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INCREASE OF FOREST PLANTATIONS PRODUCTIVITY IN PLACES OF ILLEGAL AMBER MINING OF WESTERN POLISSIA

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Summary

The article reveals the problem of illegal amber mining in Ukraine, its negative impact on natural resources and increasing the productivity of forest plantations in both communal and state-owned forests. The main reasons for this phenomenon are considered: relative ease of access to amber deposits, their remoteness from populated areas, and the difficult accessibility of territories due to wetlands and dense afforestation.

The article notes the important role of forests, especially in the Polissia region, in ecosystems and emphasizes their ecological importance. It is noted that forests perform a variety of functions, such as sanitary and hygienic, water protection, rec-

reational, sanative, educational and aesthetic. The importance of forest areas for the preservation of rare species listed in the Red Book of Ukraine is noted.

The main focus is on the economic and environmental consequences of illegal amber mining. A large number of persons engaged in unauthorized mining is indicated, which leads to serious economic losses for the state and society. Emphasis is also placed on the need for reclamation of disturbed areas as a way to restore natural biotopes and improve the ecological situation.

The article calls for effective measures from the state and the public to solve the problem of illegal amber mining, in particular through the implementation of reclamation projects and increased control over the use of natural resources.

Introduction

As known, amber is mined in Ukraine on lands occupied by forests, swamps, wetlands, as well as on lands of various agricultural purposes, such as hayfields, meadows, pastures, and arable land. Unauthorized extraction of amber will lead to partial or complete destruction of these natural objects and their environmental protection functions.

The vast majority of the forests of Ukrainian Polissia consist of conifers (scots pine), hardwoods, and soft-leaved trees (oak, birch, alder, aspen, ash, spruce, and linden). As a result of the photosynthesis process, 1 ha of mature forest releases oxygen and absorbs up to 8 kg of carbon dioxide (CO_2) per hour. One hectare of forest can emit up to five kilograms of phytoncides and filter up to 70 tons of dust during the year [1-3].

According to their ecological significance, forests, as well as territories covered with tree and shrub vegetation, perform sanitary and hygienic, water protection, recreational, health, educational, aesthetic and other functions. A significant number of rare species listed in the Red Book of Ukraine grow in forest areas

The main reasons for illegal amber mining

As of today, there are up to 300,000 citizens in Ukraine who engage in unauthorized extraction and/or sale of amber. The illegal activity of such "diggers" causes serious economic losses to the state and society, is accompanied by a worsening of the social climate, leads to the degradation of large areas of forest land, and the deterioration of the ecological situation. Since disturbed biotopes cannot be restored to their original state naturally, without human intervention, they require reclamation.

The main reasons for unauthorized extraction, processing and sale of amber in the conditions of Ukraine include the following:

- amber deposits are located relatively close to the surface and water bodies and at a considerable distance from populated areas;
- the territories are difficult to access due to characteristic wetlands and dense afforestation;
- insufficient effectiveness of legislative acts and their compliance during regulation of activities;
- high level of unemployment;
- low level of environmental awareness of the local population;
- recognition of amber as precious stones.

The state, in the form of central and local authorities, both legislative and executive, is forced to make efforts to solve the mentioned problem, but no noticeable progress has been achieved so far.

One of the areas of intervention in the situation by state bodies and the public is the practical implementation of the rehabilitation of disturbed areas. To this end, the Cabinet of Ministers adopted Resolution No. 1063 of the Cabinet of Ministers dated November 30, 2016, which approved the "Procedure for the implementation of the pilot project of reclamation of forestry lands disturbed by illegal amber mining." According to this resolution, the order of the State Forestry Agency of Ukraine No. 138 dated 21.04.2017 established the "List of forestry lands, within which there are parts disturbed due to illegal amber mining and in need of reclamation", which included 2,046 disturbed plots with a total area of 30,037.6 hectares.

Negative environmental consequences of illegal amber mining

It is quite obvious that widespread methods of illegal amber mining, such as mining, underground water leaching, and water erosion in pits, have a significant negative impact on the ecological state of the development areas.

Illegal mining is uncontrolled, and this applies to both raw materials and the consequences of mining, which include the disturbance of natural areas. All parts of nature are closely related to each other as a complex system. Thus, the disturbance of the geological environment necessarily affects the neighboring environments [4-6].

"Artisan" extraction of amber from the subsoil of Polissia is carried out, as a rule, by individuals or organized groups of persons, in the absence of documents necessary for the development of deposits

or deposits of this type of minerals in accordance with current legislation. Thus, there are two main methods of amber extraction: mining and underground hydraulic leaching, which depend on geological conditions. The use of a particular approach is determined by a set of factors listed below:

- depth of amber deposits;
- the depth of groundwater and the presence of aquifers;
- the suitability of amber-containing deposits for erosion;
- amber content in amber-bearing deposits.

As a rule, amber deposits with a shallow (up to 5 m on average) occurrence in the aeration zone are mined by pits, among which there are the least floaters, as well as rich placers in water-resistant clay deposits that are not subject to hydroerosion. Deposits that lie deeper, among the permeable sediments covered by floaters, are developed by the method of underground hydraulic erosion.

Mining of amber by dredging makes, on average, about 55% of all Oligocene amber-bearing layers covered by small-scale industries. This method consists in the penetration from the day surface of vertical mine workings of various cross-sections and configurations among Quaternary and Oligocene deposits, aimed at the opening in the subsoil (partially or at full capacity) of amber-bearing horizons and at the same time mechanical extraction of lump amber from the emissions of the mining mass. The vast majority of pits are dug by hand with bayonet and scoop shovels using other tools similar in simplicity. That is why this method is a pioneer in artisanal amber mining in Ukrainian Polissia.

When using the mining method to extract amber, the grass and shrub layer of the forest is completely destroyed, and the root system of the trees is significantly damaged, and sometimes the trees are cut down and uprooted. Due to lack of soil and due to damage, the root system is not able to hold the trunk in a vertical position and the trees bend or even fall under their own weight. At the same time, neighboring plants can be damaged, the undergrowth dies. Over time, most trees die. In such areas, the main soil cover is almost completely absent. Instead, a large number of pits significantly reduces the area for the development of seeds and, therefore, young forest. Thus, the modern forest is being destroyed, and there are no conditions for its restoration.

In recent years, miners have begun to use preliminary exploration of the subsoil with the help of auger drilling wells to increase the efficiency of mining. If amber or organic-enriched siltstones and black clays are discovered during drilling, four more wells are drilled at a distance of 0.5-5.0 m around the prospecting well in order to establish the direction of the "vein" (that's what miners call productive lenses enriched in organic matter rocks with rich amber placers). In this way, the amber plume is contoured and miners can lay pits without going beyond the amber placer.

Digging of pits in the conditions of Polissia by diggers is carried out without prior storage of sod-podzolic soils of the vegetation layer. Sometimes technical means, such as small excavators or bulldozers, are involved in the digging of pits, which remove overburden, which are unproductive Quaternary deposits.

Usually, amber-bearing sandy deposits of the Oligocene contain water-pressure floats, which significantly complicate, and sometimes make it completely impossible, the passage of shafts. In connection with the floaters, the development of the productive horizon is limited to flooding, as there is a risk of the walls collapsing. As a result, miners develop mainly the upper part of the amber deposit layer, and the main volume of the productive horizon is not involved at all during the destruction of the pit.

A similar, but at the same time, different picture is observed in hydropump extraction of amber. At the same time, two types of negative consequences can be considered. The first is the creation of funnel-shaped cavities in the soil, covering it with washed material; the second - violation of the hydrogeological regime of this territory due to the influx of large volumes of water. Mechanical impact causes the soil to settle and lie under a layer of sandy-clay material. Additional moistening with technological waters increases the level of groundwater over a long period of time [7-9].

Thus, the root system of trees cannot maintain equilibrium in thin sandy soil due to the effects of these factors. In addition, the raised level of groundwater prevents the penetration of oxygen to the roots, and they die from waterlogging. When the number of dead roots reaches a critical limit, the plant dies completely. The difference of the hydropump method is only that the soil and rock are not moved

into dumps, but spread evenly over the territory by water flows, creating conditions for further self-renewal of the forest.

Underground hydraulic erosion is a set of measures aimed at extracting amber from the subsoil. This is achieved by disintegrating and destroying the productive amber layer with a pressure jet of water, after which pieces of amber are carried to the surface. This method came to Ukraine in the early 90s of the last century from neighboring Poland. Its essence consists in the vertical erosion of sandy-clay rocks by pressure water and the raising of amber together with the upward flows of the pulp.

Hydraulic pump units are used for hydraulic washing. These units consist of intake, supply and discharge parts. The source of water collection is a fire hose with a large diameter (140 mm), which is lowered into the water body. A powerful hydraulic pump based on BMW, Audi, Mercedes and Volkswagen engines and a fire hose with a diameter of 100 mm and a length of 20-300 m (from 500 to 800 m) with a reducer at the end. A rubber hose of small diameter (80 mm) with a cylindrical steel tip - fire nozzle, which has strong sharp-angled teeth at the end. This design allows you to create a water pressure with a flow rate of 800–1800 l/min at the outlet of the tip and wash away dense silty and clay rocks.

When conducting artisanal amber mining, the "test exploration" of a promising area is most often carried out not with an auger drill, but with a hydraulic pump unit itself, laying test wells along the profile or at random. The use of such a search method is popularly called "beating traffic jams". In this way, miners will immediately learn about the prospects of this or that deposit and the economic feasibility of its development based on the visually estimated output of amber.

The method of underground hydraulic erosion of amber has a number of advantages and disadvantages compared to mining. The advantages are its high productivity and efficiency in application, i.e., in the same time, you can cover an area ten times larger with hydraulic washing and, accordingly, extract more amber than with

pits. With this method, exploration and extraction of amber are combined, which saves material resources and efforts of miners.

The disadvantages of the hydro method are that it directly depends on the sources of water supply. This condition of application also determines the seasonality of hydropump extraction of amber, when there is no water in the amber-bearing areas in reservoirs, or it is scarce, in low-water periods of the year. This drawback is partially eliminated by the creation of artificial dams by diggers on watercourses, which retain and accumulate the necessary supply of water. Among the disadvantages of amber mining by the underground hydraulic erosion method, the low percentage of amber yield in relation to its natural concentration can also be attributed.

The combined mining of amber is used by diggers in the case of its extraction from the productive horizon by the method of underground hydraulic erosion at the site of previous pits dug up. Such mining takes place in those areas where the hydrogeological conditions did not allow to sufficiently develop a productive horizon by dredging, or where the area with a large amber content is poorly or incompletely excavated. In the first case, amber is extracted from the lower undisturbed part of the amber-bearing layer and the inter-pit space. In the second, mainly the inter-pit target is eroded, as well as the bottom of the pit to the bottom of the amber-bearing rocks.

Based on the analysis of the state of disturbed areas, it was established that the species similarity of the floristic composition of most forest communities after amber mining in the investigated areas is very low.

It should be noted that for the extraction of amber with pumps, deep channels were dug that drain forests on large areas, which leads to a change in the hydrological regime of the territory and a weakening of the ecological stability of forest ecosystems [10-12].

It was also found that, in most cases, the number of plant species in the disturbed areas was smaller compared to the original phytocenoses. This indicates the general destruction of phytodiversity as a result of illegal amber mining.

Conclusions

Considerable reserves of amber are concentrated in the territory of Ukrainian Polissia. Almost 6% of the world's reserves of this mineral are concentrated in the Rivne region alone. Illegal mining of amber started due to a number of factors, the main of which were: recognition of amber as a precious stone, high level of unemployment of the local population, ineffectiveness of legislative acts regarding the regulation of this type of activity.

Illegal extraction of amber by diggers has a significant negative impact on the environment: soil degradation, destruction of forest lands, waterlogging, disturbance of the terrain. Due to the scale and nature of such impacts, even after the cessation of illegal activities, nature cannot restore itself (return to its original state) without human intervention.

That is why there is an urgent need for further reclamation of such disturbed lands by increasing forest plantations, both in communal and state-owned forests.

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