

## IMPACT OF HOSTILITIES ON THE ENVIRONMENT OF THE NORTHERN REGION OF UKRAINE

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### ABSTRACT

The Chernihiv region is located in the north of Ukraine, on the border with Russia and Belarus. Therefore, it has had a significant negative impact and horrific consequences from Russia's military aggression. During the period of the Russian military siege of Chernihiv (37 days), the aggressor state was causing irreparable and catastrophic damage. At the same time, indirect losses may manifest in the coming years and decades and these consequences are unpredictable. And now the enemy fired and destroys the border of the region every day. Undoubtedly, the war had a very negative impact on each component of the environment: phytocenosis, microbiocenosis, zoocenosis, hydrosphere, air, soil. The consequences will be long-term and will not only be local but also global.

**Key words:** impact of hostilities, environment, northern region of Ukraine.

### MATERIALS AND METHODS

General scientific and special methods were used to study the declared problem. System analysis, information-bibliographic method for researching priority trends. Their use made it possible to comprehensively consider the constituent elements of the study of the subject. Comparative analysis and generalization were used to formulate the conclusions.

### RESULTS

According to the Ukrainian Helsinki Human Rights Union for the period from 24.02. 2022-24.02.2023 (year of full-scale invasion) in the Chernihiv region it was recorded: Artillery shelling 2095 times, shelling from RSSU "Grad" 35 times, 190 aircraft, 17 rocket strokes, shelling with RSZV "Smerch" 8; 11 shellings, cassettes 14 times, 96 shelling of small arms [1].

The short-term consequences of hostilities for the environment can be summarized as follows: degradation of soils through mines, clogging of their explosive objects, military garbage; emissions of harmful gases and extremely toxic combustion products; consequences of man-made disasters caused by combat actions, etc.

The Chernihiv region has a significant and branched water network (rivers, lakes, swamps). Water resources have also been contaminated. Pollution of reservoirs was observed as a result of the equipment there. The rivers belong to the Dnieper River basin, which will inevitably lead to wider migration of pollutants and xenobiotics.

A significant number of objects of the nature reserve fund are registered in Chernihiv Oblast. So, as of January 2022, there were 677 of them, with a total area of 262,753 thousand hectares. The percentage of conservation is 7.88%. The natural reserve fund of the region is represented by: 2 national natural parks, 3 regional landscape parks, 459 nature reserves, 139 natural monuments, 1 zoological park, 2 dendrological parks, 19 parks-monuments of horticultural art, 52 protected tracts [2] .



Figure 1. The Chernihiv region is located in the north of Ukraine.

*Sources: google map.*

The above destroys the environmental balance of the region, given that most areas were affected by a global catastrophe at the Chernobyl nuclear station in 1986. The main factors that will affect the environmental situation of the region for a long time are mines and contamination of the territory as a result of hostilities that lasted here in February-April 2022 products of disintegration from everything left. There is also an irreversible negative impact on the biotic component of ecosystems. The consequences of mass deaths of animals and fish, the decomposition of which worsens the environmental situation, is a risk of spread of infectious diseases and even epidemics.

The soil is one of the greatest wealth of the state, the most difficult to clean environment, a non-renewable resource, not only the productivity and quality of the produced products depends on its condition, but also the preservation of biodiversity and the ecological state of the biosphere as a whole. This is an environment where all elements of the biosphere interact: water, air, living organisms. Ecocide, which has been taking place in Ukraine since February 24, 2022 due to the aggression of the Russian Federation, leads to a catastrophic state of all components of the natural environment, including soils.

According to the data of the Ministry of Agrarian Policy, it is impossible to use approximately 25% of Ukrainian lands due to military operations. As a result of active hostilities in nine regions of Ukraine, irreparable damage has been caused to the soil cover. More than 200,000 hectares of territory are polluted and damaged by mines, ammunition and equipment debris.

Currently, the ecological condition of soils and, in particular, chernozems in the war zone is extremely critical. Given that Ukraine contains about 9% of the world's chernozem reserves, 30% of European reserves, chernozems occupy an area of about 27 million hectares (46% of the territory), this issue is of particular concern

It is extremely dangerous that all this arsenal of weapons and shells enters the soil. Products of combustion of military equipment, petroleum products, etc. The air is polluted. The dangerous substances contained in ammunition are explosives [3]. TNT (trinitrotoluol) belongs to the group of nitroaromatic compounds known for their explosive force. Military equipment and ammunition contain a wide range of heavy metals (lead, mercury, arsenic, cadmium, copper, nickel, price, etc.).

Since the beginning of the 90s of the last century, trinitrotoluene has not been used in the USA in industry and mining due to the toxicity of the explosion products. Military equipment and ammunition contain a wide range of heavy metals (lead, mercury, arsenic, cadmium, copper, nickel, zinc, etc.). Mercury and its compounds are contained in detonators. Due to the use of mercury fulminate, the explosive detonates faster. In addition, a lot of sulfur remains in the soil. Part of this chemical element in the form of powder remains in and around the eruptions, and in contact with the precipitation turns into sulfuric acid.

According to the definition of the World Health Organization, lead, mercury and cadmium are the most dangerous toxic pollutants with mutagenic and carcinogenic effects. They represent the "terrible trinity" in the natural environment. Compounds of heavy metals are persistent pollutants. After entering the ecosystem, they will constantly be in it, accumulating and redistributing among the components of the biocenosis.

The priority pollutant is lead, which is part of many ammunition (mines, rockets, aerial bombs and other types of modern projectiles). Ukrainian scientists found an excess of the background level in terms of lead content in all soil samples, the average content of the element in the contaminated territories in the combat zone in the Sumy region was 5.4 times higher than the background value [4]. Decomposition of Pb compounds that have already entered the environment is very slow, because the surface of lead ammunition residues in the anaerobic sediment zone is covered with Pb sulfides, which have low solubility and prevent further decomposition. Vertical and horizontal migration of heavy metals is predicted in the explosion zones of artillery shells and aerial bombs. This leads to the emergence of secondary pollution risks and the expansion of the risk area.

In addition, dangerous geomorphological processes can occur in sinkholes and on their slopes, which lead to the engineering complication of the territory, unfavorable physical and chemical processes in the soil and, accordingly, the expansion of the area of contaminated soil .

Mercury and its compounds are contained in detonators. In addition, a lot of sulfur remains in the soil. Part of this chemical element in the form of powder remains in the scraps and around, and in contact with precipitation is converted to sulfuric acid. Heavy metal compounds are resistant to contaminants. Vertical and horizontal migration of heavy metals is projected in the areas of explosion of artillery shells and airbombs.

This leads to secondary risks of contamination and expansion of risk area. Studies conducted on the territory of the Kyivska community, where active fighting took place in February-April 2022 (7 km from Chernihiv) that in the bombardation zone the soil was re-delay, movement, seal, deformity, and heavy pollution. Vertical and horizontal migration of heavy metals can lead to secondary risks of contamination and expansion of risk area.

The amount of damage from soil pollution only arable land of the Kyivska tergrapher, which amounted to 49,2 million dollars, is calculated [5].

## **CONCLUSIONS**

- Thus, the environmental state of the environment as a result of Russian aggression is an important problem of environmental safety, which requires a comprehensive approach to its solution. In the war zones, polycomponent pollution of all environmental objects is a wide range of dangerous pollutants and xenobiotics of different chemical composition.

- The ecocide, which takes place in Ukraine since 24.02.2022 due to Russia's aggression, leads to catastrophic deterioration of the state of all the components of the environment.
- It is extremely important and relevant to introduce systematic monitoring studies of the state of natural objects that have suffered from hostilities in order to identify ecocide cases and to find effective measures to reduce negative consequences.

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