Role of Non-Black earth swamps in Russia's ecosystem

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Abstract. The relevance of researching wetland communities in anthropogenically transformed landscapes stems from the establishment and maintenance of a biomonitoring database for vulnerable and ecologically significant native ecosystems within the ecological-biological framework. Data on biodiversity and resilience are presented for seven semi-natural wetland systems, along with an assessment of their stability. The aim of this study is to present biomonitoring data on a complex of different wetland types in the long-developed Bryansk region to support the development of ecological framework elements and maintain the homeostasis of anthropogenically altered territories. Field survey, floristic, geobotanical, and ecological research methods were employed. The key factors influencing cenotic diversity in wetlands were identified as water mineralization and moisture variability. A rare raised bog type for the region—the Semenovskoe Bog (Rognedinsky District, Bryansk Oblast)—was examined. The highest Simpson diversity index was recorded in wetland areas dominated by woody, woody-herbaceous, and woody-moss communities, particularly in the Petrovskoe and Galoe bogs. In contrast, the Glazhenka Bog exhibited the lowest biodiversity indicators due to significant alterations in its hydrological regime and limited area. The Semenovskoe Bog, a protected natural site with raised wetland communities, displayed low diversity values: its unique ecological conditions, characterized by a highly acidic environment, limit floristic diversity (particularly vascular plants) while preserving critical habitats. The disturbance index (Id) indicated that all studied wetlands experience minor anthropogenic pressure and can be classified as conditionally pristine, non-exploited geoecosystems.

1 Relevance of the topic

Wetland ecosystems play a crucial role in global carbon sequestration, oxygen regeneration, water balance maintenance, and biodiversity conservation. These ecosystems are particularly vital for climate regulation and biodiversity preservation in the long-developed Non-Chernozem Region of the Russian Federation, specifically within Bryansk Oblast. Wetland components require continuous ecological monitoring, environmental control,

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protection, and the development/implementation of national projects under frameworks like the non-governmental organization Wetlands International (1997) [1-6].

Minimizing anthropogenic damage to bogs and wetland areas can be achieved through improved environmental management strategies and comprehensive studies of wetland ecosystem conditions. Bog massifs represent highly valuable open natural systems that evolve through interactions with surrounding environmental factors - topography, geological structure, and climatic/hydrological conditions. Thus, wetlands serve as critical components within interconnected environmental systems, with any external impacts reflected in their transformation processes [2, 4, 5, 7-10].

In Bryansk Oblast - the administrative center of Russia's Non-Chernozem Region - all bog massifs have been significantly modified, with their total area reduced by 60% over the past 70 years of observations. Of particular importance for ecological-biological monitoring are biodiversity inventories of semi-natural communities and the maintenance of bioindication databases. This study aims to present biomonitoring data for various wetland types in the long-developed Bryansk Region to facilitate ecological network development and maintain homeostasis in anthropogenically altered territories.

2 Materials, methods, and research techniques

During field studies, the route survey method was employed to assess vegetation characteristics: floristic composition, geobotanical features of wetland plant communities using the dominant species approach, and identification of rare vascular plant and bryophyte species [3].

The research incorporated:

- visual inspection techniques;
- cartographic analysis methods;
- sample plot methodology.

The anthropogenic disturbance index (I_d) was calculated through analytical methods combining field data and cartographic materials [3]. Alpha diversity of wetland habitats and communities was evaluated using:

Species richness metrics (total number of species per community)

Species density indicators (mean number of species per unit area).

3 Research results

The study of biological diversity in the wetlands of Bryansk Oblast was conducted as part of biomonitoring efforts targeting particularly valuable habitats for the development of an ecological network. Seven bogs formed under different geomorphological conditions were examined, all retaining features of semi-natural ecosystems with ongoing peat formation processes.

Glazhenka Bog is located within Bryansk District, south of Glazhenka Village (Figure 1, A). This small lowland bog is eutrophic in terms of trophic status and features a mosaic of uneven-aged black alder (Alnus glutinosa) and downy birch (Betula pubescens) forests, including iris-sedge, sedge-dominated, and nettle-type communities. Shrub thickets dominated by gray willow (Salix cinerea) are widespread. Open areas of the bog are characterized by communities dominated by reed canary grass (Phalaris arundinacea) with accompanying species such as purple loosestrife (Lythrum salicaria), common comfrey (Symphytum officinale), shore dock (Rumex hydrolapathum), and yellow loosestrife (Lysimachia vulgaris).

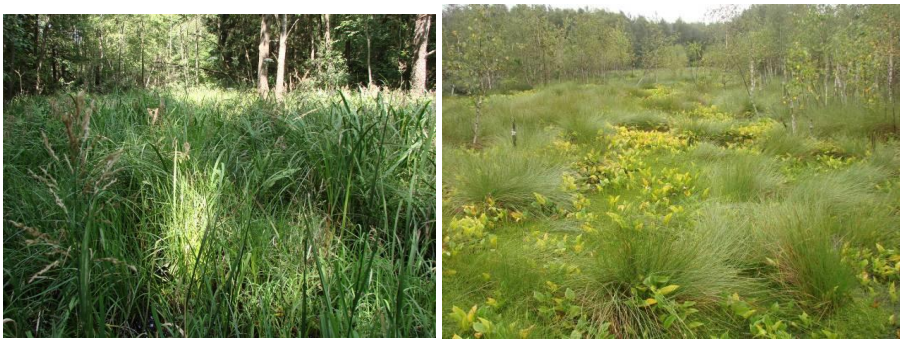
Mineral islands within the bog support small stands of aspen (Populus tremula), oak (Quercus robur), and silver birch (Betula pendula) forests with wood sorrel (Oxalis acetosella). No protected plant species were recorded within this habitat.

A B

Fig. 1. Glazhenka Bog in Bryansk District (A). Formations of black alder (Alnus glutinosa) forests in local depressions and hollows within Galoe Bog, Unecha District (B).

This wetland is of particular interest as it remains in a natural, undisturbed state.

Vadkovka Peatland, historically exploited for peat extraction by nine peat-processing enterprises since 1954, is located in Pogarsky District northwest of the town of Pogar (Figure 2A).



A B

Fig. 2. Worked-out Vadkovka peatland in Pogarsky District (A); Quarries of the depleted Paltsovskoye peatland (B).

The wetland covers an area of 1,369 ha with moderately-ash-content peat. The bog habitat exhibits transitional mire conditions supporting mosaic stands of uneven-aged black alder (Alnus glutinosa) and downy birch (Betula pubescens) forests of iris-sedge, sedge-dominated, and nettle-type communities. Open areas are dominated by reed canary grass (Phalaris arundinacea) and Glyceria maxima associations. Mineral islands within the bog complex contain small stands of aspen (Populus tremula), pedunculate oak (Quercus robur), and silver birch (Betula pendula) forests of wood-sorrel (Oxalis acetosella) and goutweed (Aegopodium podagraria) types. No protected plant species were recorded within this naturally preserved wetland ecosystem.

Paltsovskoye Mire Complex

The Paltsovskoye mire system (Figure 2B), located in Bryansk District, comprises transitional bogs totaling 1,911 ha. This exhausted peat extraction site currently supports

successional downy birch forests with high vegetation heterogeneity. Dominant communities include: Molinia caerulea stands, Sphagnum moss associations, Eriophorum vaginatum-Carex nigra communities, Ledum palustre-Vaccinium uliginosum heaths.

Natural vegetation succession processes are actively restoring the original plant cover. The drained peatland contains an extensive network of reclamation channels discharging into a minor river. No protected species were documented.

Conservation Significance

This landscape represents a regionally rare transitional watershed mire of conservation value. Currently, portions are being cultivated, resulting in annual (Polygonum aviculare, Amaranthus retroflexus) and perennial (Echinochloa crus-galli) ruderal communities. Channelized streams and drainage networks support shrub thickets dominated by Salix spp. (S. cinerea, S. aurita, S. pentandra, S. myrsinifolia) and hygrophilous communities featuring Potentilla erecta, Nardus stricta, Deschampsia cespitosa, and Carex acuta in the Residual Lakes (Figure 3)

The floating-mat lakes near Paltso settlement represent particular scientific interest. Lakeshore vegetation includes: Betula spp. stands, Bog pine (Pinus sylvestris f. uliginosa) communities, Boreal bog species complexes, rare occurrences of Gentiana pneumonanthe and Dactylorhiza incarnata (monitoring list species).

Galoe Bog, Unecha District

As one of Bryansk Oblast's largest wetlands, this site exhibits exceptional vegetation mosaics: Pine (Pinus sylvestris) forests, secondary deciduous stands: Silver birch (Betula pendula), Downy birch (B. pubescens), Aspen (Populus tremula), Black alder (Alnus glutinosa).

These successional forests (developing on clearcuts and burned areas) represent oxalis-Vaccinium myrtillus types, pteridium aquilinum communities, moss-rich and Aegopodium podagraria associations.

The vascular flora exceeds 100 species.

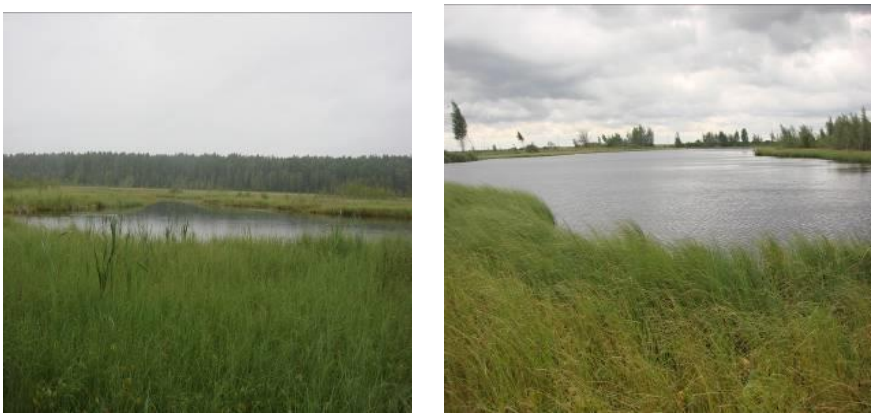


Fig. 3. Residual lakes with floating mat margins in the Paltsovskoye bog complex.

The studied bog complex covers an area of 1,369 hectares with moderately-ash-content peat. The wetland habitat exhibits transitional mire conditions supporting a mosaic of uneven-aged black alder (Alnus glutinosa) and downy birch (Betula pubescens) forests, including iris-sedge (Iris pseudacorus-Carex spp.), sedge-dominated (Carex spp.), and nettle-type (Urtica dioica) plant communities. Open bog areas are dominated by Glyceria maxima and Phalaris arundinacea associations. Mineral islands within the peatland contain small stands of aspen (Populus tremula), pedunculate oak (Quercus robur), and silver birch (Betula pendula) forests with Oxalis acetosella and Aegopodium podagraria understory. No

protected plant species were recorded within this habitat. The site represents a scientifically valuable wetland ecosystem preserved in its natural state.

This group of transitional peat bogs in Bryansk District covers 1,911 ha – Paltsovskoye Bog Complex (Figure 2B). The exhausted peat extraction site currently supports successional downy birch (Betula pubescens) forests with high vegetation heterogeneity. Characteristic plant communities include:

- Molinia caerulea-dominated grasslands
- Sphagnum moss associations
- Eriophorum vaginatum tussock communities
- Carex nigra-Ledum palustre-Vaccinium uliginosum heath complexes

The site exhibits natural vegetation succession processes restoring the original plant cover. The drained peatland contains an extensive network of reclamation channels discharging into a minor tributary. No protected species were documented.

Conservation Significance

The Paltsovskoye bog complex represents a regionally rare transitional watershed mire of significant conservation value. Currently cultivated areas support ruderal communities dominated by:

- Polygonum aviculare
- Amaranthus retroflexus
- Echinochloa crus-galli

Channelized streams and drainage ditches harbor Salix spp. thickets (S. cinerea, S. aurita, S. pentandra, S. myrsinifolia)

Hygrophilous communities featuring:

- Potentilla erecta
- Nardus stricta
- Deschampsia cespitosa
- Carex acuta.

Local depressions, ancient drainage channels, and stream valleys are dominated by downy birch (*Betula pubescens*) and black alder (*Alnus glutinosa*) formations exhibiting persistent waterlogged conditions (Figure 1B). The overall wetland coverage of the study area approximates 20%. These forest types represent climax communities, with some stands exceeding 100 years of age. Extensive black alder stands remain largely inaccessible throughout most of the year due to hydromorphic conditions.

Small patches of polydominant broadleaf forests occur sporadically, comprising: *Tilia cordata*, *Acer platanoides*, *Ulmus glabra* and *U. laevis*, *Fraxinus excelsior*, *Betula pendula*, *Populus tremula.*

These forests primarily correspond to: Oxalis (*Oxalis acetosella*) type, Vaccinium myrtillus type, Aegopodium podagraria type, Pteridium aquilinum type

Notably, the forest ecosystems demonstrate high disturbance levels, though containing significant old-growth components.

Wet Meadow and Shrub Vegetation

Selected bog sections support: Carex-dominated swamp meadows, *Glyceria maxima* marshes, *Phalaris arundinacea* wet grasslands. These communities represent eutrophic mire habitats, frequently featuring tussock microrelief. Riparian zones exhibit extensive willow thickets dominated by *Salix cinerea* and *S. aurita*. Meadow vegetation collectively occupies >5% of the area.

Aquatic Vegetation (Galoe Bog)

Hydric communities thrive in permanently inundated areas of transitional and lowland mires, dominated by: floating macrophytes: *Lemna minor*, *Spirodela polyrhiza*; emergents: *Sagittaria sagittifolia*, *Butomus umbellatus*; submerged

species: *Potamogeton* spp. (*P. lucens*, *P. natans*, *P. perfoliatus*); free-floating: *Utricularia vulgaris*, *Stratiotes aloides*; rooted hydrophytes: *Nuphar lutea*, *Hottonia palustris.*

Protected and Monitored Species

The territory harbors several conservation-significant taxa:

- Strictly protected (*Lilium martagon*, *Salvinia natans)*
- Monitoring list species (*Platanthera chlorantha*, *Iris sibirica*, *Viola uliginosa*, *Platanthera bifolia)*.

Petrovskoye Bog in Kletnyansky District, Bryansk Oblast is a currently active specially protected natural area (SPNA). The habitats within this territory were surveyed between 2018-2023 for vascular plants and bryophytes. While the complete characterization of plant communities in the bog remains incomplete, the SPNA exhibits diverse vegetation patterns shaped by local topography.

Spruce Forest Communities

Norway spruce (*Picea abies*) forests occupy only 2-3% of the total area. The distinctive feature of these spruce stands is their composition with significant participation of broadleaf species in both canopy and understory layers (a subformation of broadleaf-spruce forests). These communities demonstrate a well-developed shrub layer and rich ground vegetation.

Three characteristic subtypes include:

1. *Pteridium aquilinum*-type
2. *Oxalis acetosella*-type
3. Fern-type spruce forests

South Taiga Spruce Forests

The mossy (*Hylocomium*-type) and bilberry (*Vaccinium myrtillus*-type) spruce phytocoenoses resemble south taiga forests typical of more northern regions, characterized by 1-2 dominant tree species, well-developed moss and dwarf shrub layers, site quality classes I-II, timber stock reaching 300 m^3/ha at maturity. Secondary canopy species include: *Pinus sylvestris*, *Betula pendula*, *Populus tremula.* The understory is sparse, featuring *Sorbus aucuparia*, *Frangula alnus*, *Lonicera xylosteum* (occasionally)

Ground vegetation shows limited diversity, dominated by *Pleurosium schreberi*, *Hylocomium splendens*, *Dicranum* species (*D. polysetum*, *D. scoparium*) with patchy distribution of *Vaccinium vitis-idaea*, *V. myrtillus* (in depressions), *Luzula pilosa*, *Molinia caerulea*, Scattered *Oxalis acetosella* and *Trientalis europaea.*

Nemoral Spruce Forests

The broadleaf-spruce forests feature:

- Significant broadleaf component in canopy
- Rich nemoral elements in understory
- High productivity (site class II)
- Timber stock up to 300 m^3/ha at maturity

These mixed, multi-layered stands rarely form monodominant communities. Secondary canopy species include: *Quercus robur*, *Pinus sylvestris*, *Populus tremula*, *Betula pendula.*

The well-developed shrub layer contains *Sorbus aucuparia*, *Frangula alnus*, *Corylus avellana.*

Ground vegetation indicators include *Oxalis acetosella*, *Pteridium aquilinum*, *Athyrium filix-femina.*

The moss layer comprises *Pleurosium schreberi*, *Hylocomium splendens*, *Dicranum* species, *Rhytidiadelphus triquetrus.*

Downy Birch (*Betula pubescens*) Forests are represented by three ecological groups:

1. Riparian herb-type (on eutrophic waterlogged histosols) with small fragmented stands;

2. Carex-Sphagnum type (oligo-mesotrophic and eutrophic peatlands) with five small-area stands;

3. Carex-dominated type (eutrophic bogs) with two extensive stands covering ≈60% of birch forest area and featured by rare occurrence pattern.

Form on weakly flowing, Birch-Sedge-Sphagnum Forests represent highly waterlogged peat-bog soils across significant areas (approximately 20%). The stand composition includes admixtures of pine (Pinus sylvestris), black alder (Alnus glutinosa), and spruce (Picea abies). Site quality is extremely low (Va class), with timber stock (at 80 years) reaching only 70 m^3/ha. Understory and natural regeneration are absent.

The ground vegetation consists primarily of sedges (Carex limosa, C. acuta, C. pseudocyperus) and sphagnum mosses (Sphagnum fallax, S. centrale, S. magellanicum). Intermediate coverage is observed for bog cranberry (Oxycoccus palustris) and haircap moss (Polytrichum sp.).

Microhabitat distribution:

- In depressions (rarely along bog margins): marsh cinquefoil (Comarum palustre), marsh fern (Thelypteris palustris), bogbean (Menyanthes trifoliata);
- On micro-elevations: bilberry (Vaccinium myrtillus) and cowberry (V. vitis-idaea).

Black Alder Stands are widely distributed (11% of forested area) across microhabitats, and represented by three ecological groups:

1. Forests on relatively rich, normally moist soils (oxalis-alder type);
2. Forests on rich, waterlogged soils (nettle- and fern-alder types);
3. Forests on eutrophic peat bogs (sedge-, fern-, meadowsweet-, and willow-alder types).

Among these, oxalis-, nettle-, marsh fern-, and willow-alder types occur sporadically, while meadowsweet- and sedge-alder types are least common.

By Meadowsweet-Alder Stands the feature admixtures of downy birch (Betula pubescens), spruce (Picea abies), oak (Quercus robur), aspen (Populus tremula), and ash (Fraxinus excelsior). Their characteristics include:

- Site quality: II;
- Timber stock (30-70 years): 280-300 m^3/ha;
- Weakly developed understory (buckthorn Frangula alnus, willows Salix caprea, S. cinerea, S. aurita);
- Absent regeneration layer;
- Ground vegetation dominated by meadowsweet (Filipendula ulmaria), with common nettle (Urtica dioica), yellow loosestrife (Lysimachia vulgaris), marsh marigold (Caltha palustris), and marsh bedstraw (Galium palustre).

Sedge-Alder Stands are characterized by complex composition and structure, including black alder, ash, oak, spruce, downy birch, and aspen. Their features include:

- Site quality I-II;
- Understory typically contains buckthorn and willows;
- No natural regeneration;
- Ground layer dominated by sedges (Carex nigra, C. elongata, C. cinerea);
- Frequent occurrence of marsh fern (*Thelypteris palustris*) and wetland forbs.

Marsh Fern-Alder Stands grow as site quality II stands with black alder, downy birch, and spruce in canopy. Understory contains buckthorn and willows (Salix spp.). Ground vegetation features are dominance of marsh fern (Thelypteris palustris) and unique combination of wetland herbs in hollows (Hottonia palustris, Menyanthes trifoliata, Phragmites australis), and less hygrophilous species on hummocks (Filipendula ulmaria, Dryopteris spp., Athyrium filix-femina)

Obleševo Bog (Klintsy District, Bryansk Oblast) is an exhausted peatland (1,256 ha) with waterlogged depressions supporting diverse bog habitats dominated by:

- Small-leaved swamp forests (black alder and downy birch, ~25% coverage);
- Absence of spruce, ash, and aspen stands due to edaphic conditions;
- Minimal forest area on oligotrophic and eutrophic waterlogged histosols.

Downy birch forests occur primarily as:

- Sedge and sedge-herb types on eutrophic bogs
- Riparian herb-type stands with nearly equal proportions of downy (B. pubescens) and silver birch (B. pendula) - sometimes classified as derived silver birch stands.

The stand characteristics are:

- Site quality I-II;
- Admixtures of black alder, aspen, and oak;
- Understory of willows and buckthorn;
- Abundant sedges and wetland forbs in ground layer.

Sedge-Dominated Downy Birch Forests are confined to low-lying bog areas. The tree layer of sedge birch forests is dominated by downy birch (Betula pubescens), occasionally with admixtures of pine (Pinus sylvestris), silver birch (Betula pendula), black alder (Alnus glutinosa), and more rarely spruce (Picea abies). Stand quality class III. The understory of willows and alder buckthorn (Frangula alnus) is moderately developed. The ground vegetation consists of Carex species and marsh fern (Thelypteris palustris). The moss layer includes Climacium dendroides, Calliergonella cuspidata, and sphagnum mosses (Sphagnum squarrosum, S. centrale).

The downy birch stands consistently contain admixtures of black alder and aspen (Populus tremula). The understory typically includes buckthorn and willows. Natural regeneration is absent. The ground vegetation is dominated by hygrophilous species, notably common reed (Phragmites australis) and eutrophic sedges. Moss cover is concentrated primarily on root hummocks.

Lowland Sedge Bogs occupy up to 50% of the bog territory, these areas have been used historically and continue to be used for haymaking. The peat layer thickness ranges from 0.5 to 1.3 m. The majority of open bog areas (10-30%) are covered by shrub vegetation and scattered trees of black alder, willows, and downy birch. Some sections have up to 60% shrub cover. Meadow and marshy areas occur along the bog perimeter.

Semenovskoye Bog (Rognedinsky District) is a unique raised bog located at the southern boundary of the sub-taiga zone, exhibiting mosaic distribution within the Polesye landscapes. Designated as a protected area (nature monument) covering 10 hectares, it is situated southwest of Semenovka village with the purpose of conserving: the raised bog ecosystem, adjacent forest communities.

Its key environmental functions, include formation of rare plant species habitats and maintenance of the hydrological regime.

The key feature is – it is one of the largest surviving populations of round-leaved sundew (Drosera rotundifolia).

Documented sphagnum moss communities, include sphagnum fallax-Carex lasiocarpa communities dominated by sedges and various sphagnum species (including S. angustifolium); Scots pine (Pinus sylvestris) present as a secondary species (3.5-4 m height, 7-8% canopy cover); forms along the periphery of small bogs.

Sphagnum magellanicum (S. divinum)-Eriophorum vaginatum communities:

- Dominated by cottongrass and S. magellanicum hummocks with inclusions of S. fuscum;
- Sparsely distributed Scots pine and downy birch;
- Round-leaved sundew populations on moss patches (density: 6.5±0.2 individuals/m²);
- Occupy central bog areas with high water table levels.

Sphagnum cuspidatum-Eriophorum vaginatum communities occupy hummock depressions with standing open water, contain stunted Scots pine and downy birch, are located in central bog sections.

Juncus filiformis-Eriophorum vaginatum communities are:

- Cottongrass-dominated with Sphagnum fallax and S. angustifolium ground cover;
- Scots pine and birch trees (up to 5 m tall) distributed along bog margins.

Small-area communities of Sphagnum fallax-Eriophorum vaginatum occur in marginal bog zones, featuring diverse moss species (S. fallax, S. angustifolium, S. magellanicum, S. russowii, S. fuscum).

Key indicators of Biodiversity Metrics describing plant community biodiversity in the wetlands are presented in Table 1.

Table 1. Characteristics of biodiversity in wetland communities.

Indicators	* Vegetation communities						
	1	2	3	4	5	6	7
Number of vascular plant and moss species (at description sites)	82	79	96	124	132	119	31
Average number of species per site**	27.5	27.2	31.9	46.3	52.4	48.9	12.4
Simpson Diversity Index	17.7	16.2	19.7	22.2	24.7	21.6	7.3

*Note. Generalized characteristics of plant communities: 1 - Glazhenka bog, Bryansk district; 2 - Vadkovka bog, Pogarsky district; 3 - Palsovskoye bog, Bryansk district; 4 - Galoye bog, Unechsky district; 5 - Petrovskoye bog, Kletnyansky district; 6 - Oboleshevo bog, Klintsovsky district; 7 - Semyonovskoye bog, Rognedinsky district.

** Average number of vascular plant and moss species per site during geobotanical description.

The highest Simpson diversity index values were recorded for various wetland areas composed of woody, woody-herbaceous, and woody-moss communities - in the landscapes of Petrovskoye and Galoe bogs. The sampling plots registered 125 to 130 species. Significant floristic diversity was also recorded in the Oboleshevo wetlands - 118 species across all sample plots. The Simpson Index (SI) values for communities of these three bogs were also maximal - ranging from 21.6 (Oboleshevo) to 24.7 (Petrovskoye). The SI is closely related to the area of the sites, as large landscapes develop diverse habitats occupied by different communities. Galoe and Petrovskoye bogs have the largest areas with central zones that have undergone minimal changes and anthropogenic impacts.

Glazhenka Bog is characterized by some of the lowest biodiversity indicators, as it has experienced significant transformations of its water regime and has a small area. The wetlands average 81 species, with SI = 17.7. Vadkovka Peatland in Pogarsky District - an extensive worked-out area representing overgrown quarries from open-pit peat extraction. The plant communities represent successional stages of cenosis development, with SI = 16.2. Similarly, Paltsovskoye Bog in Bryansk District, which also represents exhausted peat deposits, has been characterized. Floating mat lakes and other water bodies contribute to increased biodiversity as refugia for wetland plants.

As expected, the Semenovskoye Nature Monument with communities of raised wetlands shows low diversity indicators. On average, a sample plot description includes 9 to 15 species, with SI = 7.3. The unique ecological regime of habitats with strongly acidic conditions does not promote the development of diverse flora, particularly vascular plants.

Analysis of the vegetation affiliation of studied bogs according to the EUNIS international habitat classification system showed that wooded (forest) bogs belong to group T1 East European black alder swamp forests - alliance Alnion glutinosae Maicuit

1929, while cottongrass- and sedge-sphagnum birch forests belong to alliance Betulion pubescentis Lohmeyer et Tx.et Oberd. 1957 [7-9, 11].

The most informative criterion for bogs is considered to be biodiversity indicators, which are proposed to be accounted for according to international criteria - the Ramsar Convention. Table 2 shows the main characteristics and significance of wetlands according to international criteria.

Table 2. Significance of wetlands in Bryansk Oblast according to international criteria.

Wetland Name	A*	B*							
	1	2	3	4	5	6	7	8	9
Glazhenka bog, Bryansk district						+			+
Vadkovka bog, Pogarsky district			+			+			+
Palsovskoye bog, Bryansk district			+			+			+
Galoye bog, Unechsky district		+	+	+		+			+
Petrovskoye bog, Kletnyansky district		+	+	+		+			+
Oboleshevo bog, Klintsovsky district			+			+			+
Semyonovskoye bog, Rognedinsky district		+	+	+		+			+

Note. *Criteria for the selection of Wetlands of International Importance adopted by the 7th (1999) and 9th (2005) Conferences of the Parties to the Ramsar Convention.

Wetland Habitats in Bryansk Oblast do not belong to Group A under the first criterion of international recommendations. The primary positions characterizing the biospheric significance of wetlands are formed according to Group B criteria. The highest number of indicators are found in the wetlands of Semenovskoye Bog, Petrovskoye Bog, and Galoe Bog. These habitats support the existence of vulnerable or endangered species and communities.

The wetlands serve as habitats for plant and/or animal species at critical stages of their biological cycles, or provide refuge during unfavorable conditions: Semenovskoye Bog, Galoe Bog, and Petrovskoye Bog.

Based on calculations of the Disturbance Index (I_d), the following conclusions can be drawn: all wetland habitats experience minor anthropogenic impact and belong to the conditionally pristine, non-exploited type of geoecosystems. Consequently, their degree of disturbance is low.

The territorial disturbance index, calculated for the bog natural complex, showed that most studied landscapes and communities belong to minimally exploited or non-exploited types, thus possessing sufficient potential for conservation and maintaining stability.

The studied wetland communities can serve as ecological cores for ecological networks, as they represent undisturbed (pristine) wetlands. Diagnosis of wetland disturbance constitutes the primary system of measures for analyzing current conditions and forecasting landscape and biodiversity dynamics. Spatiotemporal dynamics of bogs, particularly in transboundary contexts, will facilitate planning for ecological network development within frameworks of international environmental and legal cooperation. Such collaboration appears especially promising for organizing Red Book conservation measures and biodiversity protection initiatives.

4 Conclusions

The bogs studied during comprehensive monitoring in Bryansk Oblast represent important landscape components and specific biotopes that serve as refugia for numerous flora and

fauna species. The vegetation is dominated by eutrophic and meso-eutrophic communities, including aquatic cenoses. The primary factors determining cenotic diversity in these wetlands are water mineralization levels and moisture variability. A rare raised bog type for the region - Semenovskoye Bog (Rognedinsky District).

The highest Simpson diversity index values were recorded for various wetland complexes composed of woody, woody-herbaceous, and woody-moss communities in Petrovskoye and Galoe bogs, while significant floristic diversity was documented in Oboleshevo wetlands. The Simpson Index values for these three bogs ranged maximally from 21.6 (Oboleshevo) to 24.7 (Petrovskoye). Glazhenka Bog demonstrates some of the lowest biodiversity indicators due to substantial hydrological modifications and limited area. The Semenovskoye Nature Monument, featuring raised bog communities, shows low diversity values: its unique ecological regime with strongly acidic conditions limits floristic diversity (particularly vascular plants) while preserving critical habitats.

The Disturbance Index (I_d) revealed that all studied wetlands experience minor anthropogenic pressure, classifying them as conditionally pristine, non-exploited geoecosystems with consequently low disturbance levels. These wetland communities can function as ecological cores for regional ecological networks.

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