

Assessment of the Impact of the Mining Industry on Ecosystem Changes in the DashKesan District

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Abstract: Gadabay district is rich in natural resources and mining areas such as the Ugur deposit located there are rich in gold and other precious metals. Although mining activities are important for regional economic development, they have a serious impact on the environment.

This study assessed the environmental impacts of mining activities in local areas of Gadabay. Chemical analysis of soil samples and the state of vegetation cover indicate that mining activities cause soil pollution and biodiversity loss, putting the health of local communities at risk [2].

The article proposes measures to strengthen environmental monitoring and reduce environmental risks. The results will play an important role in making decisions on environmental protection for local governments and mining companies.

Keywords: environmental monitoring, mining activities, mining industry, mining companies.

1. Introduction

Gadabay district is located in the western region of Azerbaijan and is rich in natural resources. The Ugur deposit here is rich in gold and other precious metals and plays an important role in the economic development of the region. However, mining activities lead to soil and water pollution, loss of vegetation cover and endangerment of biodiversity [1].

The purpose of this study is to assess the environmental impacts of mining activities at the Ugur deposit. [3]. Soil and water samples were analyzed, and changes in vegetation were monitored using GIS technology and satellite imagery. The studies allowed us to determine the effects of pollution on the ecosystem.

The results provide important recommendations for maintaining ecological balance and sustainable development. The article will contribute to the development of effective environmental protection strategies for local governments and mining companies.

2. Object and methodology of the study

The main object of the study is the Ugur deposit in the Gadabay region and some local areas. Although the Ugur deposit is rich in gold and other precious metals and affects the regional economy, mining activities pose serious environmental risks.

Various methods were applied in the study. Soil samples were collected and analyzed for chemical composition, heavy metal concentrations, and pH level. Changes in vegetation were assessed using GIS technology and satellite imagery. Radiometer-dosimeter devices determined the exposure dose, and AAS and γ -spectrometry methods analyzed the composition of soil samples [1].

Ecological monitoring systems were created to monitor the long-term effects of mining activities and measures were developed to restore the ecological balance. Gold mineralization in the Ugur deposit occurred in subvolcanic rocks that had undergone hydrothermal changes of the Upper Bajocian age. These rocks were subjected to strong metasomatic changes and gold deposits were formed by hydrothermal effects.

3. Analysis and discussion

The research results show that mining activities in the Gadabay region change the chemical composition of the soil and increase the amount of heavy metals (Pb, Cd, As), which reduces soil fertility. GIS and NDVI analyses have proven the reduction of vegetation cover and the weakening of biodiversity. These results provide a scientific basis for the prevention of ecological problems and the development of land restoration strategies. The location of the deposit was determined and a satellite image was taken.



Figure 1. Gadabay, Ugur field

Mining activities in the Ugur deposit in the Gadabay region cause serious environmental problems such as soil and water pollution and reduction of vegetation cover. The increase in heavy metals in the soil poses a risk to agriculture, while the deterioration of water quality negatively affects the ecosystem and human health. The reduction in vegetation cover disrupts the ecosystem balance by increasing soil erosion. The exact location of the Ugur deposit was determined via satellite, and the geological and ecological features of the area were visualized. These results provide a scientific basis for the development of strategies for environmental protection.

The study reviewed NDVI indicators for 1990, 2000, 2010 and 2020 and presented changes in the vegetation cover of the area visually. The study provided accurate indicators related to the vegetation cover of the area. According to the results:

- The area of mountain species and sand showed a significant increase from 1990 to 2020. It increased from 0.2 ha to 1.6 ha from 1990 to 2000, and from 2010 to 2020, this area increased to 28.4 ha, indicating the beginning of mining activities.
- The area without forests increased from 1.6 ha to 61.5 ha from 1990 to 2000, and from 2010 to 2020, this area decreased to 4.78 ha.
- Shrubland and pasture areas increased from 90.9 ha to 129.13 ha from 1990 to 2010, and decreased to 109.8 ha in 2020, indicating the impact of mining activities on vegetation.
- The area of bare and sparse trees and shrubs decreased from 1990 to 2020.
- The area of strong dense vegetation decreased significantly from 1990 to 2020.

The humus content in the soil cover in local areas of Gadabay district varies between 4.66-7.40%. The nitrogen content is 0.36-0.50%, and the pH indicator is neutral. It was determined that the soil has a high absorption capacity (45.8-50.0 mg-eq) and its granulometric composition varies in a wide spectrum. Figure 3 shows the main aspects of soil research. These results reflect the impact of mining activities on the ecosystem and make it necessary to apply appropriate environmental measures.

In soil samples taken in the local area of Gadabay district, the content of several heavy metals and other elements was determined to be high. The elements with the highest amount in the chemical composition of the soil were iron (Fe) – 26525 mg/kg, titanium (Ti) – 2324 mg/kg, rubidium (Rb) – 145 mg/kg and lead (Pb) – 62 mg/kg. The elements in moderate amounts included chromium (Cr) – 59 mg/kg, vanadium (V) – 16.5 mg/kg, cobalt (Co) – 47.8 mg/kg, nickel (Ni) – 12.4 mg/kg, strontium (Sr) – 11 mg/kg, molybdenum (Mo) – 16 mg/kg, palladium (Pd) – 15 mg/kg, tantalum (Ta) – 6 mg/kg, osmium (Os) – 2.6 mg/kg, mercury (Hg) – 11 mg/kg, actinium (Ac) – 0.052 mg/kg, protactinium (Pa) – 1.2 mg/kg and thorium (Th) – 0.4 mg/kg. As a result of chemical analysis conducted using the AAS method, the amount of cesium, tungsten, platinum and radium elements was not determined. The exposure dose in the region ranged between 1.8-2.2 mR/h. The radionuclide content of soil samples was also determined, which indicates the presence of radiation contamination of the area. These results once again emphasize the importance of environmental protection and restoration measures.

As a result of the assessment of radiation indicators in the Gadabay region, it was determined that the levels of K-40, Ra-228, Cs-137, Sr-90, U-238 and Aeff radionuclides are within the norm and do not pose a serious radiation hazard to the environment. The values of Ra-226 and Pb-210 radionuclides are below the norm, which also does not pose a threat to the environment. The level of U-235 is slightly higher (1.65 Bq/kg), but this does not seriously affect the overall radiation safety. The low level of Be-7 (MDA=2.3) is considered a positive indicator. The value of Rn-222 is at a normal level. These results indicate that the radiation situation in the area is under control and does not pose serious risks.

4. Conclusion

Significant changes in land cover and land use were observed in Gadabay district between 1990 and 2020. Mining activities have affected vegetation cover and soil types, leading to a decrease in forestless areas, shrubs, and dense vegetation. The increase in mountain types and sand areas and the decrease in vegetation cover indicate changes in the ecosystem. The land cover is suitable for agriculture. High levels of elements such as iron, titanium, rubidium, and lead in soil samples may indicate the presence of underground resources. Radiation levels are moderate, highlighting the importance of regular monitoring. There is no radiation hazard, but continuous monitoring is important.

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