



## MAN-MADE LOAD AND ENVIRONMENTAL RESTORATION IN THE COAL MINING REGIONS OF THE LVIV-VOLYN BASIN, UKRAINE

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### **ABSTRACT**

*Mining development began in the late fifties and peaked in the early eighties, followed by a gradual decline. The greatest impact on the geological environment in the area is caused by anthropogenic processes that arose as a result of coal mining, coal preparation or are related to the activities of this complex: air pollution; changes in the nature and intensity of geochemical processes in soils associated with pollution; changes in the hydrogeological regime associated with the pumping of mine water, its discharge into surface watercourses and pollution of surface and partially groundwater; withdrawal of significant land resources from circulation for production waste, industrial complexes; changes and reduction of land productivity due to changes in soil composition and pollution; changes in landscapes, disruption of natural exogenous processes, emergence of new ones (subsidence, flooding), which are not naturally characteristic of the area.*

*As a result of the reforestation of the spoil heaps, landscapes of mixed forests with grass undergrowth and the development of the mushroom kingdom have been formed. Self-reforestation on the emerging waste heaps is observed, indicating that the biocenoses are appropriately selected for the region.*

**Keywords:** ecology of coal mining regions, environmental restoration, Lviv-Volyn basin,

### **INTRODUCTION**

The problems associated with excessive use of natural resources, which is caused by a transgress in the placement of productive forces and production capacities for a long time in certain territories, have become especially acute at the present stage of the development of society.

The maximum anthropogenic load due to the high development of the mining industry and the formation of man-made landscapes is observed within the Western Bug Valley. Large settlements are located here: Sokal, Chervonohrad, Mezhirichchya, Sosnivka, as well as 8 mines, a processing plant, tailings dumps, and mine water settling ponds. Chervonohrad district is a natural and anthropogenic system that actively affects the environment by filling it with chemical elements from dumps. At the same time, the natural and anthropogenic landscape above the mines' waste space is covered with water, completely changing the natural conditions of the region.

### **MATERIALS AND RESEARCH METHODS**

Based on field studies conducted in 2022, the authors of the publication investigated waste heaps of operating and closed coal mining enterprises of the Lviv-Volyn basin.

### **PRESENTATION OF RESEARCH MATERIAL**

Mining development began in the late fifties and peaked in the early eighties, followed by a gradual decline. The greatest impact on the geological environment in the area is caused by anthropogenic processes that arose as a result of coal mining, coal preparation or are related to the activities of this complex: air pollution; changes in the nature and intensity of geochemical processes in soils associated with pollution; changes in the hydrogeological regime associated with the pumping of mine water, its discharge into surface



watercourses and pollution of surface and partially groundwater; withdrawal of significant land resources from circulation for production waste, industrial complexes; changes and reduction of land productivity due to changes in soil composition and pollution; changes in landscapes, disruption of natural exogenous processes, emergence of new ones (subsidence, flooding), which are not naturally characteristic of the area.

Exogenous processes within the district include subsidence in aeolian loess loams and karst in Cretaceous sediments. Waterlogging is a widespread natural process that affects the geological environment and is detrimental to the development of agriculture and industrial construction. New intensive wetting and waterlogging of the land is being established, and significant waterlogging is observed in areas previously wet. In some places, round or oval depressions intensively flooded or filled with water have formed - lakes up to 100-150 m in size, some up to 500-700 m in diameter. The intensity of subsidence at most mines in the Chervonohrad district reached 100 mm/year. The maximum amplitude of subsidence (as of the end of 1993) was recorded in the area of Velykomostivski mines No. 3, 5, 8 and reached 4 m, with an area of 4 km<sup>2</sup>. The minimum subsidence was recorded in the area of Velykomostivska mine No. 9 [1].



Fig. 1, 2, 3. Reforestation of the spoil heaps, landscapes of mixed forests



Fig. 4. Self-recovery of trees on the resulting waste heaps



Fig. 5. Development of the mushroom kingdom have been formed in the heaps



Eight settlements and more than 2,000 hectares of agricultural land (Chervonohrad district) are in the zone of subsidence and flooding. To reduce the pressure on the surface, the height of the spoil heaps has two levels. In recent years, flooded areas near towns and mines have been covered with spoil heaps and garden plots have been formed. Before 1982, such garden plots were created in swampy, subsidence areas near the villages of Sosnivka, Hirnyk, and Chervonohrad. After 1982, new garden plots were formed in the wetlands to the north-east of Chervonohrad [1, 2].

As a result of the reforestation of the spoil heaps, landscapes of mixed forests with grass undergrowth and the development of the mushroom kingdom have been formed (fig. 1 - 5). Self-reforestation on the emerging waste heaps is observed, indicating that the biocenoses are appropriately selected for the region.

### **CONCLUSIONS**

The parameters of anthropogenic impact on the geological environment and its components can be considered at the following levels:

- The regional level of technogenesis, determined by the general background parameters of anthropogenic impact on the geological environment;
- Special level of impact, which characterises the anthropogenic load on the geological environment within the Chervonohrad mining district;
- Local level of anthropogenic impact on the geological environment caused by specific anthropogenic objects and their impact on the environment.

The work carried out to restore the environment is relevant and reduces the negative impact of the region's coal mining industry.

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