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An assessment of the impact of the groundwater level decline during the open-pit extraction on the state of the subarctic wetlands

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Exploration and extraction of mineral resources have a significant impact on the environment. This anthropogenic impact is especially dangerous for the subarctic and arctic territories due to the vulnerability, instability and low capacity for self-recovery of northern ecosystems. The leading place takes the impact of open-pit mining on surface and ground waters. The region under study is characterized by excessive moistening due to the geographic location and climatic conditions.

The environmental monitoring of an open-pit mine located within the Belomoro-Kuloi plateau showed that the radius of the cone of depression is about 10 km, and its depth exceeds 180 m. A change in the hydrological regime of this territory can cause significant transformations of the oligotrophic ecosystems dominating here, and, accordingly, affect the state and functioning of relict swampy sub-tundra forests.

The aim was to assess the impact of the groundwater level decline on the structure and dynamics of oligotrophic phytocenoses and the corresponding edaphotop (the case of model sites located on an oligotrophic bog genetically and geographically close to the disturbed bogs).

It was found that both the phytocenosis as a whole and its individual components are sensitive to changes in hydrological conditions. However, they cannot act as an indicator in the short term because of the wide variability of the response, the significant ecological plasticity of the majority of bog species, and also a sufficiently long (up to 10-25 years) period for establishing the equilibrium state of the phytocenosis after the destabilizing effect. Changes in phytocenosis occur as a reaction to changes in edaphic conditions as a whole. Therefore, information on the properties and structure of peat deposits allows a rapid and reliable assessment of the processes occurring in the ecosystem during drainage.

The studying of the physicochemical properties of peat deposits confirms that changes in hydrological conditions find a fixed response in the composition of peat organic matter. Drainage of peat deposits leads to a significant increase in humification, a noticeable increase in the content of bitumen and humic compounds while reducing the content of easily and difficult hydrolysable components. This is consistent with changes in the structure and number of microbial communities, as well as with an increase in the depth of aeration of the peat deposit.

Biogeotransformation is accompanied by synchronous processes of condensation and destruction of fulvic acids, as well as partial washing out of labile organic matter from the peat structure and, accordingly, an increase in the removal of organic matter into watercourses.

At the same time, restoration of drained bogs does not ensure the remediation of the structure and group chemical composition of peat to the initial values. Therefore, a drained bog, when restored, develops according to the mesotrophic or eutrophic type, as shown by other researchers. The change from oligotrophic communities to meso- and eutrophic ones leads to disruption of the delicate equilibrium of subarctic ecosystems and reduces the list and volume of ecosystem services that these wetlands provide, both at the local and global levels.

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