ENVIRONMENTAL PROBLEMS

Vol. 6, No. 2, 2021

RUSSIAN ARMED AGGRESSION AGAINST UKRAINE – THE IMPACT ON THE ENVIRONMENT OF THE TEMPORARILY OCCUPIED TERRITORIES

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https://doi.org/10.23939/ep2021.02.088

Received: 18.04.2021

Abstract. The armed aggression of the Russian Federation against Ukraine, which has been going on since 2014, caused severe consequences for our state. Besides killing and injuring dozens of thousands of Ukrainian citizens, expelling hundreds of thousands of people from their homes, seizing and destroying infrastructure, Russia has inflicted large-scale environmental damage in the occupied territories. Thus, as a result of the occupation of Crimea, the situation with fresh water on the peninsula is rapidly deteriorating, which can significantly change the ecosystem in the future. In addition, the warfare launched by the aggressor against Ukraine in the Donetsk and Luhansk regions caused serious environmental and man-made consequences, among which the main are pollution of groundwater and surface water, flooding of mines, subsidence, air pollution, destruction of agricultural lands, destruction and damage of nature reserves, forest fires, etc. Ignoring the environmental threats caused by Russian armed aggression can lead to catastrophic aftermath in the future. To prevent this scenario, an effective response is needed not only from Ukraine but also from the entire international community.

Key words: Russian aggression, occupied territories, hostilities, water imbalance, flooding of mines, water pollution, air pollution, dangerous emissions, reserve fund.

1. Introduction

Pre-planned armed aggression of Russia against Ukraine began on February 20, 2014, with a military operation by the Russian Armed Forces to seize part of Ukraine's territory – the Crimean Peninsula. The illegal occupation of the Autonomous Republic of Crimea and the city of Sevastopol was only the first step taken by the Russian Federation to undermine Ukraine's independence and sovereignty. The goal of Russian aggression is to destroy Ukraine as an independent state. Kremlin's establishment has always been firmly convinced that without control over Ukraine Russia will never become a world leader, and a democratic and prosperous Ukraine will become the threat to the preservation of the current authoritarian regime in Russia. Because of this, the next stage of Russian aggression was an attempt to destabilize the situation in the eastern and southern regions of Ukraine in order to form a quasi-state of "Novorossiya" in this area. The full implementation of these plans was thwarted, but Russian regular troops and Russian-led illegal armed formations occupied parts of Ukraine's Donetsk and Luhansk regions. Russian aggression failed to achieve its strategic goal – Moscow not only did not keep Ukraine in the sphere of its influence but, on the contrary, lost it forever. At the same time, during the seven years of Russian armed aggression, over 13.000 people died, including more than 3.000 civilians, tens of thousands were wounded, and about 1.5 million people were forcibly displaced (Ministry of Foreign Affairs of Ukraine, 2019; Ukrinform Ukrainian multimedia platform for broadcasting, 2021). Russia is grossly and systematically violating human rights in the temporarily occupied territories. Pro-Ukrainian activists are being persecuted in Crimea, abductions and murders are widespread, and about a

For citation: Malovanyy M., Bohach N., 2021. Russian armed aggression against Ukraine – the impact on the ecology of the temporarily occupied territories. Journal Environmental Problems. Vol. 6, No. 2. p. 88–92. DOI: https://doi.org/10.23939/ep2021.02.088

hundred people are imprisoned on baseless, politically motivated charges. Purposeful repressions against the Crimean Tatars continue. Cities and villages, infrastructure and industrial facilities were severely damaged in the warfare zone in the Donbas. The temporary occupation leads to the destruction of cultural and historical heritage, as well as to catastrophic environmental consequences in both the Donbas and Crimea.

2. Assessment

In particular, in the territory of the temporarily occupied Crimea, the main problem is the violation of water and hydrological balance that arose as a result of the capture of the Ukrainian peninsula by the Russian Federation. The main source of water supply at the start of the occupation was the North Crimean Canal, which was blocked by Ukraine after the Russian occupation of Crimea (Fig. 1).

Fig. 1. Dried reservoir in the occupied Crimea

Ukraine provided up to 85 % of the peninsula's freshwater needs through the North Crimean Canal, which connects the main watercourse of the Dnieper with the peninsula, after Russia's occupation of Crimea in 2014, water delivery to the peninsula was cut off. Only 15 percent of fresh drinking water is generated from local natural effluents in Crimea. Over the seven years, the self-proclaimed "government" of Crimea has actually exhausted the reserves of drinking water generated by natural effluents. The North Crimean Canal is not working, reservoirs are not being filled up and have already turned into degrading ecological objects. Due to global warming, local rivers and lakes that are formed by runoff are not filled.

The situation with water in Crimea has an ongoing tendency to worsen due to the gradual depletion of water in reservoirs and the beginning of salinization of underground layers from which water is pumped. In addition to the gradual salinization of soils, the lack of water resources provokes man-made accidents, the largest of which was observed at the "Crimean Titan" plant in Armyansk in September 2018. In general, the critical situation with water supply creates conditions for the weakening of Russia's position in Crimea, which facilitates further de-occupation of the Ukrainian peninsula. At the same time, uncontrolled use of water resources by the occupation authorities, as well as the destruction of protected areas, the illegal buildings at natural landscape monuments, as well as the large-scale militarization of Crimea become a significant threat to the region's environmental security (Wikipedia, 2017; Robejko, 2020; Mokrušyn, 2018).

In addition, Russian armed aggression in eastern Ukraine (the Donetsk and Luhansk regions) caused serious environmental problems, such as pollution of ground and surface waters, reservoirs, floodings and subsidence, air pollution, impairment of large areas of arable land, destruction and damage of nature reserve fund, forest fires, etc.

Negative trends of environmental and man-made threats and the changes they characterize significantly worsen the security of the population in the war zone in eastern Ukraine and adjacent ecologically connected territories of the Donetsk and Luhansk regions due to the pollution of river basins and groundwater basins, destruction of lands and objects of the nature reserve fund. Therefore, the substantiation of further socio-economic development of the Eastern region of the state becomes urgent, taking into account the impact of the environmental and man-made threats, which dramatically increase during military conflict.

A significant threat to emergencies of natural and man-made origin is the presence of a large number of flooded and semi-flooded mines in the Luhansk and Donetsk regions that have a constant hydraulic connection with working mines. The poor ecological condition of coal mining areas, especially the Donbas, is also worsened by the high level of concentration of metallurgical and chemical enterprises, which increase the man-made pressure on the environment and pose real threats to public health.

According to experts from the United Nations Environment Program (UNEP), the conflict in the Donbas had destroyed ecosystems on at least 530 thousand hectares, including 18 nature reserves with a total area of 80 thousand hectares. In addition, the fires significantly damaged about 150 thousand hectares of forests in the areas adjacent to the war zone. UN data show that the Donbas is on the verge of an environmental catastrophe caused by air, soil and water pollution due to explosions of large quantities of ammunition and flooding of industrial enterprises (Fig. 2).

Fig. 2. A destroyed mine in the Donbas

There are 5.5 thousand industrial enterprises and infrastructure facilities in the region, which, if damaged, will become a source of significant damage to the environment. Pollution of rivers threatens the health of the population. The war zone, including agricultural land, is heavily filled with unexploded munitions, which will take years or even decades to clear. According to the UN, it is necessary to estimate the environmental damage caused by the armed conflict as soon as possible and minimize it. Among the primary environmental threats in the zone of military conflict in eastern Ukraine are the following: pollution of water sources, reduced reliability of water supply and impeded access of the population to drinking water. Water pollution occurs as a result of emergencies at water supply facilities and due to the lack of control over the activity of industrial enterprises in the temporarily occupied territories. Especially dangerous are the numerous tailings ponds of industrial facilities, the destruction of dams, which threatens negative aftermath for both the population and the environment of the region. In the mining areas of the Donbas, unauthorized shutdown of mines and quarries leads to catastrophic flooding and inundation of nearby towns and villages, unpredictable movement of explosive and toxic gases to areas of industrial and residential buildings, surface water and groundwater pollution. Therefore, one of the priorities of state policy to reduce environmental and man-made threats in the zone of military conflict in eastern Ukraine is to improve the system of environmental monitoring, control of critical infrastructure to prevent emergencies with large-scale negative consequences.

As a result of the shutdown of many enterprises because of Russian military aggression in eastern Ukraine, the issues of research and analysis of environmental and man-made threats, assessment of potential risks, forecasting possible scenarios of emergencies using modern scientific approaches are becoming especially important.

Among the man-made threats in the zone of military conflict in eastern Ukraine, the most urgent is the stopping of drainage and ventilation of mines, many of which have hydraulic connections. As a result of uncontrolled flooding of mines, there will be flooding of large areas of cities and towns, large-scale pollution of surface water intakes by mine waters, subsidence of the surface, migration of explosive methane from mines with its release in cities and towns. During the military conflict in eastern Ukraine, numerous cases of de-energization of coal mining enterprises were recorded. It should be noted that the shutdown of ventilation systems often led to emergencies and volley emissions of mine gases. Disruptions in the power supply of pumping stations in mine drainage systems sometimes caused complete flooding of mines, flooding of surrounding areas and significant groundwater pollution (Fig. 3).

Fig. 3. Pollution of surface waters by industrial waste

As a result of the warfare, not only surface water objects were damaged, but also engineering structures designed to supply drinking water to the population. The pumping stations, main and distribution networks of the Siversky Donets-Donbas canal, which supplies water to most of the Donetsk region, have been repeatedly destroyed and damaged. The repair of water supply systems and power lines in combat areas is often delayed, which significantly reduces the quality of drinking water supplied to consumers. Reducing the water content of the Siversky Donets River significantly increases the threat of poor water supply, while slowing down the flow rate leads to siltation of the river. Contamination of groundwater and surface water intakes with mineralized mine waters has reached an alarming scale. Dissolved mineral and organic impurities and suspended solids can enter reservoirs together with mine water. The qualitative composition of mine waters is diverse and varies significantly across coal basins, deposits and areas. Their entry into the hydrological network causes siltation, salinization and acidification of reservoirs and watercourses, thereby disrupting the ecological balance in the coal regions. Mineral impurities are sand and clay particles, mineral inclusions of coal, inert dust, dissolved salts, alkalis and acids. Organic pollution involves particles of pure coal, mineral oils and other petroleum products used for lubrication of mining

machines and mechanisms, products of living organisms, decomposition of wood, etc., and microbiological pollution (Vseukrainska Ekolohichna Liha, 2017).

Groundwater accumulates rapidly in mines. Under normal conditions, they are pumped out, cleaned and dumped into the river. However, due to the situation, the amount of incoming water at the "Zolote" Mine has increased significantly. There is not enough capacity for pumping and cleaning. As a result, untreated water can enter the surface. Moreover, due to flooding, methane is not pumped up and accumulates in voids. This increases the probability of explosions. The danger also lies in the power supply; there is a possibility that it may be shut as a result of the shelling. If this happens, the pumps will stop pumping mine water and alternate flooding of mines will begin (Fig. 4).

Fig. 4. Flooded mine

The greatest environmental risks in space and time will be associated with the continuous disruption of coal deposits and developed watercourses which shielded the leaks of saline deep mine waters. The migration of explosive methane and other toxic gases from flooded mines within cities, towns, and industrial sites could create a threatening situation in the region. Among the huge number of problems that arise due to flooding of mine waters, the most pressing are:

- disturbance of ecosystems and especially valuable protected areas, in particular, nature reserves;
- loss of greenery and forests;
- destruction of industrial, ecologically dangerous objects (landfills, unauthorized landfills);
- deterioration of sanitary and hygienic indicators of drinking water sources;
- destruction and contamination of soils;
- reduction of agricultural areas and, as a result, reduction of natural areas through their transformation into new agricultural ones.

Drainage and ventilation systems of mines, damaged as a result of hostilities, are an acute problem. Such damage causes flooding of cities and towns, pollutes surface water and affects the supply of drinking water. In addition, the burning of mine areas is an urgent problem, which causes significant air pollution.

Besides hydrological disturbances, the hydrochemical regime of rivers changes dramatically. In rivers such as the Luhan and the Velyka Kamyanka, water salinity is more than twice the norm and is 2.2–2.6 mg/l. In addition to soluble chemical compounds, a lot of suspended solid particles (from 20 to 70 mg/l) enter the rivers with mine water, which leads to the siltation of river channels (the Kazenny Torets, the Kalmius, the Krynka) and creates an additional need for their purification and direction.

The warfare in eastern Ukraine has also caused land pollution and significant disturbance to the landscapes of the nature reserve fund. The east of Ukraine is one of the few places where unique fescue virgin steppes, ravine and floodplain forests have been preserved. Valuable natural and landscape heritage are chalk rocks which got into the Top-100 of the all-Ukrainian contest «Seven Natural Wonders of Ukraine. It is important that in the territories of the Donetsk and Luhansk regions, where warfare is taking place, there is a large number of objects of the nature reserve fund. For example, in the northern part of the Donetsk region, there is the "Holy Mountains" National Nature Park which is located along the left bank of the Siversky Donets River. An important object of the NRF is the Luhansk Nature Reserve which has an area of over 2 thousand hectares and has 186 endemic plant species and over 100 animal species listed in the Red Book of Ukraine (Fig. 5).

Fig. 5. Infliction of damage to the objects of the nature reserve fund

The Russian aggression significantly affected the territories of the branch of the Ukrainian State Steppe Nature Reserve "Khomutovsky Steppe", national natural parks "Meotida" and "Holy Mountains", regional landscape parks and reserves, namely: "Donetsk Ridge", "Slovyansky Resort", "Kramatorsky", "Zuevsky", "Kleban-Byk", "Provalsky Steppe", "Tryohizbensky Steppe", "Stanychno-Luhanske". Numerous objects of the nature reserve fund of the Donbas have suffered from deforestation, forest and steppe fires [6].

3. Conclusions

Thus, the Russian armed aggression against Ukraine has led to severe damages of the environmental sphere, which may further lead to environmental/man-made catastrophes. To resolve the situation, it is advisable to take the following measures:

- to conduct a comprehensive scientific and practical study of the ecological and man-made status of the controlled territory of the Donetsk and Luhansk regions;
- to introduce a program of ecological monitoring in the temporarily occupied territories with the use of modern technical means (satellite imagery, etc.);
- to consider the environmental component in the formation of new state programs for the return of temporarily occupied territories;
- to intensify interagency cooperation in order to increase the efficiency of information exchange regarding the ecological situation in the occupied territories, in particular in the areas of hostilities;
- to take the initiative at the international level in order to expose the crimes of the Russian Federation, in particular – the deliberate provocation by Russia of an environmental/man-made catastrophe in the region;
- to comprehensively assist in continuing the consistent pressure of the international community on the Russian Federation in order to accelerate the process of de-occupation of the territories of Ukraine and further force the aggressor to comprehensive compensation for damages, including those inflicted to the environmental sphere.

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