

Additional information

General ecological features

The core of the wetland is the most valuable area of raised bogs, which can be considered as a unique natural complex. Wetland landscapes of glaciolacustrine lowlands and water-glacial plains form the periphery of the wetland act as a buffer zone between the core of the wetland and the surrounding land extensively used for economic activities.

The mosaic structure of the territory alternates different elements of relief: flat spaces, shallow basins with some hills, ridges, dunes, small outcrops and depressions with different plant communities growing on them. Autonomous natural boundaries of ill-defined floodplain glacial-lakes landscapes and natural boundaries of floodplains with linear contours are common.

The vegetation of the territory belongs to Polotsk and Surazh-Luchessy areas of the West Dvina district of geobotanical northern subzone of oak-conifer subtaiga forests.

In phytocenotic aspect, the wetland area is typical of the Polotsk Lowland in the north of Belarus. The natural vegetation occupies 95.4% of the reserve: forests - 67.3%, marshes - 26.5%, shrubs - 1.1%, meadows - 0.5%. The vegetation of the forest-marsh complex is a combination of forest and wetland type of plant communities, related to oligotrophic and oligo-mesotrophic bogs. Alternation of open ridge-hollows and hollow-lake bog complexes with wooded bogs form pine areas and typical mineral islands.

In the overall structure of the vegetation cover, 89 types of plant communities can be highlighted, which is high for the region.

Raised sphagnum bogs are the core of the wetland, which has the appearance of Northwestern swamp, with a number of special features. Vegetation of the bog is typical of the North-West sphagnum bogs, and is characterized by vegetation with continental elements (*Chamaedaphne calyculata*, *Sphagnum majus*) and some Sub- Atlantic and western species (*Calluna vulgaris*, *Sphagnum cuspidatum*, *S. rubellum*).

Other plant complexes typical of the bog are: finely-hollow (often with severe regressive effects) shrub- sphagnum complexes with rare pine (*Pinus sylvestris* f. *litwinowii* and f. *willkommii*) on top, ridge-hollow complexes on gently sloping sites, ridge-lakes on the slope and on the top, hummocky-hollow in the lower part of the slope and pine-shrub-sphagnum communities (forested ring) on steep slopes. The width of afforestation ring as well as the area of ridge-hollow complexes, and the degree of its intensity varies in different parts of the swamp, depending on the slope of the surface. At the bottom of the slopes pine-cotton grass-sphagnum, shrub-cotton-grass-sphagnum and cotton-grass-sphagnum phytocenoses can be found.

Marsh, wetland and upland forests are located on the periphery and in the islands of the bog acting as a buffer zone. The forest reserve is not very threatened by human activities due to its relative inaccessibility in a territory with a relatively low population density (for now). Here, large areas of previously common oak, as well as old-indigenous and sub-climax pine and spruce forests have been preserved. In general, forestland covers 20,158.2 ha (75.8% of

total area). Typological scheme of forest vegetation include 4 groups of formations, 9 formations, 21 series and 72 types. The predominant forest structures are pine (31.8% of the forest area) and silver-birch (32.1%). Forests characterized by a relatively high participation are among others: spruce (12.1%), bog-birch (9.2%) and black alder (9.2%). Rare and fragmented forests in the wetlands are oak and ash (0.1%) forests.

583 vascular plant species can be found in the wetland belonging to 318 genera, 89 families, 53 orders, 6 classes and 5 divisions. Among them, 5 species of club mosses, 6 - horsetails, 10 - ferns, 3 - 559 species of gymnosperms and angiosperms (423 dicots and 136 monocots).

Overall the wetland flora is a complex mix of different flora and genetic elements: taiga, nemoral, forest tundra and forest-steppe of Central European, Atlantic-European, Mediterranean and Eastern European origin of plant species.

Due to the diversity of landscapes, the weak development of the territory and a variety of native forests, meadows and wetland habitats, there is an exceptionally rich fauna within the site, comprising 9 species of amphibians, 5 species of reptiles, and at least 32 species of mammals, accounting for 77.3% of the species diversity of vertebrates Belarus.

Physical features of the site

Geomorphology.

According to the geomorphological zoning, the wetland is located in the Obol subarea of Polotsk glaciolacustrine lowlands. The characteristic morphological feature of the site is a general flat topography determined by the history of formation of the structure of the region.

Origin.

The modern relief was formed as a result of the Poozerie glaciation. Morphologically, the territory of the wetland is a flat hollow. The presence of kames, eskers, eolian mounds and hills, parabolic dunes, gullies and closed thermokarst basins stand out in a general flat landscape. The amplitude of the fluctuations of the relative heights is 2-3 m on gently undulating and flat surfaces, and 4-7 m in the plane and hilly terrain.

The current transformation of the relief is related to the prevalence of waterlog.

Hydrology and hydrography.

The river network of the wetland belongs to the basin of river Western Dvina and its greatest tributary Obol River. The following largest rivers are Sosnica, Tsenitsa, Glybochka. Floodplains are weakly marked. The width of the river valleys usually does not exceed a dozen of hundred of meters. Rivers are tortuous. The total water area covers 295.7 hectares (0.8% of the wetland).

River	pH	mg per liter						
		HCO ₃ ⁻	SO ₄ ²⁻	Cl ⁻	NO ₃ ⁻	Ca ⁺⁺	Mg ⁺⁺	Na+&K ⁺
Western Dvina, summer low water	7.40	46.6	2.2	0.9	0.3	41.6	7.5	0.9

The lakes belong to the residual and thermokarst type. Almost all lakes are dystrophic, shallow and have a low bog coast with overgrown aquatic vegetation. The largest lakes are Moshno, Rassolay and Krasomay.

Soils.

According to the soil-geographical zoning, the area is situated within the Polotsk district, in the North West Region of North (Baltic). There is a patchiness and diversity of soils due to the presence in the plains of a marshy flat undulating surface and a relatively young glacial relief formed by the distribution of the last Poozerie (Valdai, Wurm) ice.

The typical wetland soils are:

- Sod-podzolic sandy soils (the content of physical clay to 10%), characterized by depleted organic matter (to 1%);
- Sod-podzolic sandy loam soil (physical clay content is of 10 to 20%). Humus content is of 2-3%, and the degree of saturation of the absorption complex generally varies between 50-60%, sometimes rising to 80-90%;
- Sody-podzolic sandy loam and loamy swamped (weakly gleyey, gleyey and gley) soils with high humus content (2-3% or more), and preferably more acidic (unlike automorphic sody-podzolic soils) reaction (pH 4.5-4.0 and below);
- Turf and waterlogged soil. Characterized by large humus content (up to 4-5% and above), pH 5.6-6.0 and above;
- Peat soils.

Climate.

The climate of the wetland is temperate continental, formed in the interaction of marine and continental influences. The alternation of air masses of different origin creates an unstable type of weather, with mild, wet winters and relatively cool and sunny summers. Weather station "Polack" is the most representative for climate characteristics of the wetland. Long-term average annual temperature is $+5.5 \pm 0.1$ °C, varying in different years from +3.2 (1942) to +7.5 °C (2010). The warmest month of the year is July (+17.4 °C), the coldest is January (-6.7 °C), but often the shift of heating and cooling occurs in August and February, respectively.

Absolute limits of variation in air temperature are from -40.0 to +36.0 °C. Comparison of the data for the period 1945-1991 and 1992-2010 showed that in recent years, for most of the year the temperature was higher by 0.2-3.2 °C; greatest difference observed in the period from January to April. The maximum increase of average temperatures is in January (+2.1 °C), February (+2.0 °C) and March (+2.2 °C).

Long-term average annual rainfall for the period of record is 694 ± 11 mm, varying in different years from 457 (in 1959) to 815 mm (1998). The highest rainfall (average 380 mm) falls in the warm season (April- September). Minimum precipitation is usually in February (average 31 mm) and the maximum in June (77 mm).

The average annual rainfall since 1991 has increased from 669 (1945-1991) to 715 mm (1992-2010).

The average annual relative humidity is 79%. Maximum annual variation of the relative humidity falls on November-December, and it is 88-90%, the minimum (67-74%) in May. Dry days when the relative humidity does not exceed 30% are very few (for a long-term annual average - 7.7), with a third of them in May.

Physical features of the catchment area:

The river network of the wetland belongs to the basin of the river Western Dvina. Obol River is its greatest tributary and runs along the eastern and southern boundaries of the reserve. The river in the site covers more than 50 km. The Valley is trapezoid with a width of 300-600 m. The floodplain is bilateral and sometimes is absent. The riverbed is meandering, 20-40m wide. On the territory of the wetlands, river Obol takes two right tributaries - Tsenitsa and Glybochka. The width of their valleys is typically less than a few dozen, at least hundreds of meters. In the valleys of these rivers, floodplains are weakly marked. The next largest river is Sosnica, a tributary of the West Berezina. Sosnica River flows along the western boundary of the wetland. Valley is unexpressed and the channel is sinuous with a width of 1 to 3 m.

Aquatic systems play an important role in wetland landscapes; the largest of them is Moshno, Rassolay and Krasomay. The genesis of the basins of the lakes belongs to the residual and thermokarst type. Almost all lakes are dystrophic, shallow and have a low bog coast with overgrown aquatic vegetation. Lake Moshnia is connected to the lake Krasomay and the river Tsenitsa by streams. The river Glybochka flows out of Lake Rassolay.

Ecosystem services**Current scientific research and facilities**

Case studies of landscape and biological diversity in the reserve were carried out for the preparation of the scientific substantiation of the protected area "Kozyansky"

In 1998, experts in various fields from the Scientific and Practical Center of Bioresources of NAS and the V.F.Kuprevich Institute of Experimental Botany of NASB carried out detailed studies of the flora and fauna of the site. Systematic lists of the major groups of vertebrates were prepared, rare and vulnerable species were identified and an assessment of the status of the wetland was produced.

Social and cultural values

Historical and cultural significance. On the territory of the wetland there are 17 objects protected by the state as historical and cultural values including 15 historical and 2 archaeological monuments.

The archaeological heritage. Represented by the ancient castle and Burial mounds located near the village of Krasomay.

Historical monuments are related to the events of the Second World War. This is immortalized by the burning of villages - Bochkany, Drazhaki, Zaozerye, Zalesie, Zueva, Papova, Shchemilovka and Yamischa, and mass graves of Soviet soldiers and partisans.

The socio-economic potential.

The current land use. The main land users in the wetland are: the State Forestry Institution "Shumilino Forestry" (Kozyany, Mishnevo, Nikitin forestry), the State Forestry Institution "Polotsk Forestry" (Goryany forestry), the Municipal Unitary Agricultural Enterprise "Mishnevichi", the Unitary Enterprise "Shumilinskiy Raiagroservice" and the Open Joint Stock Company "New Gorianny."

On the agricultural land within the wetland all traditional agricultural activities are permitted.

In the forests, picking berries and mushrooms is allowed. Given the high density of game species of ungulates, hunting is allowed but regulated by law. On the territory of the wetland, recreational fishing is also allowed.

Population and settlement system.

In the territory directly adjacent to the wetland within the Polotsk district, there are about 24 villages. In Shumilinsky district there are 54 rural settlements. Half of the rural communities in the nearest area within Shumilino district live at a walking distance (about two thousand people).

In Polotsk district, within walking distance to the reserve, there are 11 settlements with a total population of 0.5 thousand people. The largest settlements in the Shumilino district are centers rural councils: Mishnevichi (0.8 thousand), Berezina (0.3 thousand), as well as farms and their divisions: Gorovoe (0.3 thousand) and Grudinovo (0.2 thousand), the other are from 10 to 100 people. In Polotsk district, the nearest village still fewer than Shumilino district, of which only Zalesie (0.1 thousand) and Matusow (0.1 thousand) are different, and in others only 10 to 50 people live.

All other rural communities of both regions are far enough, and the wetland isolated from them by extensive forests.

Within the boundaries of the wetland only two small rural settlements of Schumilino district are: Rovnoe and Zapolyanka with a population of up to 50 people each.

Industrial production.

Almost all industrial enterprises of Polotsk and Shumilino districts are remote from the wetlands. The territory is not a source of raw materials, which ensures the operation of industrial areas. In areas directly adjacent to land, the construction of new industrial plants in the near future is not planned, except for the possible development of a small-scale processing complex.

Mineral resources.

On the territory of the wetland mineral deposits are: 2 deposits brick-tile raw materials (clay, loam), one of which is minutely explored and exploited ("Zapolie"), as well as sapropel deposits of the lake Tennitsa. The deposit's reserves are classified in categories A + B + C1 reserves in the amount of 18,580.5 thousand m³ and C2 in the amount of 2337.7 thousand m³. The field operated since 1995 by Obol ceramic plant of Ministry of Construction and Architecture of the Republic of Belarus.

Development of the field currently has no negative impact on the safety of the natural complex.

Engineering and transport infrastructure.

In the south, road of national importance P20 Vitebsk-Polotsk limited area of the wetland. On the territory of wetlands and in its immediate vicinity the location and construction of new transport and utilities and facilities of national importance is not provided.

Recreational resources.

Recreation areas "Ozernaia" and "Turovlya" in Polotsk district are characterized by high quality of recreational resources. Due to the fact that in structure of forest, swamp forest dominated, its territory to organize mass types of short-term rest and improvement of the population is of little use. The territory of the wetland is a traditional gathering place for berries and mushrooms by local population and residents of Polotsk and Novopolotsk.

Agricultural production.

The agricultural land covers an area of 891.1 hectares within the wetland: arable land - 746.7 hectares, hayfields and pastures - 144.4 hectares. Plowed agricultural land is relatively high (78%), but arable land are small in size and scattered across sites, efficient and cost-effective use of which is problematic. Fertility of agricultural and arable land is low (29 - 32 and 30-32 points, respectively), and the natural potential of land use slightly more than half.

Three plants lead in agricultural production: Municipal Unitary Agricultural Enterprise "Mishnevichi", Unitary Enterprise "Shumilino Raiagroservice", Open Joint Stock Company "New Gorianny."

Forestry.

The wetland forests belong to the I and II groups of forests and three economic categories: the exploited forest, shelter belts along roads and riparian strips. Forest management is carried out by Shumilino (Kozyany, Mishnevo, Nikitin forestry) and Polotsk (Goryany forestry).

Forests of I group (49.8%) are the most ecologically valuable forest communities, and provide a high ecological value territories included in the wetland. Forests of II group cover the 50.2% of the area of forest land.

The growing stock of forests is more than 2336.5 thousand m³ of timber, including 807 thousand m³ of softwood, hardwood - 2.4 thousand m³. In stocks of commercial timber, economically valuable species represent the 47.6% of the total stock.

The territory is rich in berries and mushrooms. Forest area is covered with over 20% of blueberry, cranberry and over 10% red bilberry (549 hectares).

Hunting.

The territory has an extremely high hunting-economic potential and can be used for commercial hunting (in science-based volumes) and for the organization of recreational hunting. Elk, deer, wild boar and roe deer are some of the target species hunted within the site as well as fur-bearing animals like otter, mink, forest polecat, pine marten, ermine, fox, and raccoon dog.

Current recreation and tourism

The wetland is located at a distance of 25 km from the city of Polotsk and is directly adjacent to the road Polotsk - Vitebsk. From early spring to late autumn and winter, tourists, vacationers and hunters, actively visit the site. During the summer and autumn there are many amateurs gathering mushrooms and berries, as well as flowers and medicinal plants.

Within the site there are 8 equipped recreational facilities established by decision of Shumilino executive committee. Among them there are pavilions, toilets, a parking area, campfire sites, camping place, and a temporary site for storing waste.

Four hiking routes have been created to promote ecotourism. "Mystery of Kozyany land" is a path that combines 12 points with information about the historical and environmental features of Kozyany site and its surrounding area. The route has been designed for organized groups of tourists and schoolchildren.

There is an ecological route named "Heritage of Kozyany land" which includes 5 tours and a water route called "Obol catamarans" with a length of 18km. This route operates since 2007 and in the middle reaches Obol. It can be done in 8 hours.

Also located within the site near the village Rovnoe the "Hunter House" can be visited.

Current land (including water) use

- State Forestry Institution "Shumilino Forestry" (Kozyany, Mishnevo, Nikitin forestry);
- State Forestry Institution "Polotsk Forestry" (Goryany forestry);
- Municipal Unitary Agricultural Enterprise "Mishnevichi";
- Unitary Enterprise "Shumilinskiy Raiagroservice";
- Open Joint Stock Company "New Goriany."

The main types of land use:

Forestry

- logging;
- reforestation;
- secondary forest (collection of berries, mushrooms, medicinal and industrial raw materials);

Recreation

- hunting;
- fishing.