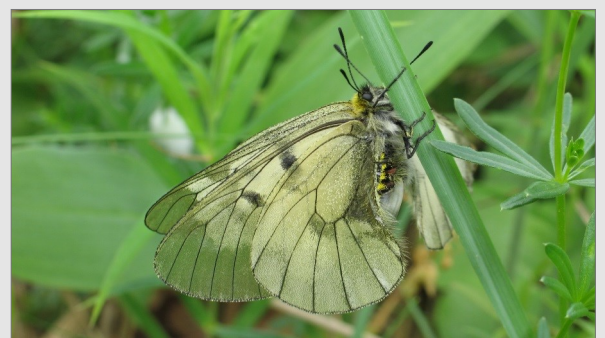
After the rain, droplets of water falling from the birch tree on the sand and breaking algal soil crust form a distinct pattern around *Corynephorus canescens* tussocks. Photo: I. Bobrowska.



Plants of the sandy soils, occurring in both grassland and forest fringe communities: *Epipactis atrorubens*, *Dianthus arenarius* and *Trifolium arvense*. Photos: J. Dengler.



Forest fringes and light forests are home to many tall herbs with large and colourful flowers as (from the left to the right): *Cypripedium calceolus*, *Campanula cervicaria* and *Centaurea phrygia*. Photos: I. Dembicz.



The mineral islands of the Biebrza valley are the last stronghold for *Dracocephalum ruyschiana*, one of the rarest plants of Poland. On the picture with its pollinator *Bombus lucorum* agg. Photo: I. Dembicz.

Butterflies of the mineral islands include more common species, such as *Polyommatus icarus* (top) and *Melanargia galathea* but also rare and threatened ones like *Parnassius mnemosyne* (here during mating). For the last species, typical for the mineral islands, proximity of warm, sunny grassland patches and oak-lime-hornbeam forests with *Corydalis* spp. is especially important. Photos: I. Bobrowska, J. Dengler, I. Dembicz.



Open sandy areas are home to a specialised insect fauna: *Philanthus triangulum* with its prey *Apis mellifera* carried to the hole in the sand to feed the larvae (top left), well camouflaged *Oedipoda caerulescens* (top right), *Cicindela silvatica* running among *Cetraria* spp. and *Cladonia* spp. (bottom left), and *Bembix rostrata* (bottom right) – females of this species put a lot of effort in caring for their larvae and they are very faithful to its nest sites, often nesting in the same places year-on-year. Photos: J. Dengler.



Diploschistes muscorum – lichen occurring in dry grasslands on sandy and calcium-rich soil. In early growth stages it parasitises on lichens of the genus *Cladonia*. Photo: J. Dengler.