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**SECURITY OF THE XXI CENTURY:
NATIONAL AND GEOPOLITICAL ASPECTS**

Collective monograph

In edition I. Markina, Doctor of Sciences (Economics), Professor



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METHODOLOGICAL BASIS FOR ENSURING THE ENVIRONMENTAL SECURITY OF THE TERRITORY

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One of the components of the national security of the country is environmental security. This category can be considered in global, regional and local contexts. Ensuring environmental security consists in providing environmental balance and protecting the environment where the population of Ukraine lives. Therefore, there is a need to maintain a balance between human existence and potential risks of environmental hazards.[1].

An essential element of studies on environmental security is defining the concept of environmental risk, which until now has been interpreted ambiguously. In a broad sense, risk (R) is the value defined in monetary units and is calculated as the product of the probability of the risk situation (P) and the value of the possible environmental and economic damage from it (Y)[2,3,4,5,6].

Many authors consider that not only the public health risks, but also a number of other types of risk refer to the environmental risk issues. In particular, S.I. PyrozHKov [7] distinguishes the following types of environmental risk: 1) the risk of natural systems destruction; 2) public health risk; 3) the risk of man-made systems for a particular industrial enterprise; 4) risk of natural resources management; 5) the risk of natural disasters; 6) the risk of regional military conflicts; 7) the risk of environmental terrorism.

Environmental security is achieved by a system of measures (forecasting, planning, advance preparation and implementation of a set of prevention measures) providing the minimum level of adverse effects of nature and the technological processes of its resource development on the human health and activities while maintaining sufficient rates of development of industry, communications and agriculture.

According to Schmal A.G. [8], the environmental security system includes three main components, namely:

- integrated environmental assessment of the territory (identification and assessment of a complex of environmental hazards factors that occur in a given territory; zoning of a territory according to the degree of resistance to environmental hazards, compiling and maintaining the cadastre of environmental impact objects, determining the level of anthropogenic pressure, compiling and maintaining the

cadastre of “polluted” areas);

- environmental monitoring (standardization of environmental impacts, control of sources of environmental impact, quality control of environmental components);
- managerial decision-making (the formation of environmental policies; the prevention of manifestations of anthropogenic factors of environmental hazard; minimization of the consequences of natural factors manifestations of environmental hazard; the development and improvement of environmental legislation and methods for the formation of environmental outlook).

Figure 1 shows the algorithm of determining the environmental security level of the territory.

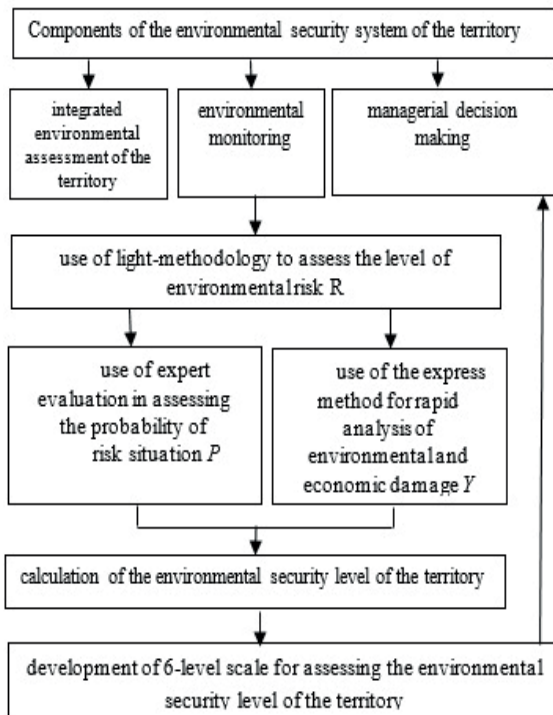


Fig. 1. Algorithm of determining the environmental security level of the territory

We suggest using the “light”- methodology of environmental risk assessment to monitor current values of environmental risk levels. This methodology provides analysis and assessment of environmental risks for quick respond and managerial decision-making in critical situations. For this, first of all, a high rate of risk assessment and pre-prepared options for action in various situations are needed. We suggest the use of expert evaluation in assessing the probability of a risk situation P.

Experts are suggested to assess (by point scale) the impact of environmental risk factors on a limited number of main recipients by the following parameters: frequency of manifestation; intensity of impact; losses for the last 5 reporting periods. In addition, experts consider 2 groups of recipients: objects of the business environment and objects of social infrastructure. In more detail the methodology is presented in [9].

Let us look closely on the determining the value of the environmental and economic damage Y. It is especially relevant in case of unpredictable emergencies. Environmental and economic damage from natural hazards at the global level is characterized by the following major trends:

- there is no a single region in the world, wherever the largest natural disasters occur;
- the total number of victims of the main types of natural disasters for 35 years amounted to 4,4 billion people, that is, 50% of the population of the planet;
- there is a relation between the level of socio-economic development of countries and the tendency for natural disasters.

In recent years, natural and man-made emergencies are characterized by an increase in environmental and economic damage. In addition, disasters not only pose a danger to the population, but can also create a long-term cumulative impact on the state of the environment of the region, the country and the planet as a whole.

The dynamics of occurrence of natural, man-made and social disasters on the territory of Ukraine over the past 10 years is shown in Figure 2. There is the dynamics of decrease in number of disasters from 2008 to 2013. A further increase in their number is caused by the unstable situation in the east of Ukraine [10]. Unfortunately, there is a steady tendency for an increase in damage from disasters, both natural and man-made, even against the background of a decrease in their number [11].

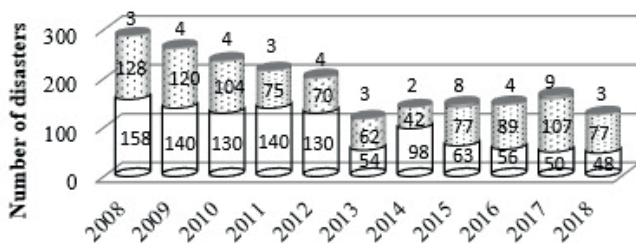


Fig. 2 . The number of natural, man-made and social disasters for the period 2008-2018 in Ukraine

It is suggested to use the express method for the rapid analysis of the environmental and economic damage from disasters with a minimum amount of

initial information. The assessment is carried out by the following stages: selection of the industry; determining the type of disaster; identification of the region where the incident occurred; determination of climatic conditions; determining the generalized characteristics of the active impact zone; defining the area of pollution; identification of the zone of active pollution; identification of recipients in the zone of active impact; determination of environmental and economic damage caused by an incident.

Environmental and economic damage from man-made disasters can be determined with the use of the concepts of damage per unit and the zone of active impact. The principle of calculation on determining the environmental and economic damage by the express method is reduced to the formula:

$$Y = \sum_{i=1}^n y_i \cdot Q_{reci} \cdot M_{cond} \cdot K_{regi},$$

where y_i – damage per unit caused to the i -th recipient (UAH/cond.ton*No. recip.); Q_{reci} – number of the i -th recipient in the zone of active impact [12].

$$Q_{reci} = \rho_{iZAI} \cdot SZAI,$$

$SZAI$ –area of zone of active impact (km²); ρ_{iZAI} – density of the i -th recipient in the zone of active impact (units/km²); M_{cond} – number of conditional emissions that affects the i -th recipient, (tonnes).

$$M_{cond} = \sum_{j=1}^m M_j \cdot A_j,$$

M_j – mass of the j -th emission (tonnes); A_j – indicator of the relative aggressiveness of the j -th substance in relation to the i -th recipient; K_{reg} – regional correction factor for the i -th recipient, that characterizes the deviation of territorial damage forming indicators from their average in Ukraine; n – number of types of recipients in zone of active impact; m – number of types of hazardous substances generated as a result of disaster.

$$K_{regi} = \frac{\rho_{iz}}{\rho_{iy}}$$

where ρ_e – density of i-th recipient in z-th region; ρ_{i0} – density of i-th recipient in Ukraine; i – recipient; z – region.

The matrix of indicators of damage per unit y can be developed by the results of their detailed calculation for each recipient by several hazardous objects located in these economic regions. The calculation of damage per unit was carried out on the basis of the “Methodology for assessing the damage from the consequences of man-made and natural emergencies” [13] that is approved at the state level. The level of detail of the damage per unit depends on the condition of the recipients, averaged over the regions of Ukraine. The algorithm for the implementation of the express method and the main calculation indicators are presented in the study [14].

Based on the suggested methods for calculating the probability of occurrence of risk situations (P) and the value of environmental and economic damage (V), we calculate the level of environmental security of the territory (country, region, city). We assess the level of environmental security of the territory by comparing the obtained value of environmental risk R and the value of weighted average risk for the studied territory Rt.

We suggest 6-level scale for assessing the environmental security level of the territory for managerial decision-making:

- A – (maximum level) more than 90%
- B – (high level) from 71 to 90%;
- C – (average level) from 51 to 70%;
- D – (acceptable level) from 31 to 50%;
- E – (insignificant level) from 11 to 30%;
- F – (neglected level) less than 10%.

Using an alphabetical scale for the assessment of the environmental security level of the territory has several advantages: simplicity of perception of the results; simplicity of relations of assessment results with specific management decisions and the necessary actions due to the results of assessment. An early warning system should be established for risks of A and B categories.

Thus, expert assessment methods and express methods are widely used while developing the programs for managing environmental security. The suggested methods can be used for quick and approximate assessment of damage due to risky situations, which will allow:

1. to study the most important environmental risk factors that may affect the vital activities of the global community;
2. to establish permissible risk thresholds, the violation of which leads to a decrease in the environmental security of the territory;
3. to develop the approaches for early recognition that will allow to quickly make adequate decisions in accordance with a certain level of environmental security of the territory;
4. to expand the international cooperation in searching ways for more effective

use of existing agreements, programs and institutions to solve the challenges of global environmental security.

For that reason, the prevention measures are necessary precondition for ensuring the environmental security of the territory. International experience shows that the costs of forecasting and readiness for natural disaster are almost 15 times less than the costs of eliminating the consequences.

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