

# ECOLOGICAL AND TECHNOGENIC SAFETY OF THE ECOSYSTEMS OF THE AGRARIAN SECTOR OF UKRAINE

## Эколого-техногенная безопасность экосистемы аграрной сферы Украины

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**Abstract:** *The article substantiates the urgency of the eco-anthropogenic component of national security both of the state as a whole and of its regions. The types of interaction between society and the environment are determined. It is suggested to consider the ecosystem as a complex combination of flora, fauna and dynamics of natural systems and processes, which interacts with social institutions and power structures. The concept of environmental imbalance is formulated as a real threat to the disruption of life support mechanisms and the creation of obstacles to the economic and social development of the country, improving the quality of life of the population. The main threats to the technogenic security of the country are identified*

**KEYWORDS:** ECOLOGICAL, TECHNOGENIC, SAFETY, AGRICULTURE, ENVIRONMENT, ECOSYSTEM

### 1. Introduction

Over the last three decades all over the world gradually got used to numerous global environmental problems and threats. Environmental issues have become synonymous with a global outlook [1]. Defining globalization through social processes that interact and involve inter-regional and transcontinental measurements, it is necessary to consider four typical properties in the study of environmental problems, namely:

- not all environmental problems as not all reactions to environmental threats are global;
- ecosystems are a complex combination of flora, fauna, and dynamic natural systems and processes that interact with social institutions and power structures;
- are the main processes of environmental degradation and social impact on them;
- to understand environmental degradation and its scale means understanding the construction of human perception models of global environmental change [2].

Today the importance of environmental threats appears to be a determining and guiding factor in the development of international relations and changes in the geopolitical situation. Threats of natural and technogenic areas in the short term can become dominant. These threats are able to create and enhance a number of other threats, which are characterized by extremely high gradient enhancement factors and the defeat of the population, the environment at the time of their origin and development [3].

Excessive use of natural resources by man has led to the deterioration of the ecological situation. The main consequence of this is environmental pollution, changed environmental conditions. The growth of economic demand for natural resources creates problems of their preservation and reproduction, which today are transnational. The world community has a positive experience compliance with environmental and technological safety. International environmental organizations have carried out practical activities aimed at ecological improvement of economic relations in national and international scale.

### 2. Ecological and technological safety as a scientific problem

The processes of globalization, increasing disparities in economic development and resources between economically developed and underdeveloped countries, the growth of population and migration of the population increasing the threat

to humanity in the long run due to the emergence of impulses disruptive of conflicts on a world scale in the form of environmental hazards [1]:

- the destruction of the ozone layer of the atmosphere and the manifestation of global climate change;
- pollution of the oceans;
- the increasing number of the world's population;
- limited access to the world's resources and disproportionate use by countries of the world;
- the civilization confrontation between the Christian and Muslim world;
- the establishment and functioning of the global terrorist network;
- the proliferation of nuclear, chemical, biological, geophysical, aerospace, psychotropic, environmental weapons and technologies of mass destruction;
- the formation of new centers of power, opposition and struggle between them for leadership;
- the emergence of a global social outbursts and protests;
- the growth in consumption and resource scarcity and energy security.

Environmental weapons include almost all types of ionizing and electromagnetic radiation, heat and light, noise, other acoustic and seismic vibrations, shock waves, thermal processes, the formation of zones of high pressure, vibration, dirt and the like. The main danger of the use of environmental weapons is the unpredictability of the magnitude of the consequences of their impact on the ecological balance of the environment. Therefore, allocate following groups of the negative consequences of military action in the context of international environmental security:

- the withdrawal from the market for a long period of land;
- direct destruction of the environment;
- the maintenance for a long time threats to the local population from bombs, mines and shells that did not explode;
- reallocation of resources from civilian production and environmental protection;
- the bomb targeted environmentally hazardous sites, which are destroyed and the destroyed industrial zone, growth of the lesion environment that leads to the fact that local military action acquire the features of a large-scale ecological warfare.

The future combat capability of the powerful military of any country will be determined not only potential weapons, but also environmentally friendly features, information modifications in the transformation of military technology, aimed at combating global threats to the peaceful existence of mankind.

Household productive human activity involves several types of interaction of society with the environment. The first is the human impact of society and its production, when in the process of economic and industrial activities on the natural environment is only used for the dispersion and distribution of industrial and domestic waste, without any purposeful action to transform nature. To the second type of human interaction with nature include the impacts associated with the effective use of natural resources, environmental conditions and possibilities of the biosphere. The third covers the processes and activities aimed at the use of natural conditions and resources through the implementation of large-scale transformations of the natural environment and ecosystems [4].

The analysis of literary sources showed a variety of definitions of the environmental component of national security. The environmental component of the national security means the protection of man and nature from adverse environmental factors. But this is only possible when the environment is a new system that combines natural, industrial and social system in which meets certain requirements: sanitary-hygienic, aesthetic and material needs of human; the conservation of the natural resource and environmental potential of natural ecosystems; maintaining the ability of the biosphere as a whole to self-regulation.

Environmental safety is usually regarded as a system of actions aimed at the protection of society from threats caused by natural disasters and man-made disasters. We believe that this approach is rather simplistic because it doesn't reveal the peculiarities of nature and the relationship of the ecological state of the environment with security companies. The greatest risk to the environment, and through feedback and for society, causing pollution of the natural environment. Often the pollution of the environment may be small, but there is a direct threat to human health or degradation of the ecosystem.

In developed countries, the nature and scope of policy the preservation of the environment due to the limits match the interests of the environment with the material interests of the economic system. The use of a certain adaptation of experience gained in Ukraine, its expansion will contribute, in our opinion, achieving a balanced relationship between economic needs and the environment.

Environmental problems have put humanity before choosing the further development, a growth-oriented agricultural production based on efficient use of natural resources, primarily land. After all, the land as national wealth is the basis for solving many socio-economic problems and food security of the country. Intensive agriculture on a global scale led to the emergence of a number of global challenges – socio-economic, demographic, climatic and the like.

National security is considering including the global problems of technogenic safety in the sphere of civil and defense purposes as one of the most important spheres of life support of man, society and the state, as well as the environment.

### 3. The state environmental and technological safety in Ukraine

Excessive industrialization of the cities of Ukraine and of the objective difficulties of the transition period to a market economy led to a gradual increase in the number of accidents and other emergency situations. Places of greatest concentration of population of Ukraine are the areas with the most threatening state of the natural-technogenic safety. Therefore, we believe that the definition of the basic parameters and peculiarities of natural and technogenic component of national security is one of the conditions of development of regional development plans to ensure life safety of the population.

The complexity and scale of the problem of security of the population and the environment in an emergency situation, the necessity of its solving by public authorities is due to the fact that in nature, technology and society there are many sources of risk, threats and different threat factors. In Ukraine, still lack the

concept and the program environmentally sound development, in particular, the mechanism of rational use and protection of land resources [5].

In modern conditions, a special feature of the ecological state of Ukraine is that acute local ecological situation is exacerbated by the major regional crises, in particular long-term environmental, economic and social consequences, including the Chernobyl disaster. Ecological imbalances pose a real threat of infringement of life-support mechanisms and impede economic and social development hampering the improvement of the quality of life of the population of the state.

Low technical level of existing sewage treatment plants, and high degree of wear, determine low efficiency cleaning systems, which is reflected in particular in the gap reduce the flow of contaminants into the environment from the recession. As a result, in recent years in reducing gross pollution is increasing, their proportion per unit of output. A feature of the country is also a high level of pollution of some regions of toxic and radioactive substances. He remains the highest in the world.

So, in 2014-2015 technogenic load on environment somewhat softened (tab. 1), but the ecological situation in the environment, as vitally important environment for human existence, is still quite difficult.

Table 1  
Indicators of emissions of polluting substances in 2010-2015 in Ukraine

Indicators	2010	2011	2012	2013	2014	2015
Emissions of polluting substances in atmosphere, thousand t	6878,0	6677,3	6821,1	6719,8	5346,2	4521,3
Discharge of polluted wastewater into surface water bodies, million m <sup>3</sup>	1744	1612	1521	1717	923	875
Waste of I-III hazard classes, thousand t	1659,8	1434,5	1368,1	923,8	739,7	587,3
Spending on environmental protection, mln. hrn	10366,6	12039,7	13924,7	14339,0	13965,7	16915,5

The main air pollutants in the country are the enterprises of processing and extractive industries (respectively 33% and 21% of harmful emissions) and producers of electricity, gas and water (37 %). The main stakeholders in the country consumed 7.1 billion m<sup>3</sup> of water, 2.7 billion m<sup>3</sup> (27.6 %) less compared to 2010 and 4.2 times less than in 1990, compared with 1990 volumes of water directed to agricultural use has decreased 12 times.

The most acute problem of disposal and recycling of hazardous waste in Zhytomyr, Zaporizhia, Kharkiv, and Cherkasy regions, where the share of processed and treated waste was less than 10 % of the total number of educated.

Therefore, it is important to improve the ecological state of the natural environment with forests (the state refers to the low forest cover countries in the world – table. 2). The whole area of

Table 2  
The lands of Ukraine in 2015

The structure of the land Fund	Area, thousand ha	Percent of total area
All lands	60354,9	100,0
agricultural land	42726,4	70,8
forest and forest covered area	10633,3	17,6
built-up land	2552,9	4,3
earth under water	2426,4	4,0
open wetlands	982,3	1,6
other lands	1033,8	1,7

the forest Fund of Ukraine is 10.6 million hectares. Total forest cover of the territory of Ukraine amounts to only 17.6 %, while Japan reaches 68%, Finland and Sweden – 57, Canada – 32, US – 33, Germany – 26,9, France – 24%.

#### 4. Threats and risks of ecological safety of agricultural sphere of Ukraine

In Ukraine in the agricultural turnover is about 80% of the arable land, whereas in countries with intensive development of agriculture is much lower (Germany: 67%, France 61%, United States – 43%, UK 35%). The high proportion of tilled soil is a negative phenomenon for our country, for two reasons: first, it promotes the loss of humus (according to the Institute of soil science and agricultural chemistry of UAAS, the annual loss of humus per 1 ha of arable land amount to about 1 t); second, the evidence predominantly extensive agriculture and low level of agricultural production [6].

According to the UN, the Ukrainian soil has the opportunity to feed 100 million people. This can be achieved with effective management. The current state of use of agricultural land is a critical threat. Every year from the fields is transported to 600 million tons of fertile soil over the last 30 years the average content of humus dropped from 3,5% to 3,2%, dramatically increased the acidity and salinity, the area of land exposed to erosion, increasing annually 80-100 thousand hectares and made up one-third of the arable land. Radionuclide contaminated over 3.5 million hectares of farmland and nearly 70 thousand hectares are withdrawn from circulation. The black soil is extremely contaminated with pesticides and nitrates, the average concentration of pollution per 1 sq km is 6.4 times higher than in the US and 3.2 times higher than in the countries of the European community [7].

Thus, the modern use of land resources does not meet the requirements of environmental management. Brought ecologically valid ratio of the area of arable land, natural grassland, forest and water areas that adversely affect the sustainability of the agricultural landscape, causing the degradation of soil and is a real threat to economic security in the agricultural sector.

Evaluation of indicators of ecological safety of agriculture of Ukraine for 2010-2015 are shown in table. 3.

Ukraine is the poorest of the water resources of Europe and is one of the regions with significant anthropogenic pressures on water sources and lack of sufficient fresh water. The coefficient of purity of the water used in agriculture is very low – 0,01. The coefficient of water use efficiency is also low, at 0,1, besides, tends to decrease. Under the influence of chemicals in agricultural production, land drainage, water resources are undergoing significant changes. In river basins reduces the sustainability of natural landscapes, disturbed the balance in ecosystems and degrade surface water quality, with the result that rivers have lost their natural self-cleaning ability.

Pollution, reduced biodiversity, under irrigation with water of poor quality occurs salinization, reduced crop yields, with the watering of the cattle with contaminated water by 40-70% reduced productivity in livestock, deals heavy damages and fisheries where the commodity deteriorates the quality of the fish die young and forage organisms [10].

About the deterioration of the ecological and technological status is confirmed by the fact that the area of agricultural land, which were made of mineral fertilizers, is almost 37 times larger than the area of land fertilized with organic compounds.

Now most countries are trying to reduce the negative environmental impacts of farming, translating agricultural production on organic principles of growing of crop production. Ukraine has also introduced organic farming.

According to the Federation of organic movement of the area of certified agricultural land in Ukraine under cultivation of

organic products amounts to more than a quarter of a million hectares, and the state ranked 21st among the world leaders of the organic movement [11].

Table 3

Indices of ecological safety of agriculture of Ukraine						
Indicator	2010	2011	2012	2013	2014	2015
The coefficient of purity of the water used	0,01	0,01	0,01	0,01	0,01	0,01
The coefficient of water use efficiency	0,11	0,10	0,09	0,10	0,10	0,09
The coefficient of ecological stability of land use, points	0,40	0,40	0,40	0,39	0,39	0,40
Coefficient of anthropogenic load	3,53	3,52	3,52	3,53	3,53	3,53
Coefficient of atmospheric pollution	8,20	8,70	8,00	7,70	7,70	7,69
The level of tilled soil farmland	78,1	78,2	78,3	78,3	78,3	78,4
The ratio of capital expenditures on environmental protection	0,51	0,57	0,24	0,35	0,35	0,33
The ratio of current expenditures on environmental protection	0,49	0,43	0,76	0,65	0,65	0,65
The ratio of costs for air protection	0,01	0,01	0,02	0,01	0,01	0,01
Number of employees industry agriculture, working in conditions not meeting sanitary-hygienic norms, thousand people	47,7	42,5	42,5	36,9	36,9	36,8
% to the account of payroll employees in the industry	8,3	8,7	8,7	8,7	8,7	8,7

The coefficient of ecological stability is one of the criteria of efficiency of land use. During the last five years on the territory of Ukraine, environmental stability is characterized by a low level of 0.40. You must also consider that the number of objects technological security include production, storage, disposal and destruction of potentially dangerous products (radioactive, chemical, biological, explosive) used in the defense and civil systems, but the withdrawal of the operating status of compliance with the process safety requires significant resources (for nuclear materials and facilities, the cost of decommissioning may exceed 3-5 times the cost of their creation and commissioning).

There is a food and environmental threat from the use of genetic modification in domestic agricultural production. The key issues that can lead to GMOs are considered: violation of biological balance through displacement of transgenic plants of existing species, which threatens the extinction of plants, animals and insects that depend on them; the lack of long-term systematic studies of the effect of GMOs on human health and the environment; uncontrolled discharge in the food is harmful GM ingredients, which could threaten human health [12].

#### 5. Conclusion

The global importance of environmental threats appears to be a determining and guiding factor in the development of international relations and changes in the geopolitical situation.

They operate by their own laws and interacting, able to broadcast synergistic effects in the future. Through this threats of natural and technogenic areas in the short term can become dominant.

Directions of development of ecological and technogenic safety of the state proposed to define [12]:

- controllability and predictability of the development of high-tech complex;
- scientific and technological activities and professional education;
- information and communication technology;
- environmental technology;
- industrial and agricultural production on the basis of the latest technologies and techniques;
- energy use of promising and innovative technologies and resources;
- combined transport infrastructure, diagnostics and monitoring of the technological infrastructure;
- the production and disposal of radioactive, chemical, biological and explosive products;
- military-technical cooperation;
- system protection high-tech facilities from accidents and disasters.

Analysis of the global and internal threats to ecological and technogenic safety of Ukraine has shown that there is a large number of them and the urgent need to engage in at least their neutralization. In the man-made aspect of our country added the threat of military action in the East of the country. In environmental aspect the biggest challenges – agriculture and deforestation, especially in the Carpathians. Therefore, the relevance of eco-anthropogenic component of national security as a state in whole and its regions, is undeniable, as this security is associated with the survival of the population and the future of the state as a whole.

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