

Environmental Problems of Ukraine During the War Period: Ways of them Overcoming

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Abstract. The article presents environmental problems of Ukraine. Attention is focused on the problems of the natural environment, which existed before (the Chernobyl disaster, disposal of radioactive waste, processing and cleaning of mixers, pollution of water resources, etc.) and greatly worsened due to military actions. In addition, a number of new environmental threats associated with war are listed. The territory of Ukraine is subjected to bombardment and destruction every day, one by one, once inhabited cities and villages disappear from the map, leaving behind either a burnt ruin, the products of combustion of which rise into the atmosphere and spread around the world, or a putrid supply, the products of which decay enter the soil and with underground water or vapors pose an irreparable threat to the entire environment and health. The article emphasizes ecological migrations caused by the war.

In the first place in Ukraine is the safety of the population, protection against enemy attack for the preservation of life. Unfortunately, environmental problems have receded into the background, but they are not devalued, but remain promising on the way to victory. The Ministry of Environmental Protection and Natural Resources of Ukraine keeps statistics of environmental damage caused to Ukraine due to the war. Considering their depth and irreparability, these problems will have to be solved for more than a dozen years. And this, in turn, sets priority tasks that can already be solved today in the safer territories of our country. The publication highlights international connections and projects that contribute to the improvement of the ecological state and will be able to ensure the restoration of the environment in the post-war

period. The article presents a survey of the population of Vinnytsia, Khmelnytskyi and Lviv regions regarding their actions to overcome the environmental crisis; implemented measures and prospective programs contributing to the improvement of the environment are presented. Attention is drawn to modern environmental education and volunteer nature protection activities of citizens of Ukraine.

Keywords: *ecological problems, threat to the environment, overcoming the ecological crisis.*

I. INTRODUCTION

Ukraine has long suffered from environmental problems, such as emissions of harmful gases into the atmosphere, pollution of water bodies by emissions from factories and plants, pollution of chernozems by fertilizers and pesticides, waste disposal. The development of metallurgy (mining and mining, chemical and metallurgical, machine-building, fuel and energy, construction, agro-industrial) annually affected the ecological situation in Ukraine. The explosion of the fourth nuclear reactor at the Chernobyl nuclear power plant became a major environmental crisis for Ukraine. It led to radiation contamination of more than 200,000 square kilometers. In Ukraine, there is still a 30-kilometer exclusion zone, an area deprived of free access, which has undergone intense contamination with long-lived radionuclides.

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With this in mind, Ukraine has always taken an active part in environmental activities and tried to support global environmental policy. It ratified and supported a number of conventions, in particular: the Convention on the Protection of Biological Diversity (Rio de Janeiro, 1992), the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (Paris, 1993), the Convention on Nuclear Safety (Vienna, 1994), Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001).

A large number of Ukrainian and European scientists studied the issue of overcoming the ecological crisis. H. Jonathan in the early 1990s characterized the global environmental crisis and insisted on the aggravation of the problems of the natural environment. In particular, he claimed that the emission of carbon dioxide causes great damage to the atmosphere, which in turn affects the destruction of the ozone layer [4]. The writings of C. Vlek, S. Clayton, P. Devine-Wright, P. Stern, L. Steg, L. Whitmarsh, A. Carrico, M. Bonnes emphasize the need to change the global thinking of mankind in order to overcome the ecological crisis. The authors claim that a humane ecological worldview affects the behavior of an individual in relation to the natural environment, stimulates it to environmental protection activities and life activities in harmony with nature [9], [2]. O. Mudrak emphasizes the importance of organizing and carrying out a number of environmental activities and involving the population in them for the real awareness of nature's problems and overcoming them [5]. Focusing on the general environmental problems published by the Earth.ogr website in 2024, we determined that the most typical for Ukraine are: global warming, plastic pollution, the problem of food waste disposal, atmospheric pollution, a decrease in the amount of drinking water, a decrease in biodiversity, deforestation, soil degradation, etc. [1]. Ye. Zasiadko, commenting on the ecological situation in Ukraine, claims that it will be impossible to restore some land plots or it will take hundreds of years; it is difficult to calculate the damage caused, especially in the occupied territories, however, assessing the general situation, it was established that Mykolaiv and Kharkiv regions are leading in the number of documented cases of negative impact on the environment in the territory controlled by Ukraine. "The global danger is connected to nuclear threats. Events at the Zaporizhzhia NPP, fires and the occupation of the Chernobyl Exclusion Zone, and missiles flying above the South Ukrainian NPP cause great concern. If any big incident happens at the Zaporizhzhia NPP, the resulting radiation pollution could affect not only Ukraine, but European countries, as well. It could be akin to a second Chernobyl disaster, and also affect the Black and, consequently, Mediterranean Seas" [3].

However, the full-scale invasion of Russia on the territory of Ukraine on February 24, 2022 caused great damage to the natural environment. Because of military operations, it is not possible to fully assess the environmental situation, although the results are recorded every day. Dozens of cities and villages are wiped off the face of the earth, the territory of our country is repeatedly

bombarded with cluster and phosphorus bombs, military actions affect the population of animals and plants, in particular, the explosion at the Kakhovka hydro-electric station and the massive flooding of several Ukrainian villages became a devastating disaster. With the unfolding of the war, it becomes unequivocally clear that the longer it lasts, the more ecological cover is deployed, and the more time it will take to eliminate it.

The purpose of the article: to generally characterize the current ecological situation in Ukraine and to predict ways to solve it.

The goals of the study are to model the ways to overcome the ecological crisis in Ukraine in the post-war period based on summing up the results of the theoretical generalization of the indicated issue.

II. MATERIALS AND METHODS

The aggravation of the environmental crisis in Ukraine affects the global environmental crisis in general and may lead to irreversible consequences. In the studies of O. Omelchuk and S. Sadogurska, the following environmental problems of Ukraine during the war were identified:

- *Impact on the landscape:* part of the forests of Ukraine (Donetsk, Luhansk, Zaporizhzhya, Kherson regions) are under the influence of the occupiers, their territory is littered with ammunition, which will pose a threat to the population for more than a dozen years. In addition, wood is used for the construction of fortifications, cooking and heating.
- *Loss of biodiversity.* Due to hostilities, migration routes of migratory birds are disrupted: Azov-Black Sea - with the highest concentration of migratory birds in Ukraine; Polissky latitudinal – along the Polissya forest belt and in the north of the Forest Steppe; and the Dnieper Meridian Migration Path, which runs along the Dnieper River and its tributary the Desna. Along these routes, migrating flocks of geese, ducks, swans, and cranes used to stop for rest and food, but now it has become impossible, many of them die when they get into the combat zone or do not have the opportunity to rest, which also affects them badly. In particular, in the forests, animals that fall on scattered explosive shells are destroyed, constant hostilities have a negative effect on the population of offspring, the breeding of baby animals.
- *Fires in ecosystems.* Due to explosions, detonations of oil stations and gas pipelines, territories are ignited, which leads to the release of harmful substances into the atmosphere, soil and water bodies. This leads to the pollution of a large number of territories, which negatively affects all living things.
- *Chemical pollution.* During the detonation of rockets and artillery shells, a number of chemical compounds are formed: carbon monoxide (CO), carbon dioxide (CO₂), water vapor (H₂O), brown gas (NO), nitrous oxide (N₂O), nitrogen dioxide (NO₂), formaldehyde (CH₂O), vapors of cyanic acid (HCN), nitrogen (N₂), as well as a large amount of

toxic organic matter, the surrounding soils, wood, turf, structures are oxidized. In the atmosphere, oxides of sulfur and nitrogen can cause acid rain, which changes the pH of the soil and causes plant burns, to which conifers are especially sensitive. Acid rain has a negative effect on the human body, other mammals and birds, affecting the condition of mucous tissues and respiratory organs.

- *Pollution of the seas.* The coastal zone of the Sea of Azov is covered with water mines that are encountered by marine life. In addition, during hostilities on the seas, ships sink, oil products are spilled, which negatively affect marine biocenoses, forming films on the surface of the water, which disrupts the exchange of energy, heat, moisture and gases between the sea and the atmosphere. In addition, they directly affect physico-chemical and hydrological conditions, cause the death of fish, seabirds and microorganisms. All oil components are toxic to marine organisms. Oil has another side property. Its hydrocarbons are able to dissolve a number of other pollutants, such as pesticides, heavy metals, which, together with oil, concentrate in the near-surface layer and poison it even more.
- *Soil pollution.* Explosions and detonations of agricultural machinery cause soil contamination with fuel and lubricants and other petroleum products. In soils contaminated with fuel and lubricants, water permeability decreases, oxygen is displaced, and biochemical and microbiological processes are disrupted. As a result, the water and air regimes and the circulation of nutrients deteriorate, the root nutrition of plants is disturbed, their growth and development are inhibited, which causes death.
- *Depopulation of cities and villages.* As a result of the military operations, more than a hundred Ukrainian cities and villages turned into wasteland. Their destroyed and bombed-out remains undergo oxidation, weathering, and rotting, and all this takes hundreds of kilometers. It is not soon to dispose of waste and clear the territory for the reconstruction of property, so it poses an ecological threat [6].

On the website of the Ministry of Environmental Protection and Natural Resources of Ukraine, 3,750 damages caused to the natural environment as a result of the war are recorded, of which: 622 cases of atmospheric pollution, 2,912 cases of soil pollution and 216 cases of water pollution, which in turn have many other consequences. As a result of military actions, 66,877 hectares of burned forests and other plantations were burned, which caused the release of about 54,685,316 tons of harmful substances into the atmosphere; the amount of burned oil, oil products and gas is 722,741 tons, which caused the release of 979,526 tons of harmful substances into the atmosphere; emissions of other pollutants into the air amounted to 98 tons. The area of littered land is 18,303,827 m², and the area of contaminated soil is 747,928 m². The mass of pollutants that got into water bodies is estimated at 1,693 tons, the mass of extraneous objects, materials, waste and/or other substances in water bodies is 36,205,704 kg, etc. [11].

In the course of the research, we used the following methods: analysis of scientific literature, analysis of statistical data of the Ministry of Environmental Protection and Natural Resources of Ukraine, analysis of the main environmental problems, population surveys.

349 respondents from Vinnytsia, Khmelnytskyi and Lviv regions took part in the survey. The purpose of the survey was to determine the readiness of Ukrainian citizens to change their way of life in favor of nature and to participate in overcoming the ecological crisis in the post-war period. The survey was conducted from December 2023 to February 2024. During the survey, respondents gave answers to 8 key questions.

Answering the question "Are you interested in environmental problems in Ukraine?", 196 citizens answered that they are very interested, 53 are interested from time to time, 73 people pay attention to those problems that are most often discussed in the mass media, 27 citizens are rarely interested in environmental problems. In the answers, the following phrases were most often heard: "even before the war, the issue of ecology worried me a lot, and now it is a hundred times more, if we do not stop military operations, our state will soon become unfit for life and will be a hotbed of global environmental problems"; "I have always been interested in healthy eating, and it is inextricably linked with ecology, today it is very difficult to grow ecologically healthy food, given the amount of harmful emissions into the natural environment"; "it seems to me that the issue of environmental security in Ukraine should be second only to the end of the war and the return of the territories".

To the question "How do you assess the current environmental situation in Ukraine?" 284 respondents answered that the situation is difficult, dangerous and needs a radical solution; 65 people indicated that the indicators of radiation, air and water quality still remain normal in the territory far from active hostilities, but the eastern part of Ukraine has worse indicators, and it is a matter of time when they will start to affect the whole of Europe and the world.

Difficulty answering the question "Can you name the main environmental problems of your region, city/village?" the respondents did not have any. In the Vinnytsia region, the citizens mentioned such problems as: waste disposal, decrease in the amount of fresh water, increased acid rain, increased soil degradation, deterioration of air quality. In the Khmelnytskyi region, the respondents singled out such problems as: the deterioration of water resources, the deterioration of the atmosphere due to a series of explosions of oil bases in the region, as well as the related ingress of various toxic chemicals into the natural environment, which affects human life. In the Lviv region, the respondents singled out such problems as: garbage disposal, problems with overpopulation of cities due to population migration from eastern regions to western regions, and correspondingly higher consumption of resources, problems with the deterioration of water resources. We conducted the survey in territories less affected by hostilities, but after two years of war, they are already feeling its ecological consequences.

Similarly, respondents listed environmental threats in war zones: land mining, destruction of biodiversity, transformation of cities and villages into ruined wastelands, which after bombing and massive explosions pose a threat to air, water, soil and all living things.

Next, we asked the respondents whether they are ready to change the style of their everyday life in order to minimize the use of resources and take care of their recovery. Answering this question, 145 respondents indicated that since the beginning of the war they had already changed their attitude towards the natural environment, began to treat it more carefully, realizing the threat posed by the war; 104 people indicated that they feel a great responsibility for the preservation and increase of natural resources, the restoration of the natural environment in the territories where hostilities are currently taking place, these respondents are trying to change their everyday behavior in order to actively participate in the ecological reconstruction of Ukraine in the future; 67 people are thinking about this issue, but have not yet taken active steps to preserve natural resources, and 33 respondents have not yet thought about this issue.

We also asked the respondents what environmental works they do to preserve and restore natural resources. The main answers are: sorting and humane disposal of garbage, evacuation of animals from the territory of hostilities and their resettlement in shelters, cleaning of springs and rivers, care of birds and animals in winter, economical use of water resources, clearing of destroyed buildings in areas where hostilities have passed, work on cleaning the soil after explosions of oil depots, prevention of forest fires, rejection of plastic.

Our next question was "What, in your opinion, is the first priority in solving environmental problems?". We received the following answers to this question: "cessation of hostilities, development of a plan to stabilize the environmental situation, implementation of the world's leading practices of conservation and restoration of natural resources, training of ecologists capable of improving the environmental situation".

The question "Are you ready to join the eco-restoration of Ukraine in the post-war period? How exactly?" respondents commented as follows: "this is a necessity for every citizen of our country, we are all responsible for the natural environment, its restoration and preservation for future generations", "we will definitely join, and the first priority is to clean up destroyed cities, plant trees in forests, engage in restoration of soils and water bodies contaminated by lubricants and oil products", "the environmental crisis in which our state is now will change the consciousness of citizens, we already feel the dangers that threaten us, so we should change our thinking style to an ecological one today".

The results of the conducted survey proved that citizens of Ukraine are aware of the range of environmental dangers and threats facing them, they are ready for environmental and nature protection activities, many are already engaged in them, moreover, citizens of Ukraine are in the process of changing their attitude

towards nature from a consumerist to a consumerist one, gentle and restorative.

III. RESULTS OF THE RESEARCH

In order to overcome the environmental crisis in the war and post-war period, in our opinion, it is important to work in three main directions: this is an active environmental activity with the involvement of world experience in overcoming environmental dangers and disasters; this is the strengthening of the training of specialists in the environmental and nature protection sphere, the training of teachers who are able to raise a new ecologically literate and conscious generation; this is a large-scale educational activity among the population, involving citizens in a number of environmental actions, challenges that will affect their lifestyle and environmental awareness.

Eco-activism is progressing in Ukraine, today it has become popular to follow a healthy diet, travel on ecological modes of transport, and participate in environmental actions. It is important to continue this course, because it affects the ecological consciousness of the population.

It is important for Ukraine to work within the framework of "The European Green Deal" program, a set of political initiatives put forward by the European Commission with the general goal of making the European continent climate neutral by 2050. The main goals of the European Green Course are to transform Europe into a climate-neutral continent, improve the well-being of citizens, protect biological diversity, and green the economy. The main goals of The European Green Deal are to transform Europe into a climate-neutral continent, improve the well-being of citizens, protect biological diversity, and green the economy [10]. In the context of The European Green Deal, the Ukrainian economy is trying to adhere to a "green" policy, making maximum use of powerful cleaning filters at enterprises, reducing harmful emissions into the atmosphere, and manufacturing products that can be recycled after use.

Taking care of the ecological restoration of the country, it is important to enlist the support of foreign partners, use the world experience of environmental restoration, cooperate with global environmental organizations, such as: UNIDO (United Nations Industrial Development Organization, UNIDO), UNESCO (United Nations Educational, Scientific and Cultural Organization, UNESCO), OSCE (Organization for Security and Cooperation in Europe), EBRD (European Bank for Reconstruction and Development), GEF (Global Environmental Fund), EIB (European Investment Bank), EEA (European Environmental Agency). In addition, it is important to support and develop environmental organizations in Ukraine (National Environmental Center "MAMA-86", "Ecology-Pravo-Lyudyna", All-Ukrainian Environmental League, etc.).

Today, it is necessary to work on a plan to restore the natural environment and stabilize the ecological situation, clearly thinking through all the steps, taking into account the interrelationships in the natural environment. It is

clear that it will not be possible to comprehensively grasp the entire threat, but it is possible to work selectively, for example, thinking of a plan for the restoration of forest plantations, water purification, waste disposal in occupied and bombed territories.

For the restoration and preservation of the natural environment, the education of the younger generation is of great importance, it is important to raise an eco-conscious nation capable of overcoming the ecological crisis, to treat nature with care.

IV. CONCLUSIONS

Ukraine has always suffered from environmental problems, but tried to solve them. Considering Russia's military aggression against Ukraine, colossal damage has been caused to the environment. Pollution caused by explosions of phosphorus and cluster bombs, detonation of a number of factories, plants, oil bases, Kakhovska hydroelectric power station, pollution of soil, water bodies, atmosphere, etc. will have to be eliminated for more than a dozen years. Environmental danger is increasing every day. It is extremely important to stop hostilities for the preservation and restoration of nature.

The survey conducted during the research showed that the citizens of our country are aware of the deterioration of the ecological state and are ready to take active actions to overcome the ecological crisis. The Ministry of Environmental Protection and Natural Resources of Ukraine records the damage caused to nature and works on the development of promising ways to overcome the environmental crisis. The stabilization of the ecological situation in Ukraine will affect the stabilization of the ecological situation in the world.

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