

ENVIRONMENTAL AND ECONOMIC LOSSES OF THE AGRICULTURAL SECTOR OF UKRAINE AS A RESULT OF RUSSIAN AGGRESSION

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Abstract. The article presents the results of a study of economic and environmental losses of Ukraine's agricultural sector as the result of Russian aggression. It is noted that a significant part of environmental issues in Ukraine are the result of global processes (warming, biodiversity loss, pollution, overpopulation and urbanization, harmful effects of heavy industry), also, of the Soviet era energy and resource-intensive economy, consequences of the Chernobyl accident (radioactive contamination), degradation of agricultural land, military infrastructure, etc. After gaining independence these problems not only did not diminish, but also deepened. However, efforts to ensure environmental protection were interrupted by the military attack of the Russian Federation. The authors collected and summarized information on the amount of environmental and economic losses of the agricultural sector of Ukraine. Their interrelation is emphasized. The sources are analysed. It is noted that in wartime accurate accounting of losses and damages is impossible, so the main attention is paid to the analysis of their causes, structure, and consequences. It is shown that the economic and environmental damage caused by the war was inflicted not only on Ukraine, but also to neighbouring countries and poses a potential danger to the World. The problems associated with increased competition in the European agricultural market due to the impact of the war and the inaccessibility of traditional sales markets are highlighted. Based on the Ukraine's recovery plans and regional programs, the authors identify key areas of work for the future. The significant support from the United States, the European Union and other countries and its importance in the future to overcome the consequences of the war are emphasized. The authors have summarized the common economic and environmental problems that need to be addressed.

Key words: Ukraine, public administration, ecology, agricultural sector, impact of war.

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Introduction

Many of the environmental issues in Ukraine are the result of global processes (warming, loss of biodiversity, pollution, overpopulation and urbanization, harmful impact of heavy industry etc.) or the legacy of the Soviet era energy and resource-intensive economy, consequences of the Chernobyl accident (radioactive contamination), degradation of agricultural land, military infrastructure etc. After gaining independence, these problems have not only not diminished, but have deepened the destruction of forests and green spaces and soil depletion due to their barbaric use. Waste disposal problems also became more and more frequent. Environmental and economic problems of the agricultural sector are an important part of the overall problems, the solution of which were realized in attempts to create an ecological network of Ukraine (Zakon Ukrainy..., 2024).

The materials of the study "**Environmental Trends: Citizens' Views**" conducted in November-December 2020 by the Gorshenin Institute in cooperation with the Friedrich Ebert Foundation in Ukraine, (Ekolohichni trendy..., 2021) showed that many Ukrainians were concerned about the state of the environment, noting pollution and water shortages, global warming, increasing waste, the danger of nuclear power etc. At the same time the war in Ukraine, socioeconomic difficulties, and the impact of the pandemic are worrying factors.

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The research conducted for the 30th anniversary of independence revealed significant environmental problems and allowed us to identify priorities for the coming years. It was noted that there was an accumulation of environmental problems primarily in the temporarily occupied territories of Donbas and Crimea, as well as deforestation and illegal amber mining, as well as environmental damage from accumulation of waste. At the same time, the formation of a powerful environmental movement, increased use of renewable energy sources, creation of the of the State Energy Efficiency Fund, implementation of environmental programs etc. For example, the share of electricity produced from renewable sources (solar, wind and bioenergy plants in Ukraine) increased from 1% in 2014 to more than 7% in 2020, and the number of owners of home solar stations over the same period increased from a few dozen to 30 thousand. Energy substitution and saving programs have also intensified significantly. The data summarized in Table 1 convincingly demonstrate the breadth of the tasks set (Ekolohichni priorytety..., 2021).

Table 1

Environmental priorities of Ukraine as of 2021

Tasks	Components of implementation
Climatically neutral economy	Decarbonization of the energy, transport and industry sectors
Energy independence	Refusal to import fossil fuels
Renewable energy	Development of renewable energy sources.
Abandonment of nuclear power energy	Decommissioning of nuclear power plant units/blocks, transition to renewable energy
Clean water	Implementation of modern the European Union environmental standards and strengthening of environmental supervision of the agricultural sector, as well as investments into the infrastructure
Clean air	Abandonment of outdated, old technologies, strict control of enterprises
Sustainable agricultural and good practices in agricultural sector	Development of small and medium-sized farms, ecological production
Refusal from coal	Revitalization, replacement with modern energy sources, creation of new jobs
Development modern system of public transportation	Reducing the number and level of use of private means of transportation mainly cars, creation of modern urban infrastructure
Adaptation to climate change	Making environmentally friendly decisions
Energy efficiency	Abandonment of energy-intensive sectors of the economy,
A well-established system of handling with waste	Separate waste collection, in-depth recycling, reuse of reuse of goods and packaging.

Source: author's calculations based on Ekolohichni priorytety..., 2021

However, since 2014, environmental and economic problems have emerged, and with the intensification of Russian aggression in 2022 environmental and economic problems related to the hostilities have become more acute. At the same time, experts note that since the beginning of the full-scale war, access to environmental data has been significantly complicated or closed by the authorities, who citing security concerns or lack of funding. There is no single tool for free access to state monitoring data, and all subjects of state monitoring collect, process and use data independently, mostly without publication of primary data (Vplyv voiennykh dii ..., 2023).

Materials and methods

Environmental issues in Ukraine are constantly in the centre of attention of the public and authorities; and with the beginning of the Russian aggression, they are increasingly worrying the world community. It is advisable to distinguish two periods of studying this issue: pre-war and the time of Russian military

aggression. In the pre-war period, the most important sources of environmental information were official reports and materials of public discussions were important sources of environmental information. During the war, the main sources were materials of periodicals and publications of research carried out jointly by Ukrainian and foreign scientists within the framework of grant programs. An important methodological document is the Law of Ukraine "On Environmental Impact Assessment" (2017), which is aimed at preventing environmental damage, ensuring environmental safety, environmental protection, rational use and reproduction of natural resources, in the process of making decisions on economic activities that may have a significant impact on the environment, taking into account state, public and private interests (Pro otsinku vplyvu ..., 2017).

The regulations governing the activities of government authorities, businesses and the public under martial law. The specifics of the activities of the Ukrainian authorities under martial law has already been analysed (Lakhyzha M., Kachan Y., 2022).

The main comprehensive source is the National Environmental Reports of Ukraine, which have been prepared since 1992 and submitted to the Verkhovna Rada of Ukraine by the Ministry of Environmental Protection and Natural Resources of Ukraine. The latest available report is for 2021 (Natsionalna dopovid ..., 2021).

Annual reports on the state of the environment in the regions of Ukraine are prepared by regional state administrations and posted on their websites (Dopovid pro stan ...,2022).

An important source is the results of the implementation of international documents signed by Ukraine. For example, the National Reports of Ukraine to the Convention on Biological Convention. Research is periodically conducted jointly with international organizations. For example, in 2016 the World Bank published "The Environmental Analysis of Ukraine". After 2015, attention was paid to the implementation of the Sustainable Development Goals and relevant information. Annual regional reports on the state of the environment are also important documents. However, during the war, some businesses took advantage of their right to limit reporting, including on the state of the environment. Some environmental researches were done by Ukrainian scientists within the framework of international projects. For example, in 2017, the results of an environmental damage assessment in eastern part of Ukraine were published (Otsinka, 2017; Yehorycheva S., Hudz T., Lakhyzha M. 2020; Garafonova O., Zhosan A., Khudolei V., Tyukhtenko N., Tymkiv I., Riabets N., 2023; Garafonova, O., Zhosan, H., Marhasova, V., Tkalenko, N., & Trukhachova, K. 2022); Teixeira Silva, Jaime A., Kobilianska I., Kucher A., 2023).

We have also traced criticism of official materials, which mainly concerns insufficient involvement of stakeholders in their preparation and low level of influence on policymaking. This criticism is usually made by representatives of human rights and environmental organizations. As example is the publication of the executive director of the "Green World", the head of the NGO "Helsinki Initiative - XXI" O. Stepanenko dedicated to protect environmental rights of Ukrainians (Stepanenko, O., 2024).

The question naturally arises of the methodology for calculating environmental and economic losses. The methodological basis for determining losses is based on internationally recognized standards. At the state level, such work is carried out by state and local authorities with the involvement of civil society and business self-government bodies. For example, recommendations for farmers and resources for recording losses were developed by experts from the USAID Agricultural and Rural Development Program, and the All-Ukrainian Agrarian Council. For documenting losses, farmers are encouraged to contact the police or the Security Service of Ukraine; military administration or local authorities; other authorities in certain cases to the State Environmental Inspectorate, State Service of Ukraine for Food Safety and Consumer Protection, State Service of Ukraine for Geodesy, Cartography and Cadastre, State Water Agency for proper

calculation of the amount of damage. It is also proposed to leave information about losses on the Internet portals created by the initiative of the Office of the President of Ukraine and the Office of the Prosecutor General of Ukraine on the following the Internet portals (<https://dokaz.gov.ua/> and <https://warcimes.gov.ua/>). The following are recorded evidence of damage to facilities and property, direct losses, and lost profits. Ukraine's recovery projects contain specific proposals and help to better orientate the areas of work. An example is the for Ukraine (Draft Ukraine Recovery Plan..., 2022).

The authors of the article used the following research methods: system analysis - to define and characterize the object and subject of the research; abstract-logical method - for scientific substantiation of conclusions regarding the formation of a strategy for the development of the agricultural sector in Ukraine).

Public goods – theoretical background. Results of the support

The analysis of environmental issues in Ukraine during the period 2022-2023 primarily concentrated on war-related issues. At the same time, more and more attention is being paid to the growing environmental and economic problems. Environmental and economic processes taking place in Ukraine, which is in the geographical centre of Europe, have a major impact not only on neighbouring countries but also on the whole of Europe. For example, the harmful impact of emissions from Ukrainian coal-fired power plants is felt in neighbouring countries, especially in Poland and Romania. Awareness of the negative impact of the war on the environment in the first days of its intensification became noticeable not only in Ukraine but also in neighbouring countries. For example, in March 2022 the Polish newspaper "Rzeczpospolita" wrote: "Although the greatest tragedy of the war in Ukraine is undoubtedly the suffering of its inhabitants, experts warn that Russian aggression also poses serious environmental risks" (Wojna w Ukrainie, 2022).

The analysis of the Polish press in 2022-2023 shows a constant appearance of materials in it, related to the Russian-Ukrainian war and its negative impact on the environment and economy. The threat is pointed out not only to Ukraine and Europe, but also to the World. For example, J. Behr emphasized that the trench warfare turned hundreds of square kilometres of fields into scorched wastelands with contaminated soil and groundwater. Unique steppe and wetland ecosystems of southern and eastern Ukraine, habitats of endangered species of plants and animals. The Russians' blowing up of the dam in Nova Kakhovka caused the largest environmental disaster in Europe in many years: a major flood in the Lower Dnipro Valley and pollution of the waters of the river and the Black Sea. However, the war could be a catalyst for positive change in the long run. Rebuilding Ukraine could change the post-Soviet model of utilizing the natural resources of its South and East, based on heavy industry and large-scale agriculture. In particular, the natural reconstruction of the former floodplains (Velykyi Luh) offers a chance to restore biodiversity in this most transformed by anthropogenic activity in the country (Berh, J., 2023).

In June 2022, the Minister of Environmental Protection and Natural Resources of Ukraine Strilets, R. called the environmental situation in Ukraine caused by the war a ticking time bomb, naming 257 known cases of ecocide at that time, including the explosions of fuel and lubricants, oil product storage facilities; air strikes on enterprises that use hazardous chemicals in production; destruction of sewage treatment facilities; damage to soil cover, burning of forests etc. (Strilets, R., 2022).

Experts of the NGO "Green World - Friends of the Earth" within the framework of the international program "Clean Air for Ukraine" with the financial support of the Ministry of Foreign Affairs of the Czech analysed the damage caused by Russian aggression to the environment in Ukraine, identifying three main areas: 1) massive release of toxic substances into the environment of a military nature; 2) physical impact (fires, explosions, soil damage etc.); 3) destruction of the environment due to man-made disasters caused

by military actions (Anhurets, O., Khazan, P., Kolesnykova, K., Kushch, M., Chernokhova, M., Havranek, M., 2022).

The unprecedented consequences of the Russian aggressors' explosion of the Kakhovka hydroelectric power station on 6 June 2023, has led to the draining of the reservoir and unexpected flooding of the areas below the dam. An expert, the head of the Ukrvodokanalekologiya Association Novytskyi identifies four categories of consequences of the Kakhovka hydropower plant explosion: 1) humanitarian (loss of centralized water supply and sanitation in many settlements of three regions - approximately 880 thousand people); 2) economic (stoppage of industrial production at many large enterprises, the threat to the nuclear power plant); 3) social (growth of unemployment, decline in living standards, domestic problems); 4) environmental (disaster that covers 5 thousand square kilometres - the estimated amount of damage is more than 55 billion UAH, the impact on the Black Sea ecosystem as a result of a decrease in water salinity (Novytskyi, D., 2023).

According to the Ministry of Economy of Ukraine daily environmental damage in Ukraine is growing by about 102 million Euros every day. The Ukrainian authorities and experts emphasize the need to start reconstruction now. Stage zero is the demining of more than 170 thousand square kilometres of the country's territory. Almost 6 million Ukrainians are at risk, 800 of whom have already fallen victim to mines.

Problems of the agricultural sector: the relationship between economic and environmental losses

The interconnectedness of economic and environmental problems in the agricultural sector was pointed out by Ukrainian scientists even before the full-scale war. The Ukrainian scientists have repeatedly pointed out the interconnection of economic and environmental problems in the agricultural sector. They emphasized the following deterioration of the ecological quality of the environment due to a significant increase in anthropogenic and anthropogenic and technogenic load on it (Mishenin, Ye., Yarova, I., Dutchenko, 2017; Hranovska L. 2007; Zinovchuk N.2007; Furdychko O., 2014).

The economic and environmental problems of the agricultural sector in 2000-2021 were actively considered through the prism of the principles of sustainable development: partnership, integration ecosystem and environmental management, justice for all generations, civilized competitiveness. However, despite discussions about changing the emphasis of economic policy more effectively confront the aggressor, Ukraine's economy remained bureaucratized, corrupt, and inefficient. Ukraine's export potential was determined primarily by monopolies concentrated in metallurgy and agriculture. The war has caused the breakdown of logistics chains, the blocking of markets, and environmental disasters at large livestock complexes, which makes functioning of of large-scale agro-holding companies particularly complicated. Therefore, in the first months of the war, it was necessary to urgently reduce the tax burden on business and stimulate the activities of small and medium-sized businesses, including the agricultural sector. Thanks to the measures taken in the context of a full-scale war, Ukraine's agricultural sector has shown considerable resilience. The main task of providing the population with food is crucially important as Ukraine remains one of the guarantors of food security in the world. However, the agricultural sector faced additional risks: loss of production and resource potential (reduction in the number of employees; temporarily occupied territories, the territories of military operations, the liberated territories disabled; loss of equipment); exit of individual producers from business; loss of part of the infrastructure (destruction of warehouses by the enemy, warehouses, granaries, logistics structure; blocking of sea and river ports; losses from power outages etc.) (Ahrarnyi sektor ekonomiky..., 2023).

According to the Ministry of Agrarian Policy and Food of Ukraine, due to military invasion, the sown area in Ukraine decreased by 25% in 2022. The sown area of all categories of farms in the government-controlled territory of Ukraine for the 2023 harvest was to be 21.8 million hectares, which is 6.8 million hectares less than in 2021 (21.8 million hectares versus 28.6 million hectares). The problems were particularly severe in those areas that were under temporary occupation and in the war zone. Thus, according to the central newspaper "Uriadovyi Kurier", in 2022 farmers in Kharkiv region sowed 68.4% less winter crops than in 2021. According to the information of the district state administrations of the Kharkiv region, as of February 2023, 483.5 thousand hectares of agricultural land needed to be surveyed for its possible contamination caused by mines and explosive remnants of war, and another 72.3 thousand hectares of land of agricultural land where military operations took place needed to be surveyed after the end of hostilities. The war damaged industrial infrastructure: elevators, warehouses, large agricultural enterprises and small farms; more than 70 agricultural enterprises. Almost half of the agricultural machinery and equipment was damaged or stolen by the occupiers (Breslavets, B., 2023).

At the beginning of 2023, the International Marketing Group with the support of the organization "Help-Hilfe zur Selbsthilfe Ukraine" together with the Ukrainian Business Council conducted a representative survey of 400 small farms from all regions of Ukraine to assess the impact of the war on them and collect information about the needs of farmers. The biggest losses farmers suffered due to the destruction of production facilities; the suspension of investment projects; the destruction of transportation infrastructure; pressure on inflation and the exchange rate due to the narrowing of the range of domestic goods, energy shortages etc. In farmers' opinion, the most topical problems are: lack of skilled workers; raiding, shortcomings in settlements with retail chains networks; risks due to power outages; unpredictable actions of the state (Vplyv viiny..., 2023).

In February 2023, the Law of Ukraine "On compensation for damage and destruction of certain categories of real estate objects as a result of hostilities, acts of terrorism, sabotage caused by the military aggression of the Russian Federation and the State Register of Property Damaged and destroyed as a result of hostilities, terrorist acts, sabotage caused by the armed aggression of the Russian Federation against Ukraine" entered into force. The state has adopted the following programs to support small and medium-sized businesses:

- grants for the creation of greenhouses and support for horticulture, berry growing and viticulture;
- budget subsidies per unit of cultivated agricultural land for agricultural activities to provide support to farms and other agricultural producers;
- a special budget subsidy for the maintenance of cows of all productivity areas to provide support to farms and other agricultural producers.

As of 24 February 2023, the losses, and damages of the agricultural sector in Ukraine were estimated at 40.2 billion US dollars. Agricultural land has suffered damage, farmland was particularly damaged because of pollution and contamination during the hostilities. The facts of pollution and soil contamination, as well as their extent, are established by authorized persons - representatives of the State Environmental Inspectorate of Ukraine, by inspecting the land plots, data from remote sensing of the land, research of soil samples obtained, processing of conclusions of any expert examinations, explanations, certificates, documents, materials, information, obtained, in particular, from any sources, operational reports of individuals and legal entities etc. The amount of damage caused to the owners of agricultural land plots is determined in accordance with the Procedure for Determining and Compensating Damages to landowners and land users, approved by the Resolution of the Cabinet of Ministers of Ukraine of 19 April 1993, No. 284.

The issue of competition

Realizing the huge potential of the agricultural sector of Ukraine and taking care of its growth, it is worth paying attention to the problems that arise in connection with competition on the European market. This problem has been greatly exacerbated by difficulties in exporting grain and other goods to traditional markets in Africa and Asia. For example, in Poland already at the beginning of 2023 they wrote about "Polish troubles due to Ukrainian agricultural competition" (Bielecki T., 2023). The importance of this problem was also confirmed by the protests of Polish farmers.

Ukraine is already implementing several tasks related to the recovery from the hostilities. The first task is to minimize possible consequences, the second is to overcome losses and is to overcome losses and damage. According to the website of the Ministry of Economy of Ukraine, there are two Ukrainian armies in the country: the armies of defense and recovery. As of 20 November 2023, more than 70 thousand unemployed people were involved in public works under the "Army of Recovery" project, and they earned 462 million UAH for performing such work. The types of such work depend on the needs of the of the region (Armija vidnovlennia..., 2023).

Ensuring the development and submission of proposals to the President of Ukraine on Ukraine's recovery is one of the functions of the National Council for the consequences of the war, which was established on 22-04-2022. The Restoration Fund of Ukraine and other charitable organizations that offer or help Ukrainian citizens to use funds, who have suffered from the hostilities. The Draft Recovery Plan for Ukraine prepared by the National Council in mid-2022, as of 13 June 2022, estimated direct documented damage to infrastructure at almost 100 billion US dollars. The total indirect loss to the economy is 126.8 billion US dollars. Over the next period of the war, these costs increased significantly, which was especially evident after the occupiers blew up the Kakhovka hydroelectric power station.

Conclusions

- 1) Government documents and academic literature have repeatedly emphasized that it is impossible to make accurate estimates of damage and losses in wartime, especially in the field of ecology. Therefore, special attention is paid to documenting losses and damage according to international methodologies and standards. Some losses of natural ecosystems and unique natural sites are already irreplaceable, while the restoration of other losses (soil, forests, and the natural richness of flora and fauna in some areas) will take decades to restore.
- 2) Environmentalists are identifying the areas of loss and are concentrating their efforts for restoration: 1) damage to the nature reserve fund and other protected areas; 2) damage to forests areas; 3) damage to water resources; 4) damage as a result of attacks on infrastructure and industrial facilities; 5) military waste (destroyed equipment, destroyed and used ammunition); 6) emissions of hazardous substances into the atmosphere; 7) damage to land resources.
- 3) It is important to realize that the development of the Ukrainian agricultural sector creates competition for many countries producing agricultural products and may lead to structural changes in the economy of the European Union. First of all, we are talking about the agrarians of Poland and France. Therefore, a comprehensive approach is needed in this case as well. In our opinion, ecological production, which has been developing in Ukraine for a long time, has good prospects, as revealed by the example of Private Enterprise "Agroecology" and other enterprises of the Poltava region.
- 4) In the agricultural sector, the interconnection of economic and environmental losses is particularly noticeable and must be addressed comprehensively. While estimating the economic and environmental

damage caused by the military, it should be noted that not only Ukraine, but most countries in the world have suffered.

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