Proceedings of 4th International Conference CNDCGS'2024
ISSN 2669-2023 (print) / ISSN 2538-8959 (on-line) / DOI 10.3849/cndcgs.2024.170

Impact of the War in Ukraine on Global Environmental Security

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Abstract

The article examines the environmental consequences of the Russian-Ukrainian war and their impact on global environmental security. The authors consider various aspects of the ecological consequences of the war, in particular, local ecological consequences manifested in the growth of carbon dioxide emissions, the increase of specific waste, the pollution of water; environmental challenges of post-war reconstruction; the connection between military actions and the threat of global warming. The authors emphasize that the ecological consequences of this war will be felt not only on the territory of Ukraine, but also far beyond the country's borders, both in the short and long term. It is concluded that in the short term, the full-scale war of Russia against Ukraine resulted in an energy imbalance and a global crisis, in the long term, such a shake-up of the system will be able to accelerate the development and transition to renewable energy sources and bring the world closer to climate goals and reduce dependence on supplier countries fossil fuel.

KEY WORDS: *Russian-Ukrainian war, environmental consequences of war, global climate change, goals of sustainable development*

Citation: Shevchenko, O.; Shevchenko, A. (2024). Impact of the War in Ukraine on Global Environmental Security. In Proceedings of the Challenges to National Defence in Contemporary Geopolitical Situation, Brno, Czech Republic, 11-13 September 2024. ISSN 2538-8959. DOI 10.3849/cndcgs.2024.170.

1. Introduction

Environmental pollution is the least obvious but very serious consequence of war that cannot be underestimated. The war made Ukraine even more vulnerable. In addition to economic consequences, destruction of infrastructure and forced migration, the war causes serious direct and indirect environmental consequences, in particular, pollution of air, water and soil, as emissions from explosions, fuel burning and other sources enter the air as a result of hostilities; the destruction of natural ecosystems, because as a result of hostilities, significant areas of forests, steppes, meadows and other natural ecosystems are destroyed or damaged, which leads to the disruption of natural processes, the reduction of biodiversity and the deterioration of the quality of the environment as a whole; spread of diseases and pests through polluted air and water; an increase in the risk of man-made disasters, since as a result of hostilities, numerous infrastructure facilities, including damaged or destroyed oil refineries, chemical plants, and other facilities that may pose a potential threat of an environmental disaster.

The ecological consequences of this war will be felt not only on the territory of Ukraine, but also far beyond the country's borders, both in the short and long term. The war has a negative effect on the planet's climate, in particular, due to the increase in the amount of greenhouse gases in the atmosphere, which were formed as a result of the burning of fuel and other energy sources during hostilities; deterioration of the quality of life of the population due to air, water and soil pollution; a decrease in investment in renewable energy sources, which may slow down the transition to clean energy and lead to further increases in greenhouse gas emissions.

Although today there is no universal methodology for determining the amount of emissions caused by military actions, the assessment of the amount of fuel consumed by the military and the amount of greenhouse gases produced as a result of military actions is a significant factor in the success of international climate policy and the achievement of the UN Sustainable Development Goals and The goals of the Paris climate agreement. The restoration of Ukraine's environment after the war will be a long and difficult process. This will require significant investment and international cooperation.

Ukraine has undertaken a number of environmental obligations, both at the national and international level, and is trying to fulfill them. The fulfillment of these obligations is one of the factors of the success of the euro integration policy of Ukraine and ensuring the sustainable development of the country.

Peer-review under responsibility of General Jonas Žemaitis Miltitary Academy of Lithuania and University of Defence, Czech Republic

Researching the impact of the consequences of Russia's war against Ukraine on global environmental security is a complex task due to several key factors, in particular, the lack of data and access to the territory, the complexity of the impact, the long-term consequences of military actions at the local and international levels, the complexity of assessing the extent of damage, political and social factors etc. Military conflicts often make it difficult to access areas for sample collection and observation. The presence of danger for researchers and destroyed infrastructure can significantly limit the possibility of conducting field research. The Russian-Ukrainian war affects ecosystems in many ways, including direct environmental destruction, water and soil pollution, forest fires, biodiversity loss, and more. Studying and disentangling these different influences requires an interdisciplinary approach and the use of different research methods. The environmental consequences of war can manifest themselves long after the end of the conflict. For example, soil and water contamination with heavy metals and chemicals can have long-term effects on human health and the environment. Tracking such consequences requires long-term research and monitoring.

This war has already led to changes such as population displacement, land use changes and infrastructure destruction. Assessing the real extent of environmental damage requires accurate and detailed data, which are not always available in conflict situations. Political instability and social problems associated with war can also complicate research. For example, Russian troops restricted the access of representatives of international organizations, such as the IAEA or the Red Cross, to the Zaporizhia NPP or to Ukrainian prisoners. Developing appropriate methods for assessing and modeling the environmental effects of war is a challenging task. This includes the use of geographic information systems (GIS), remote sensing, environmental modeling, and other modern technologies that require specialized knowledge and resources. In general, the study of the environmental consequences of the Russian-Ukrainian war is a multidimensional task that requires the synergy of various scientific disciplines, access to reliable data, and consideration of numerous risk factors.

2. Method of investigation

The issue of studying the impact of the war in Ukraine in the context of global environmental security is complex and refers to the interdisciplinary field of knowledge in international security, ecology, international relations, and political science. This determines the methodological basis of the research, which is based on the principles of objectivity, multifactoriality and systematicity. Therefore, for the study of the phenomenon of global environmental security as a component of military actions, using the example of Russia's armed aggression against Ukraine, the most justified method is, first of all, the interdisciplinary method of discourse analysis, because it allows you to answer the following questions: first, what local environmental consequences will Russia's war against Ukraine have ; secondly, what are the environmental challenges of Ukraine's post-war recovery period; thirdly, what are the global environmental consequences of the war in Ukraine and how will it affect global warming; fourthly, what environmental obligations Ukraine has undertaken and how it is able to fulfill them during a full-scale war.

The study of the impact of the environmental consequences of the war in Ukraine was conducted using a systemic approach and its component as a political analysis, which gave a holistic view of the environmental consequences of military actions at the regional and international level. The application of the method of analysis and synthesis made it possible to systematize environmental challenges, as well as to assess their short- and long-term consequences. The method of document analysis made it possible to determine the key components of climate policy at the level of the UN, the European Union and Ukrainian climate commitments.

The empirical basis of the work was the basic documents of the UN and the Council of Europe [14] on the main directions of international climate policy, official documents of the Ministry of Environmental Protection and Natural Resources of Ukraine and the Ministry of Regional Development of Ukraine [1, 3, 13], analytical materials of ChatamHouse and the National Institute for Strategic Studies [4, 8-11], as well as studies of Ukrainian international environmental organizations [5-7, 12].

3. Investigation Results

Local ecological consequences of Russia's war against Ukraine. The obvious consequences of military actions in Ukraine are the loss of life, the destruction of houses, the destruction of civil and military infrastructure, mass migration, the deterioration of the economic condition of countries and the living conditions of the population. At the same time, military actions pose a threat to the environment of the country where hostilities are taking place. Russian troops are taking deliberate actions that cause man-made accidents and threaten the environmental security of millions of people who live far beyond the borders of hostilities.

Fighting and the need to build fortifications lead to the destruction of forests and other natural ecosystems. A decrease in the number of trees, in turn, leads to an *increase in carbon dioxide emissions into the atmosphere*. A calculation made by international researchers shows that in the first year alone, the war in Ukraine caused about as many emissions as a country like Belgium during the same period - namely 120 million tons of CO2 equivalents.

Due to the destruction of buildings and infrastructure facilities, both directly next to the contact line and throughout Ukraine, very large volumes of dust and greenhouse gases enter the atmosphere, which pollute the air and affect climate change. Emissions of carbon dioxide and other harmful substances contributing to global warming have increased significantly. This is provoked, in particular, by fires in forests, settlements, and fields; burning of oil and gas storage facilities, factories, gas stations; use of inefficient diesel generators; destruction of military equipment in large quantities; the use of military equipment, in particular tanks and combat aircraft, which produce harmful gases as a result of their work, etc.

According to Chatham House, during the first seven months of hostilities, about 100 million tons of carbon were released into the atmosphere, the share of emissions caused directly by hostilities amounted to 19% from the total volume of emissions, with the largest part falling on fuel consumption by the Russian and Ukrainian troops. Another 15% of emissions were caused by frontline fires [1].

As a result of military operations on the territory of Ukraine, numerous detonation products of rockets and artillery shells are released into the atmosphere. When projectiles hit buildings and structures, fires occur, due to which dangerous combustion products enter the air - mainly nitrogen oxide, heavy metals and gaseous compounds. In addition, due to the occurrence of fires in natural ecosystems and the burning of crops, forests and forest strips, emissions of soot and gas-aerosol compounds occur. Greenhouse gases are also produced due to the combustion of fuel as a result of the operation of aircraft, heavy military equipment, and rocket launches. All this leads to the fact that harmful compounds enter the atmosphere and useful components are destroyed.

Since the beginning of the full-scale Russian-Ukrainian war, Ukrainian pyrotechnics neutralize hundreds of munitions per day in the combat zone and in the de-occupied territories. In the occupied and de-occupied territories, heavy military equipment is moved through the forests, military units are located in the forests and active combat operations are conducted. More than 40% of forest fires in Ukraine are caused by shelling. The total area of forests affected by the war is approximately 3 million hectares, which is almost 30% of all forests in Ukraine. In terms of size, it is like the area of the whole of Belgium. Another 1 million hectares of forest were damaged in the occupied territories. According to the independent anti-corruption center NGL.media, "Since the beginning of the full-scale war, the Russian invaders have completely destroyed more than 600 km² of forests in the occupied territories, the cost of which was at least 350 million USD" [2]. Constant shelling leads to numerous fires and, as a result, harmful emissions into the atmosphere. Thus, emissions of carbon dioxide into the atmosphere have already amounted to almost 70 million tons, including 54.7 million tons from forest fires, 979.5 thousand from the burning of oil products, 11.9 million tons from the burning of other objects.

All these pollutions have negative consequences and they are divided into three different groups: *meteorological, weather and climatic*. Meteorological effects from hostilities change the optical and physico-chemical characteristics of the atmosphere (turbidity, formation of gaseous and aerosol substances, etc.). When talking about weather and climate, we are talking about various gas-aerosol impurities, soil particles and other combustion products that cause condensation. In turn, it leads to an increase in cloud cover, more frequent precipitation (including acid rain), and an increase in thunder and thunderstorms. Dark rains, which can form if the core of condensation is soot, should not be excluded. Instead, the period of exposure of these products ranges from several hours to several weeks, until they are completely "washed out" from the atmosphere. Taking into account that currently explosions and shelling in some regions of Ukraine occur constantly, the process of emissions can drag on for months.

This war caused a dramatic increase in the volume of specific *waste*, including damaged and abandoned vehicles and equipment, shell debris, construction debris, and household and medical waste. Some of the waste is quite toxic, especially shell fragments, medical waste and construction debris containing asbestos and heavy metals. According to the Ministry of Environment, the volume of such waste has already reached a scale not seen on the European continent since the Second World War. On the territory of Ukraine, there is more than 325,000 tons of destroyed Russian equipment [3]. In addition, huge volumes of waste from the destruction of residential and transport infrastructure were created, which is a new challenge for the country. According to preliminary estimates of the Ministry of Development of Communities and Territories of Ukraine, Russian troops destroyed about 6,800 residential buildings. Only in the de-occupied territories of Kyiv, Chernihiv and Sumy regions, about 15.2 billion tons of waste was generated from the destruction of buildings and structures due to the actions of the Russian Federation. More than 200,000 cars and trucks destroyed in Ukraine during hostilities are now stored in specially designated places. The longer such waste remains on the territory of Ukraine, the more damage it will cause to the environment, polluting the soil, water, and air, as well as causing additional emissions of greenhouse gases, which will have a negative impact on global climate processes. At present, work has begun to clean the territories of destruction waste where possible. Thus, according to the report "Ukraine: rapid assessment of damage and needs for restoration" [4], 5% of garbage trucks, 17% of biogas plants, and 9% of sorting lines were destroyed and damaged in the country. Direct losses in the field of waste management - 95.36 million dollars. In the United States, the estimated cost of removal of construction debris and rubble is $320.7 million. USA, and the loss of profits of waste disposal enterprises is estimated at 11.9 million dollars. USA. Such calculations were made only for certain regions of Ukraine, including the territories of Donetsk, Luhansk, Kharkiv, Kyiv, and Chernihiv regions, but they make it possible to estimate the overall scale of potential losses in the entire territory of Ukraine. Given the fact that the post-war reconstruction of Ukraine should not copy the pre-war structure of the economy, which was based on fossil fuels, was inefficient and polluted the environment, scientific research aimed at creating favorable conditions for the introduction of effective trends and technologies for waste processing is of particular importance today wars for their reuse.

According to the experts of the National Institute of Strategic Studies, in the short term, for the effective management of war waste, Ukraine should focus on eliminating and reducing immediate risks to human health and the environment. The preparation and implementation of comprehensive environmental cleanup measures, especially related to the collection, safe disposal and management of huge amounts of military and other waste, will make it possible to reduce the immediate risks to public health. In the long term, the management of war waste should be subordinated to the task of developing an ecologically clean, "green" economy in Ukraine [5]. The problem of preventing ecological threats to the environment due to the Russian full-scale invasion requires special attention from domestic specialists and the world public. Today, those crimes against nature that take place in the combat zone are defined by experts as *ecocide* [6]. The largest of them is the explosion

of the Kakhovskaya HPP dam, which occurred on June 6, 2023. This is the biggest man-made disaster in Ukraine since the explosion at the Chernobyl nuclear power plant. Aquatic ecosystems were the most affected by this ecocrime. The "Let's do i Ukraine" team, with the support of the Ukrainian Scientific Center for Marine Ecology, conducted three environmental missions last year to study the effects of the Kakhov disaster on water bodies. During the missions, water samples were taken from reservoirs, wells, as well as samples of bottom sediments from the Dnipro River, flooded areas, and the Dnipro-Buzka estuary. Samples from the Dnipro near Kherson, the Dnipro-Buzka estuary, the Black Sea near Ochakov, and samples from the Odesa Bay showed the same pollution structure. At all these stations, the content of petroleum products, toxic metals (zinc, cadmium, arsenic) and organochlorine compounds exceeds the maximum permissible concentrations. Metals such as zinc and cadmium are toxic to many species of aquatic organisms, especially at high concentration levels. The results of the research will also be used as part of criminal proceedings conducted by the Specialized Environmental Prosecutor's Office of Ukraine and the Main Investigative Department of the Security Service of Ukraine. Figure 1 shows the Kakhovskaya HPP a day before the dam destruction and a day after.

(a) (b)

Fig. 1 Kakhovskaya HPP on June 5, 2023, the day before the dam breach: (a) (left) and (b) Kakhovskaya HPP a day after the dam breach, on June 7, 2023 (right). Source: https://www.bbc.com

Water. Even before the start of the full-scale war, Ukraine had a shortage of water resources. In 2019, Ukraine ranked 125th among 181 countries in the world in terms of available drinking water reserves. According to experts, the southern, eastern and some central regions of Ukraine are already critically short of water reserves, and the drought of 2020 was one of the most severe in recent decades. It is clear that climate change will continue to worsen the water supply situation. Russian aggression became a significant challenge for agriculture due to soil pollution, destruction and damage of agricultural machinery, and constant shelling. According to calculations by the Kyiv School of Economics, the repair and replacement of the irrigation infrastructure alone in the affected regions will cost 225 million dollars. USA [7]. The occupiers' forced withdrawal of Dnieper water from the Kakhovsky Reservoir and its supply to Crimea in violation of technological requirements had a negative impact on water availability in the region. It is impossible to fully assess the losses, because the Kakhovskaya HPP was under occupation before its detonation. These losses are not compensated by natural hydration.

3.1. Environmental Challenges of the Period of Post-War Reconstruction of Ukraine

Emissions. According to estimates, the largest share of emissions will be caused by post-war recovery, when power plants, industry and buildings will have to be rebuilt. The construction sector, which uses a large amount of concrete, is generally one of the sectors with a very high level of greenhouse gas emissions.

Waste. International and European experience shows that it is possible to reuse certain types of war waste, destroyed objects and property. For example, after the Second World War, the reconstruction of Warsaw was accelerated by the use of materials that remained after the end of hostilities. In particular, undamaged whole bricks were reused, and construction waste was crushed into concrete. Today, in countries such as Denmark, the Netherlands, and Germany, builders are required to use a certain percentage of products from recycled waste. In the Netherlands, there has been a law for about ten years that prohibits the disposal of recyclable construction waste to landfills. Such experience is particularly important for Ukraine. Given the fact that the post-war reconstruction of Ukraine should not copy the pre-war structure of the economy, which was based on fossil fuels, was inefficient and polluted the environment [8], scientific research aimed at creating favorable conditions for the introduction of effective directions and technologies with processing wastes of war for their reuse. At the same time, in the short-term perspective, for the effective management of war waste, Ukraine should focus on eliminating and reducing immediate risks to human health and the environment, and conducting comprehensive measures to clean up the environment. In the long term, the management of war waste should be subordinated to the task of developing an ecologically clean, "green" economy in Ukraine.

Water. Even after the end of hostilities and restoration of the irrigation system due to climate change, the volume of fresh water in most river basins of Ukraine will continue to decrease. This means that the country's agriculture will constantly experience a shortage of water, and therefore it is critically important to adapt it to climate change, taking into account the

decrease in water content of rivers and the issue of water security in the region. Therefore, water resources in Ukraine are threatened not only by the actions of the occupiers, but also by climate change. It is obvious that post-war reconstruction must take into account not only the consequences of hostilities and occupation, but also the negative impact of climate change. After the restoration of peace, it will be necessary to restore a controlled and technically correct water supply to the Crimean Peninsula. It will also need to be taken into account when rebuilding agriculture, in particular, irrigation systems, in order to ensure the Crimeans' need for water and have a minimal impact on the irrigation of fields in the regions dependent on the Kakhovsky Reservoir.

3.2. Global Environmental Consequences of the War in Ukraine and the Threat of Global Warming

The ecological impact of the Russian Federation's war against Ukraine is not limited exclusively to the territory of Ukraine. Inger Andersen, Deputy Secretary General of the United Nations, Executive Director of the United Nations Environment Program, said that "countries directly bordering Ukraine are aware that the war waged by the Russian Federation has a cross-border impact on nature" [9]. She believes that the pollution of the Black Sea, the Dnipro River or the air should cause concern for all those who could potentially be affected by such an impact, since forests run across the border, water flows into a neighboring country, water-bearing arteries are connected underground, the marine environment and winds are not subject to human control. This situation calls for additional research into cross-border impacts.

The war aggravated the issue of international food and energy security, in particular, due to periodic blockades of food exports from Ukraine through the Black Sea. Global energy independence, which is a prerequisite for international political security, has experienced significant challenges. Although EU countries are attracting additional resources to get rid of energy dependence on the Russian Federation, in the short term there is a risk of delaying or canceling actions to reduce their carbon footprints and return to fossil fuels. But on the other hand, military aggression is an argument for the gradual reduction of dependence on fossil fuels. With international help, post-war Ukraine can rebuild its damaged infrastructure and take a step forward to a more sustainable, cleaner, low-emissions future [1].

The biggest climate challenges for humanity in this century are the reduction of biodiversity, overpopulation and global warming of the planet, which leads to the mass extinction of species, the reduction of useful resources for maintaining a normal standard of living and threats to the existence of humanity. The war on the territory of Ukraine significantly increases the negative effect of these challenges.

Man has disturbed and changed the ecosystems of about 70% of the surface of our planet. Since the advent of agriculture, the biomass of terrestrial vegetation has halved, and 20% of its original diversity has been lost forever. Another 20% of all species are threatened with extinction within the next few decades. War accelerates the process of extinction because war destroys ecosystems - steppes and fields are bombarded with artillery, forests are burned. As a result, all this leads to the death of plants and insects typical for these areas, as well as large animals such as mammals and birds. The area becomes unsuitable for their existence, and new places are occupied by invasive, more aggressive species for which eruptions from explosions are a favorable place for reproduction, and for other plants such soil will be unsuitable, which will further accelerate the capture of our territory by harmful plants.

Another problem, which, at first glance, is not related to war, is the overpopulation of the planet. Of all the animal biomass on Earth today, the majority is represented by livestock (59%) and humans (36%), and only about 5% of this total biomass is wild mammals, birds, reptiles, and amphibians. By 2050, the world population is likely to increase to 9.9 billion. In the end, this will lead to a need for so many resources that our planet simply will not be able to satisfy it. According to experts, the war is directly related to the overpopulation of the planet, since the use and destruction of natural resources during military operations occurs much faster. The main "resource" in Ukraine in economic terms is soil. If earlier they were fertile, which was the reason for the active development of agriculture, now more than half of all territories in Ukraine are arable land. War directly destroys fertile soil as a resource because fertile topsoil cannot be formed on arable land. The most fertile soils - chernozems - are formed under perennial natural vegetation, and the shelling that takes place in the fields literally leaves "chemical burns" on the ground, since the explosion is a chemical reaction. Charges also contain heavy metals and sulfur, which accumulate in the environment and lead to various harmful effects, such as mutations. Therefore, in the context of war, "scorched earth" means not only fires, but it is an acid-scorched earth, when everything that lives in the soil, plants, seeds, roots, everything is burned in the acid. Therefore, resources, in particular, clean water, a habitable atmosphere, fertile soils are the result of the activity of living organisms that reproduce these resources.

Greenhouse gases formed on the territory of Ukraine as a result of military operations will directly affect global warming. The military is one of the largest emitters of greenhouse gases in the world. Due to the war, the military industry is growing, which is very energy-intensive and additionally emits greenhouse gases into the atmosphere. Such emissions will have significant climatic effects, because in terms of volume, they can affect entire regions in terms of several months to several years [10]. On the one hand, much data on fossil fuel consumption and carbon dioxide emissions from military equipment is confidential. On the other hand, many countries, including NATO and the EU, have announced plans to become climate neutral by 2050. The war in Ukraine may negatively affect these plans. During the UN Climate Conference COP27 in Egypt, the leaders of the EU countries emphasized that the climate transformation was complicated by the aggression of

the Russian Federation against Ukraine, which led to huge human losses and caused damage to the environment. In the conditions of war, harmful emissions entering the air increase several times. For example, during fires that regularly occur in cities, industrial facilities and chemical plants due to shelling, a large amount of organic substances, black carbon, carbon dioxide and nitrogen dioxide enter the air, which harm the planet and significantly accelerate global warming. Forest fires also accelerate this process. According to estimates, more than 100,000 hectares of forests and grass ecosystems were destroyed by fire in the first year of the war. The area of fires continues to increase.

According to the UN, the war of the Russian Federation against Ukraine may disrupt the achievement of the goals of slowing global climate change and the Sustainable Development Goals, and the consequences of the war create a risk of destabilization of the world food and energy markets. The sharp increase in greenhouse gas emissions was caused by the accident and leaks from the Nordstream pipelines and emissions produced by long-haul aircraft over Asia after the imposition of sanctions against Russia. Damage to the Nord Stream pipelines created a 700-meter pool of boiling water in the Baltic Sea. According to estimates of German experts, about 300,000 metric tons of methane, one of the most powerful greenhouse gases [11], entered the atmosphere as a result of the emissions. Germany's Federal Environment Agency estimates that this amount of gas will have roughly the same impact on the climate over 20 years as the annual emissions of more than 5 million cars in the United States. However, these emissions mostly moved to other countries. In addition, the decrease in CO2 emissions in Europe due to the decrease in the use of natural gas and the energy crisis is almost completely offset by the increase in the use of oil, coal and liquefied natural gas. [12].

3.3. Environmental Obligations of Ukraine

In 2021, Ukraine voluntarily undertook to reduce greenhouse gas emissions. But as a result of Russian aggression, funds that were planned to be spent on energy efficiency, a green economy, renewable energy sources, the creation of new nature reserves and the preservation of species are now being spent on military actions, which experts define as wasted opportunities. The government of Ukraine admits that Russia's war against Ukraine is accelerating climate change and causing an increase in greenhouse gas emissions. The strategic goal of the country's post-war reconstruction is a clean and safe environment, compliance with the principles of the European Green Course, and the reconstruction of the economy according to the principles of sustainable development. To date, the Ministry of Environmental Protection and Natural Resources of Ukraine has finalized the Climate Law of Ukraine, which should cover all directions in the field of climate policy formation and implementation; completed work on a plan of measures to implement the updated Nationally Determined Contribution of Ukraine to the Paris Agreement. The ministry stated the importance of the discussion at the international level regarding the impact of the Russian-Ukrainian war on the climate, so that this issue is reflected in the annual reports of the Secretariat of the UN Framework Convention on Climate Change.

For Ukraine, an effective climate policy is directly related to the country's Euro integration policy and green reconstruction [12]. In the current difficult conditions, Ukraine continues to implement practical measures of climate obligations, in particular, the national system for monitoring reporting and verification of greenhouse gas emissions has been updated and improved; a pilot emissions trading system is planned to be launched in 2025 with a full launch in 2026, which will allow the country to join the European ETS; together with German partners, the Climate Office in Ukraine was opened as a platform for cooperation within the framework of the Paris Agreement and a tool for attracting investments for green reconstruction; Ukraine's readiness to participate in the carbon market was announced.

To update the issue of the environmental consequences of war and its consequences in the context of adaptation and overcoming the consequences of global climate change, Ukraine uses authoritative international platforms, in particular, the 28th UN Climate Change Conference, which became the largest in the history of UN climate conferences. Climate policy of Ukraine. Among the main environmental issues that became relevant due to Russian aggression, the "Aggressor refunds" initiative should be singled out - a mechanism for compensating the aggressor for damage caused to the environment and climate as a result of armed conflicts and the inclusion of this mechanism in the Paris Agreement [13].

4. Conclusions

Full-scale Russian aggression against Ukraine will have very serious negative consequences for the ecosystem of the country and the region, both in the short and long term. This war is taking place at a time of global climate change, which may also exacerbate negative climate trends. For Ukraine, the war is certainly an existential threat, but it also increases environmental degradation and creates new problems that may affect the global ecology of Europe and the world in the future. Since the beginning of the large-scale invasion of Russian troops into Ukraine, the state's environment has been under the constant destructive influence of new threats to environmental security. The active phase of hostilities in Ukraine due to Russian armed aggression, which negatively affects the ecological security of Ukraine and the countries of the region, can become one of the leading factors of climate change and disrupt the achievement of climate goals determined at the highest international level. In addition, the consequences of the war create a risk of destabilization of the world food and energy

markets. While EU countries are raising additional resources to break their energy dependence on Russia, there is a risk of a return to fossil fuel dependence, narrowing the window of opportunity to limit global temperature rise. On the other hand, although in the short term the full-scale war of Russia against Ukraine resulted in an energy imbalance and a global crisis, in the long term such a shake-up of the system could accelerate the development and transition to renewable energy sources and bring the world closer to climate goals and reduce dependence on fossil supplier countries fuel. The global ecological consequences of the war in Ukraine are complex and multifaceted. They affect all aspects of life on the planet, from people's health to the state of the climate. In order to minimize the negative consequences of the war and promote the restoration of the environment, it is necessary to take comprehensive measures at the international level. It is important to understand that the environmental consequences of the Russian-Ukrainian war may be felt for decades, and some of them may be irreversible. Therefore, combating climate change and restoring damaged ecosystems are among the most important tasks for all of humanity.

5. Limitations

Emissions caused by military operations in peacetime and during hostilities have only been partially investigated. Given the fact that such emissions can reach hundreds of millions of tons of CO2 per year, a more thorough assessment of the direct and indirect climatic consequences of war is necessary. This requires including all wartime emissions in the global tally of greenhouse gases. At the same time, today there is no standardized procedure for measuring greenhouse gas emissions by armies, and military emissions are excluded from the Paris Agreement on climate protection. Therefore, the introduction of new approaches and the creation of methods for calculating environmental damage from military actions and their impact on global climate change remain relevant. The research challenge is that, on the one hand, greater transparency can strategically weaken armies, but on the other hand, establishing common standards for assessing the environmental consequences of military actions should contribute to the successful implementation of the European "New Green Deal."

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