

Additional information

General ecological features:

The wetland features the following habitats: coniferous and broad-leaved forests, floodplain, transition mires and raised bogs, meadows, floodplain black alder and birch forests, scrub and different water reservoirs. From the point of botany and geography the reserve is located in a sub-zone of dark coniferous and oak forests, south boreal coniferous forests.

Forests occupy 86,5 % of the territory and determine peculiarities of vegetation of the reserve. Formation-typological structure of the forests is represented by four main genetic groups of forest formations: boreal coniferous (56,2 %), broad-leaved (0,9 %), deciduous wet (33,4 %) and deciduous secondary (9,5 %) forests.

In the total area of forests (68 600 hectares), pine phytocenosis dominates (46,3 %), formation of which is connected with mire ecosystems and soils of automorphic humidification regime at the watersheds of the Berezina River and its tributaries.

Monodominant pine forests, with a specific proportion of 14,3 % are edaphically associated with sandy soils and allocated in dune and bumpy, and to a less extent in plain landscape.

Mixed spruce and pine forests are confined to sod-podzol soils of final-moraine ridge and rises. They are notable for a higher efficiency of growing stock and floristic wealth of understory vegetation.

The most presented in the reserve are wet pine forests (24,6 % forest-covered territory). They grow on all types of mires, covering vast areas in central and northern parts of the reserve.

Stunted low bush and bog moss pine forest dominate on the soils with the thickness of a peat layer of more than 2 meters.

Spruce forests occupy the territory of about 7 000 hectares. They do not cover large areas and are located mostly along the Berezina River flood-lands and the skirts of lowland fens. They are composed of three edaphically associated sub-formations: taiga, nemoral and wetland.

Typical taiga dark-coniferous forests are presented by monodominant spruce forests with thick moss and dwarf shrub. Nemoral spruce forests are characterized by admixture of broad-leaved species and normally grow on mineral islands among black alder swamps in the south of the reserve. Wet spruce forests are notable for the mixed composition of tree species.

Admixture of black alder, white birch and pine is common for them. Wet spruce forests are located in a short edaphic range that limits their phytocenotic diversity.

Broad-leaved forests are located in the near-floodland part of the southern landscape area of the reserve and are presented by oak and ash forests. Oak forests with the area of 300 hectares are related to the northern area variant of spruce-oak forests. Their tree layer is notable for the compound structure and high crown density. Ground cover, young trees and underbrush are characterized by a great diversity and abundance of species. Ash forests are concentrated at the swamped right bank of the Berezina River near Lake Palik. They form compound by structure and layering co-dominant spruce, black alder and ash formation on humus-gley soils. Participation of maple, lime-tree, elm, small-leaved species in ash phytocenosis is insignificant, most often they form second sub-layer.

Among other formations that determine the image of vegetation of the Berezinsky reserve, a significant proportion of deciduous wet forests should be noted: white birch – 16,8 % and black alder – 16,4 %. Black alder forests cover the largest areas in the flat southern part of the reserve, where drainage characteristics of dense network of small streams and River Berezina are strongly pronounced. Depending on edaphic conditions and watering level, natural admixture of black alder layer is presented by white birch, spruce, and at ecotones adjusted to mineral islands – oak, ash, and maple. A natural process of black alder regeneration is typical for these forests. The main places occupied by white birch forests are skirts of vast peat moss bogs and also swampy terraces near the flood plains of the Berezina River. On transition mires a permanent admixture to birch is pine, at swamps – spruce and black alder admixture is common.

Deciduous secondary forests are not as widespread as swampy ones. At their structure dominate common

birch forests (7,6 % of area under forest), aspen and grey alder account for about 2,0 %. Appearance of these forests is mainly caused by anthropogenic influence. As a rule they have appeared on the plots of felled forest, old croplands of the former farms, as a result of overgrowing of dry meadows. Small-leaved forests are characterized by a number of serial communities, where dynamical multivariant vegetation successions take place in accordance with conditions of places of growing.

The reserve's distinguishing feature is the dominance on its territory of mire and swamp ecosystems, with the area of 50 700 hectares. The mostly presented are wet forests (54,4 %), transition mires account for 35,3 %, bogs – 10,3 %.

Types of mires and peat that is deposited in them are distinguished by the character of water- mineral nutrition and by ecological phytocenosis features (structure of present vegetation cover and occurrence of plant remains in peat). In spring bogs are covered with water remaining at a high level for the whole summer. Considerable watering and stagnant character of moistening cause specificity of vegetation cover. That's why a small number of species grow here: *Pinus sylvestris* L., *Eriophorum vaginatum* L., *Andromeda polifolia* L., *Oxycoccus palustris* Pers., *Oxycoccus microcarpus* Turcz. ex Rupr., *Ledum palustris* L., *Vaccinium uliginosum* L., *Chamaedaphne calyculata* L. The main phytocenosis background makes peat mosses. Pine – cotton grass – dwarf shrubs – peat moss vegetation communities dominate.

Swamps are characterized by high water flowage and significant watering at spring season. Such kind of hydrological regime causes a great variety of species of plants. From forest forming species here grow *Alnus glutinosa* (L.) Gaertn., *Betula pubescens* L., *Picea abies* (L.) Karst., less often Pine. In ground cover mire motley grass and sedges are abundant, peat mosses as a rule are absent or rarely present on microrises. The most typical representatives of are *Carex elongata* L., *Carex acuta* L., *Carex vesicaria* L., *Iris pseudacoris* L., *Phragmites australis* (Cav.) Trin ex Steud., *Equisetum fluviatile* L., *Calla palustris* L. Grass swamps are running, mainly flood-plain, are presented by forestless sedge, sedge-reed communities with less flowage are characterized by black alder with herbs, black alder with sedge, white birch with herbs, willow with reed and herbs associations.

Transition mires are characterized by medium moisture; flowage can vary from very weak to significant. Thus the structure of vegetation cover varies greatly, pine and white birch with sedge and peat moss communities dominate. In vegetation formation take part eutrophic as well as mesotrophic and oligotrophic species of helophytes. The most typical for transition mires are *Menyanthes trifoliata* L., *Comarum palustre* L., *Carex lasiocarpa* Ehrh., *Carex rostrata* Stokes, and also bushes: *Salix cinerea* L., *Betula humilis* Schrank.

The reserve's mires are also characterized by a significant variety of peat-beds, in formation of which take part 36 types of peat. Peat-beds as a result of consecutive peat stratification keep in themselves chronological consecution of vegetation cover development of the past epochs. The remains, pollen and plant spores, well-preserved in peat carry such information. By their structure it is possible to restore vegetation dynamics quite exactly, and therefore climate changes in this region for the last thousands of years, that define the unique importance of mires for studying of the past and working out science-based forecasts.

Peat bogs of the reserve are characterized by unique richness and diversity of hydrological conditions, peat-beds, and mire biocenosis. They don't suffer from direct anthropogenic influence, that define their multifunctional value at regional level. Against the background of anthropogenic transformation of adjacent territories, the knowledge of correlations of separate ecosystem components of natural mires will serve for a basis for the working out of methods for their preservation and sustainable use for keeping them untouched. Within the reserve the main areas of meadows are situated in flood-land of the Berezina River, along its tributaries and around lakes. According to data of I.D. Yurkevich et al. (1979, 1981), three natural meadow vegetation complexes are singled out: the Berezina River flood- land, the Serguch River flood-land and out-of-flood-land grass marshes. Total area of these wetlands is 8800 hectares, the main part of which (78 %) is located in flood-land of the Berezina River. In flood-land of the Serguch River they occupy only 12 %. The grass marshes, situated out of flood river lands have proportion of at least 10 %.

Meadow flora accounts for 330 species of higher plants and lichens, which are related to 203 genera and 76 families. In flora structure dominate the groups of rhizome, short-long- rhizome and creeping-rooted species, from life forms – hemicryptophytes. They are mainly meadow, forest, mire, early summer flowering

and summer flowering species of plants. The basis of ecological structure form mesotrophic mesophytes. In agricultural and botanical structure of flora dominate motley grass, few cereals and sedges, about 3 % of podded plants. Though in formation of meadow phytocenosis structure a determining role is played by cereals and sedges. Species from groups of podded plants play accompanying role.

Syntaxon system of herbaceous vegetation consists of 12 classes, 17 orders, 27 unions and 59 associations. In herbaceous vegetation structure of the Berezinsky biosphere reserve the leading place takes marsh (mesohygrophilous) communities (class *Phragmitetea*). Farther less presented oxylo- and hygromesophilous (class *Molinio-Juncetea*), psychro- and eumesophilous (class *Arrhenatheretea*) and acidophilous (class *Scheuchzerio-Caricetea*) grass communities. Freshwater communities (class *Potamogetonetea*) are presented by 11 subassociations.

There are notable differences in territorial distribution of grass communities too, first of all connected with hydrological regime of the Berezina River and intensity (or lack) of alluvial process. Thus, if in the head water all the ecological range of vegetation takes place – from near terrace fen to xerothermic on high near bed hills and rough communities on sandy dunes, on the middle section of flood-land lower Lipsk village, where hillness smoothes over in lowering of the territory's surface, grasses of wet and marsh meadows predominate, and lower the Kal'niksky bridge almost completely prevail majorcereal (*Phragmites australis* (Cav.) Trin. ex Steud., *Phalaroides arundinacea* (L.) Rauschert, *Glyceria maxima* (C. Hartm.) Holmb.) and majorsedge (*Carex acuta* L., *C. omskiana* Meinsh., *C. riparia* Curt and others) marsh communities.

Head waters of the Berezina River and its tributaries, particularly the Chernitsa River valley, are characterized by the wide-spread of fen and wet meadow communities. The most interesting here are the unique and quite rare for Belarus and Europe communities of *Eriophoretum polystachii*.

At the left-bank flood-plain closest to the river (nearbed) of the Berezina River on the section from Kal'nik village to Brody village, island growth of calciphile sedgebank communities - *Caricetum ripariae*, typical for the Pripyat Polesie area. *Carex riparia* quite often plays dominant role in frequently flooded low banks and hills, and also co-dominate with *Phalaroides arundinacea* or *Carex acuta*.

On the reserve's territory The Serguch River is one of the biggest left-bank tributaries that have meadow flood-land, immature and completely peated. Plain relief points at the absence of altitude levels. Change of vegetation cover occurs mainly in grade profile that is connected with the Serguch Canal activity. Northward of Kvetcha village, where drainage influence of normally functioning river has an impact, in conditions of excessive moistening on badly aired sod-peaty-gley, peat-bog acid soils acidophilous marsh grass communities are being formed (*Caricetum fuscae*, *Caricetum diandrae*, *Caricetum lasiocarpae*, *Juncetum filiformis*). Lower the Serguch Canal, in conditions of stagnant moistening and absence of alluvial processes, low sedge grasses are intensively supplanted by high sedge marsh communities of *Caricetum omskianae*, *Caricetum acutae*, *Phragmitetum communis*. Quite often all the flood-land from river-bed to forest is filled with the communities of *Caricetum lasiocarpae*. High moisture and weak flowage of the Serguch River flood-land caused formation of the unique communities with domination of *Carex elata* All. They are circumscribed here for the first time and located at the northern border of their natural habitat area. Also typical for the Poozerie area, but uncommon for Belarus grass communities of *Eriophoretum vaginati* can be met here. Their southern boundary goes over the Berezinsky reserve. Along the river banks, on the plot with less flowage and increasing moisture the association communities of *Typhetum latifoliae* and *Typhetum angustifoliae*, typical for artificial water bodies, were circumscribed for the first time (Stepanovich and others, 2003).

For grass marshes situated outside river valleys and are not under the influence of river waters, the most typical are associations of slender sedge, and along the banks of the lakes Plavno, Manets and southward – reed and connivent sedge associations. In the falls of microrelief the associations of wood bulrush and sweetflags are pointwise present. The most interesting are uncommon for Belarus and Europe acidophilous associations of *Caricetum fuscae caricetosum echinatae*. Here also grows the rare *Pedicularis sylvatica*, included in the National Red Data Book. Species composition of marshes situated outside river valleys is represented by 89 species related to 33 families, 48 genera. They are mainly long- and shorthrhizome, marsh and meadow, perennial species, of early

summer and summer period of blossoming, eutrophic, mesoeutrophic hygrophytes and mesohygrophytes.

Bush vegetation can be met generally at the Berezina River flood-land and its large tributaries and is presented by separate clumps. Totally it covers less than 1 % of the wetland territory.

Different species of willows dominate: *Salix triandra*, *Salix cinerea*, *Salix aurita*, *Salix rosmarinifolia*.

The wetland's rivers and lakes (about 2 % of the area) are shallow and highly overgrown with water and coastal vegetation. The character of water vegetation first of all is determined by the circumstance that most of the water bodies are related to shallow, high-eutrophic.

Appropriate conditions favour the intensive development of water-coastal vegetation. It's particularly developed in the lakes Plavno and Manets, that are transitive to dystrophic and where partly flooded areas were formed.

The main formations of water bodies' vegetation are wetland, stationary with floating leaves and emophytes.

The dominants of wetland vegetation at the reserve are *Acorus calamus*, *Glyceria aquatic*, *Equisetum fluviatile*, *Sagittaria sagittifolia*, *Sparganium erectum*, etc. Aero-aquatic vegetation occupies shallow waters and coastal zones of water bodies. Dominant species are *Phragmites australis*, *Scolochloa festucacea*, *Scirpus lacustris* and others. In the formation of stationary with floating leaves vegetation participate *Nymphaea candida*, *Nuphar luteum*, *Polygonum amphibium*. Here and there these species form large beds. The formation of emophytes generally includes *Ceratophyllum demersum*, *Stratiotes aloides*, *Potamogeton natans*, *P. perfoliatus*, *Myriophyllum spicatum*, etc.

Totally wetland vegetation includes 23,7 % flora species of the reserve, but only 6,4 % of them fall to share of true water plants. Among them dominate *Elodea canadensis*, *Hydrocharis morsus-ranae*, *Lemna minor*, *L. trisulca*, *Potamogeton perfoliatus*, *P. natans*, *Nymphaea candida*, etc. *Caulinia minor*, *Potamogeton rutilus*, *P. filiformis* are rarely present.

The main part of water-coastal plants is dated to nearbed parts of the rivers, and also to coastal zone of lakes, ponds and former riverbeds. Among them the most widespread are *Acorus calamus*, *Caltha palustris*, *Carex acuta*, *C. rostrata*, *C. vesicaria*, *Camarum palustre*, *Glyceria fluitans*, etc. Such wetland species as *Blismus compressus*, *Gratiola officinalis*, *Ranunculus reptans* are rarely found (Ignatenko, 1996).

Agricultural lands (generally ploughed lands) account for about 2 % of the total wetland area and are mainly adjacent to human settlements.

Physical features of the site

The site is a considerable piece of land under occupancy of forests and mires which have been preserved in their natural condition among the transformed landscapes of the Southern Poozerie Area. It is of great importance for the biodiversity conservation in the northern part of Belarus. Owing to being positioned in the watershed this site accumulates moisture and helps to keep the water content of the Berezina River.

Geomorphologically, the reserve is related to the area of Belarusian Ridge Upper-Berezina outwash and glacial lowland. The modern relief is formed generally in Quaternary by glaciers and their melt waters.

Relative heights fluctuation of relief is more than 70 meters: the highest point is in the Krasnaya Luka Hole – 226,6 m, the lowest one – in the area of Lake Palik – 154,9 m. The most common are Holocene, limno- and fluvioglacial sediments.

Considerably broken relief causes frequent changes and mixed character of soil cover. There are 5 genetic types of soil within the territory of the reserve in accordance with development degree of main soil formation process and texture of soil. Peat-boggy soils are the most widespread of all (57,7 %). Subject to the type of water nutrition and flowage they are divided in raised bog (3), transitive (2) and lowland (4) types. Sod-podzol soils are dated mainly to high ground features and develop on mellow or cohesive sands and sandy loams. Sod waterlogged soils occupy wide flat relief depression in the southern part of the reserve. Water-deposited are mainly spread in the flood land of Berezina river and its largest tributaries. The climate of the reserve is moderately continental, damp and is generated under the influence of wet and warm Atlantic air masses. Southern winds dominate on winter and

spring, western – on summer and autumn. The average temperature of the coldest month of the year (January) is -7.3o C, the warmest month (July) is +16.7o C, the average annual temperature is +5,2o C. Relevant temperatures in general for Belarus are -6.7o C, +17.8o C,

+5.8o C, respectively. The annual precipitation in the reserve's territory is 690 mm. This is slightly more than the total national level of 650 mm. The stable snow cover remains in the region for about 120 days, from the first decade of December to the beginning of April.

The reserve's territory is situated in the head waters of the Berezina River – the most important channel of the Central Belarus. It functions as water-regulation and water- protection river in the region, is a tributary of the largest and the most important river of the Black Sea basin – Dnepr. Connected with Berezina, rivers and streams, lakes and former riverbeds to no small degree form the uniqueness of the reserve and play the role of an important landscape generating component of its territory.

Catchment basin of Berezina from its head water, situated westward of the Dokshitsy town, to the outlet, situated lower of the Lake Palik, is 2760 km², length of the river here is 142 km. The reserve occupies about a third part of this territory, length of the Berezina River within the reserve is about 100 km. Along the eastern part of the reserve lies a watershed between the rivers Dnepr and Western Dvina, but less than 5 % of the reserve's territory belongs to the Western Dvina basin.

The reserve's river network is well developed and presented by 69 channels with length of 1 km and more. Their general extent is 315 km, but length of most of them doesn't exceed 5 km. Average density of the river's network is near-medium all over Belarus and is at amount of 0,41 km/km², the largest is at the south of the reserve. The highest tortuosity of stream channel has River Berezina – 1,98, at the most of other channels it doesn't exceed 1,0 – 1,2.

Berezina with its tributaries belongs to the flat type with domination of snow nutrition; summer and autumn precipitation play a sidetrack in it. Floodplain is developed all along the river, its average width is 2-3 km, plane surface is full of peat, everywhere former riverbeds are met, some of them have turned into floodplain lakes.

Seven big lakes with total area of 1683 ha add to the reserve's drainage network. The largest of them is Palik. Lakes Plavno and Manets serve as watershed barrier on the Berezina water system. The lakes' kettles are of remainder type, with round or slightly prolate from north to south shape, slopes and banks are low, almost completely wet. The lakes are shallow, and all except for Lake Palik are dystrophic, overgrown. Bottom of the lakes is flat, lined with coarse detrial high-organic sapropels (Natarov, 1996).

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Ecosystem services

Hydrological values:

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of an important landscape generating component of its territory. Forest, mire and meadow associations cover a part of the site. Owing to being positioned in the watershed this site accumulates moisture and helps to keep the water content of the Berezina River. Peatbogs (43 000 hectares) are the less transformed ecosystems and play the main role in hydrological regime of its territory. At spring period they accumulate a great amount of melt waters, by means of which they feed numerous rivers and lakes. For example, only due to the run-off the Domzheritskoe mire (11 000 hectares) water flow in Berezina is provided during specific months (Yurkevitch, Smolyak, 1975).

The hydrological role (water retention and release) of the peatbogs is significant also to the territories adjoining the reserve, preventing the creation of deep erosion channels of outflowing waters.

Current scientific research and facilities

The reserve's scientific surveys consist of leading the permanent year-round researches, aimed at studying natural complexes and natural process dynamic for rating and forecasting the state of ecosystems, features of fauna and flora, scientific basis development for nature protection and biodiversity preserving. Scientific research is carried in two directions: monitoring of processes and natural phenomena at the reserve (Nature chronicle) and fundamental investigation of the structure and dynamic of natural forest, meadow, lake and river complexes, birds and mammals fauna research. Scientific department also carries out joint investigations with the scientists of the Belarusian state university, with a number of institutes of the Academy of Sciences, with national and foreign specialists. Based on the results of scientific research, practical guidelines are worked out and introduced, and scientific papers and monographs are published. The reserve's research staff takes active part in scientific conferences.

Coordination of the reserve's scientific activity is led by the Scientific and Technical Council, members of which are the leading specialists of the reserve, and also of scientific- research institutes of the Academy of Sciences as well as of Ministries.

Social and cultural values

There is a small amount of residential localities with a total number of population up to 700 people on the territory of the wetland. The most important historical sites of the reserve are the Berezina water system; ancient burial places of Slavs; monuments of the World War II. Burial mounds - ancient burial places of Slavs – are taken under protection as a heritage of archeology.

Current recreation and tourism

The main directions of tourism activity of the reserve are recreation and ecological tourism. Every year on the basis of Natural history museum, ecological path and open-air cages attract more than 25 000 tourists and sightseers of Belarus and foreign countries. Hotels, restaurants, sauna, comfortable guest-houses, located in the neighborhood of picturesque lakes are at tourists disposal. At tourists' service in summertime are bicycles and boats, in winter – skis for tourist routes along exotic places, and also routes by foot and by car are organized for tourists to get acquainted with historical sights of the reserve – the Berezina water system; the Berezina River crossing of Napoleon; ancient burial places of Slavs; monuments of the World War II. Visiting local villages for acquaintance with everyday life of natives, traditional Belarusian cuisine, work of craftsmen, participation in cultural traditions and ceremonies are organized. Since 1994 ecological tourism based on nature observing, studying of flora and fauna in small groups is practiced in the reserve. Ten-day ecological tours guarantee the watching in natural habitat of 120-150 mammal and bird species and about 300-400 species of plants.

Current land (including water) use

According to the current environmental legislation the reserve's territory is completely excluded from economic usage. To provide the reserve's functioning and activity of the people living on its territory, special areas are identified where one can take away dead standing trees and dead fallen wood, pick mushrooms and berries, graze cattle and mow grass. The area of these plots is 16,5 % of the whole reserve's territory.