



# ENVIRONMENTAL MONITORING

## ЭКОЛОГИЧЕСКИЙ МОНИТОРИНГ

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### Assessment of the disturbance of peat bogs of the Mogilev region

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**Abstract.** The analysis of high- and ultra-high-resolution satellite images of 1,385 peat bogs (with an area of more than 10 hectares) located on the territory of the Mogilev region of the Republic of Belarus showed that about 37 % of the total area of 221 thousand hectares of peat bogs were preserved in their natural state, the rest was subjected to hydraulic reclamation. The share of drained lands with peat soils of agricultural use was about 30 %, covered with forest vegetation – about 7 %, disturbed swamps – 26 %.

**Keywords:** satellite images, natural swamp, disturbed swamp, drained lands with peat soils, covered with forest vegetation

**Authors' contribution:** All authors have made an equivalent contribution to the preparation of the publication.

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## Оценка состояния торфяников Могилевской области

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**Аннотация.** Анализ спутниковых снимков высокого и сверхвысокого разрешения 1385 торфяников (площадью более 10 га), расположенных на территории Могилевской области Республики Беларусь, показал, что из общей площади 221 тыс. га торфяников в естественном состоянии сохранилось около 37 %, остальная часть подверглась гидротехнической мелиорации. Доля осушенных земель с торфяными почвами сельскохозяйственного использования составила около 30 %, покрытых лесной растительностью – около 7 %, нарушенных болот – 26 %.

**Ключевые слова:** спутниковые снимки, естественное болото, нарушенное болото, осушенные земли с торфяными почвами, покрытые лесной растительностью

**Вклад авторов:** все авторы сделали эквивалентный вклад в подготовку публикации.

**История статьи:** поступила в редакцию 01.04.2023; доработана после рецензирования 01.07.2023; принята к публикации 10.09.2023.

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Natural peat swamps perform a variety of biosphere functions, have a great influence on natural processes, provide conditions of balanced and stable condition of this environment. They are very specific and unique natural habitats for biodiversity. Almost all species of wetland plants and animals are rare or vulnerable because they can only inhabit swamps, and the shrinking wetlands inevitably lead to a decline, and sometimes to the complete extinction, of many unique species and populations. The most important properties of the marshes in their natural state are the preservation of landscape diversity among the developed territories, the mitigation of climate change, the maintenance of a sustainable water regime in their surrounding territories. On drained, developed and exhausted peat deposits, the processes of mineralization of the organic matter of peat are intensively carried out, a fire-dangerous situation arises.

Comprehensive accounting and inventory of all peat deposits is a prerequisite for productive and rational use of raw material resources of the peat fund. It is important to have up-to-date information that considers the changes that occurred in the past years for each object – changes in areas, reserves, and conditions.

To obtain up-to-date information on peatlands of the region, their condition was assessed using satellite images [1]. For interpretation we used images prepared on the basis of high and ultra-high resolution images available on Google, Yandex

Satellite, Bing geoservices, the Earth remote sensing data on the territory of the Republic of Belarus, including aerial photography materials ([www.dzz.by](http://www.dzz.by)).

Peatland areas were assessed according to the presence of sites (and their areas) of certain uses.

Depending on the degree and type of use in economic and other activities, categories of peatland areas were identified: natural bog; disturbed bog; areas covered with forest vegetation; drained lands with peat soils of agricultural use.

*Natural bogs* are preserved in their natural undisturbed state. Limited use of natural bogs is allowed for certain types of economic and other activities that do not have a negative impact on bog ecological systems (forestry, ecological tourism, collection of wild plants, haying, hunting, and fishing, etc.), provided that the regime of protection and use of natural bogs is observed.

*Disturbed bogs* covered with woody and shrubby vegetation shall be used for forestry, gathering, harvesting of wild plants, haying, hunting, and fishing, other types of economic and other activities.

*The areas covered with forest vegetation* are characterized by the presence of tree canopy and forest amelioration channels;

*Dewatered lands with peat soils* are used for agriculture.

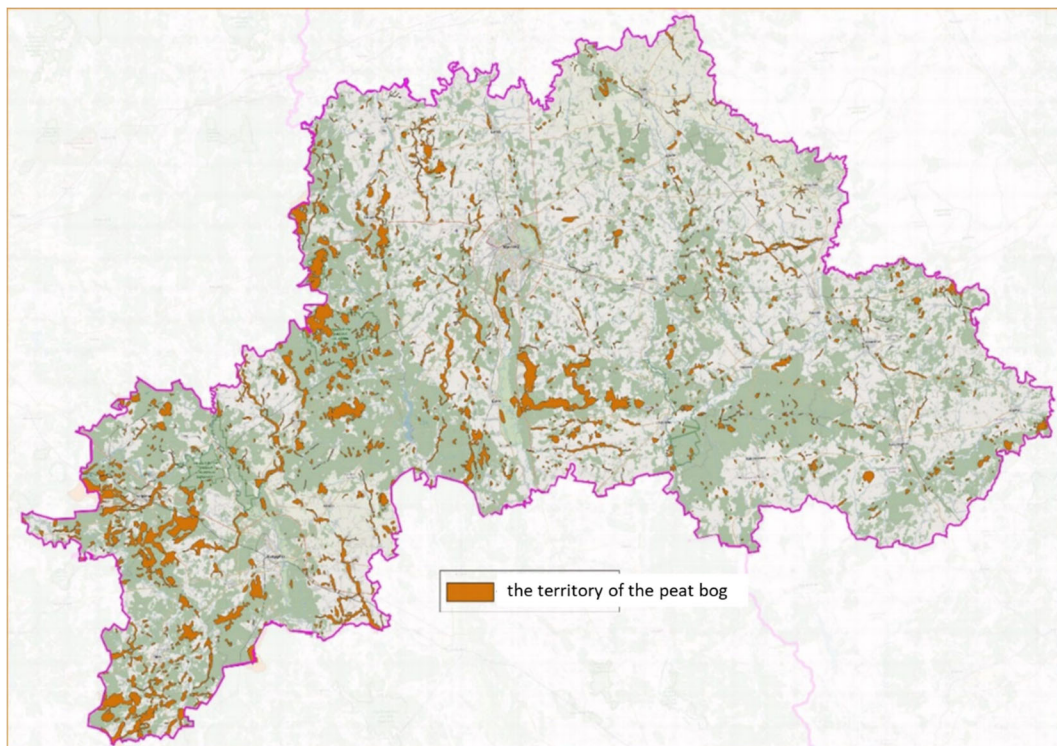
The work was carried out using a free geo-information system with open code QGIS. A database of peat field contours with topographic referencing and area-by-area rationing (based on ground survey data) was provisionally established. The attribute information of the contour database contained quantitative and qualitative information about each peat deposit. Figure 1 shows a map of peat deposits of the Mogilev region.

In total on the territory of the Mogilev region of the Republic of Belarus there are 1385 explored peat deposits with the area of more than 10 hectares, the total area of which is ~221.0 thousand hectares or 7.6% of the territory of the region [1].

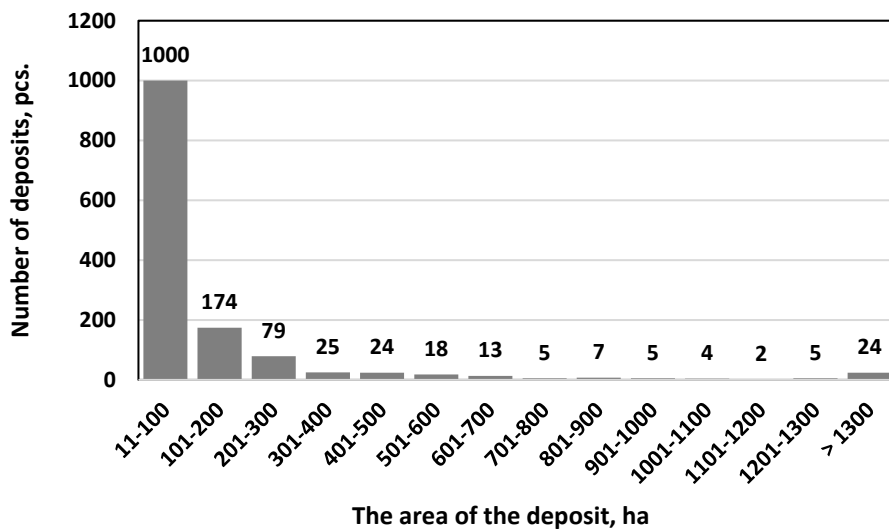
Figure 2 presents a statistical diagram of the distribution of peat deposits in the Mogilev region by area at zero deposit boundaries. As follows from the above data, the peat fund of the Mogilev region is represented mainly by small peat deposits by area: ~ 72.2% of deposits with the area less than 100 ha.

The peatland condition was analyzed by the method of expert assessments of territories using the developed decoding attributes [2; 3].

The deciphering features of plots of different categories within the zero boundary of the peat deposit were: the structure of the pattern; the tonality of the pattern depending on the degree of watering of various elements of the micro-landscape; the presence and parameters of the drainage network; the presence of the tree layer and its location. Figure 3 shows examples of fragments of satellite images of typical sites of different categories.



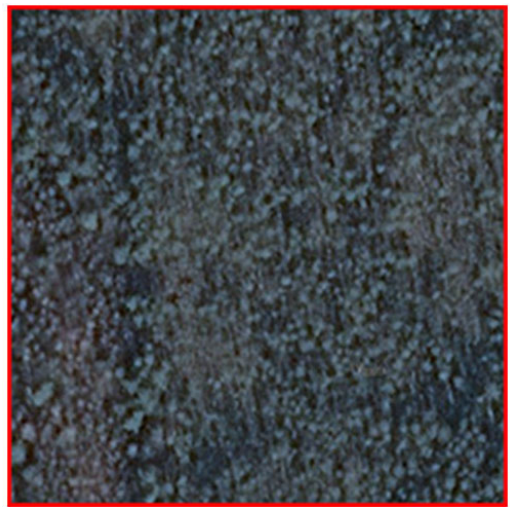
**Figure 1. Map of peat deposits in the Mogilev region**



**Figure 2. Statistical diagram of the distribution of peat deposits in the Mogilev region by area in the zero boundaries of the deposit**



**A natural swamp**



**A field covered with forest vegetation**



**A disturbed deposit covered with shrubby vegetation**



**Drained lands with peat soils**

**Figure 3. Typical areas of peat bogs of different uses (satellite images of Yandex Satellite)**  
(photo by the authors)

Figure 4 shows a map of the current state of peat deposits in the Mogilev region, created based on the performed territorial assessment.

As can be seen from Figure 4, the territories of most peatlands are characterized by the presence of areas of different uses within the zero boundary of the peat deposit.

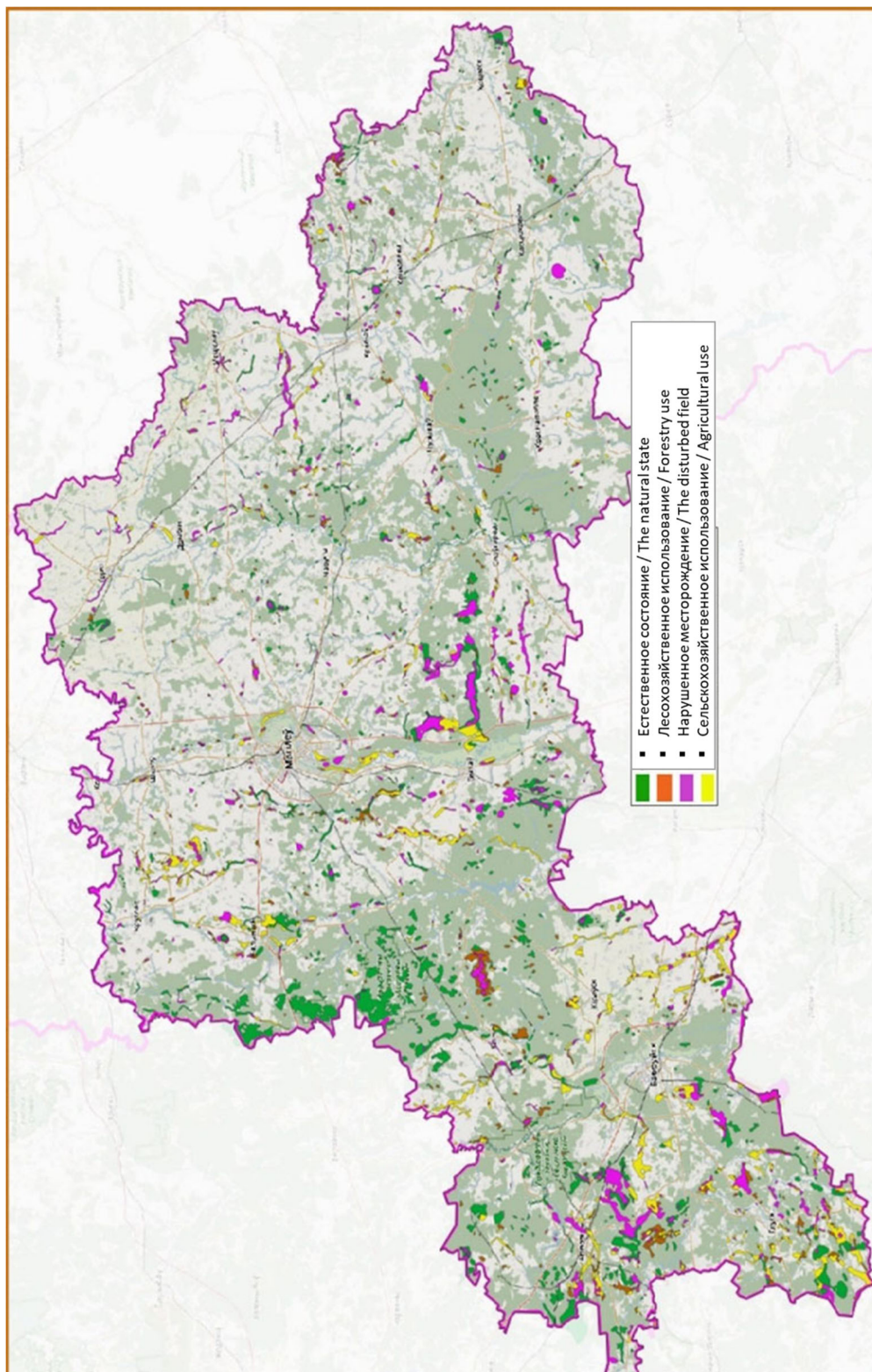


Figure 4. Map of the current state of the peatlands of the Mogilev region

Quantitative assessment of the total area of sites of different categories showed that natural peat bogs occupy an area of 82.0 thousand ha or 37.1% of the total area of peat deposits in the Oblast. Drained lands with peat soils of agricultural use occupy an area of 64.9 thousand hectares (29.4%). The area of disturbed bogs is 57.6 thousand hectares (26.1%). Peat deposits covered with forest vegetation occupy an area of 16.4 thousand hectares (7.4%). At the same time, the area of peatlands, the territories of which fully belong to one category (natural bogs) is 39.0 thousand ha (~17.6% of the total area of peat deposits in the Oblast). Thus, ~ 82.4% of peatlands are disturbed to a greater or lesser extent.

Analysis of the state of disturbed territories of peatlands in the region showed the presence of 37.0 thousand hectares of retired peat deposits, of which 78.2% belong to the category of disturbed bogs covered with tree and shrub vegetation. Effectively used in agriculture – belong to the category of drained lands with peat soils - 7.4 thousand hectares (20.16 %). Retired peat deposits covered with forest vegetation occupy 0.6 thousand ha (1.63 %).

Based on the data obtained during the analysis of peatland areas, a GIS-format database of peatlands in the region was created. The created database allowed estimating the remaining peat reserves for each of the deposits by considering the depleted areas of the deposits and losses during agricultural use of peat lands.

Thus, the analysis of satellite images of peatlands in the Mogilev region allowed to assess the degree of their disturbance, to obtain statistical data on the state and directions (degree) of their utilization.

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