Evaluation of the Work of National Nature Parks: an Integrated Approach

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Annotation: National nature parks are the most common nature reserves in the world. These include protected areas that are part of the nature reserve fund of Ukraine. They allow free access to tourists. Usually, national parks preserve the historical and cultural heritage of the region, as well as are unique natural areas with picturesque nature. In Ukraine, 56 national nature parks have been created, covering an area of 1,399,161 hectares, which is 31% of the total area of the nature reserve fund. It is important to evaluate the work of national parks, to create a kind of a rating of these environmental institutions. There are different approaches to assessing the work of environmental institutions and methods that make it possible to assess the environmental safety of an enterprise. To determine the socio-ecological and economic assessment, we have adopted a methodology that allows us to consider the problems in the complex at each hierarchical level (micro-, meso-, macro-), identify risks of eco-destruction, forecast environmental changes under the influence of economic activity, assess economic opportunities development and ensuring acceptable quality of living conditions of people, human development under natural resource and environmental constraints. To calculate the proposed method, 9 indicators were used, which standardized and separately calculated the ecological status, socio-demographic status and economic status of national nature parks, as well as a comprehensive indicator. Calculations were made according to the proposed method for 2013. It was established that 4 parks have a high level of socio-ecological and economic security - Holosiivskyi, Buzkyi grad, Dermansko-Ostrozkyi, Vyzhnytskyi, sufficient – 17 parks, low – 18, critical – 3 parks (Podilsky Tovtry, Dvorichansky, Kremenets Mountains).

Keywords: National Nature Parks, Socio-Ecological and Economic Security of the Park, Comprehensive Assessment of the Park.

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Introduction

The term «national park» first appeared in the United States, where it originated in the second half of the XIX century. Today, the national nature park is the most common nature reserve in the world. In Ukraine, the first national nature park (Carpathian) was established in the Ivano-Frankivsk region in 1980 on an area of 50,300 hectares. The number of parks began to grow in the 1990s, when legislation was drafted. To date, 56 national nature parks have been created in Ukraine, covering an area of 1.4 million hectares, which

is 31% of the total area of the nature reserve fund of Ukraine. Parks are actively working on the tasks: environmental protection, creating conditions for tourism development, conducting research and environmental education (Law of Ukraine, 1992). It is important to evaluate the work of national nature parks, especially to conduct a comprehensive assessment, as parks are public institutions and, accordingly, along with environmental and social functions, conduct economic activities.

Literature review

Today, when conducting a comprehensive assessment of the work of national nature parks, special attention should be paid to the environmental safety of the nature protection institution. The main approaches that can be used in this case may be:

- indicator, which is based on a system of indicators that describe the state of various components and levels of environmental safety;

- resource, which takes into account the efficiency of the available resources of the park.

This approach allows to identify their level by determining the most efficient use of resources necessary for the functioning of the system, which on the one hand allows to achieve the goals, and on the other - does not lead to loss of economic stability of the system and does not lead to environmental minimizes environmental risks;

- effective, in which the criteria are to reduce costs and losses associated with the destructive effects of the park on the environment;

- systemic, which allows to combine all of the above, but has a significant advantage as a research tool, as it allows to consider environmental security as a complex integrated system, to identify internal and external links, development problems.

There are enough developments that make it possible to assess the environmental safety of an enterprise. It is proposed to determine on the basis:

- general economic effect of a set of environmental measures, including averted economic losses from environmental pollution; increase in economic (monetary) valuation of natural resources as a result of their conservation or improvement; increase in sales revenue from full utilization of raw materials, reduction of negative impact on the environment (NPS), saving and preventing loss of natural resources, improving

environmental comfort, living conditions, human well-being, their health, meeting intangible human needs, maintenance of ecological balance (V.K. Zbarsky, 2008);

- integrated criterion of averted economic damage and additional income from the greening of production, proposed (S.M. Smirnaya, 2006);

- analysis of the dynamics of pollution by enterprises of the natural environment, proposed (V.A. Shpylovy, 2006);

- integrated indicator of the general level of environmental safety of the enterprise, which is based on three partial integrated coefficients: environmental damage; the impact of economic factors; the impact of environmental and economic factors (Y.V. Radevich, 2017);

- security of basic business processes using the generalized desirability function (I.V. Fedotova, 2017);

- integrated criterion, which includes the following components - ensuring health and normal human life, conservation, reproduction and productivity of natural resources of the agrosphere, balanced development and sustainability of agroecosystems (O.I. Shkuratov, 2016).

At the same time, the use of different methods of assessing the environmental safety of the enterprise:

- component, which involves identifying factors and relevant indicators that affect the level of environmental safety of the enterprise;

- index, which allows to correlate the indicators in one set, to measure the impact of individual factors on the generalizing (complex) indicator. Group and integrated indices should be used in assessing the environmental safety of enterprises. The first allows to assess its specific aspect, represented by homogeneous elements. They can be summarized, which makes it possible to obtain an aggregate assessment of environmental safety of the enterprise. This aggregate assessment is compared with its maximum possible value and on the basis of certain deviations one can get an idea of the level of environmental safety of the enterprise;

- expert (score), which is based on environmental certification and certification of the management system, which consists in assessing the environmental safety of the enterprise with the involvement of experts, as the use of statistical methods is impossible. Assessment

of environmental safety of the enterprise is carried out on the basis of qualitative determination of the probability of occurrence of risk events and the study of factors that affect it;

- rating, which is used in assessing the environmental safety of several enterprises and determines the position of each of them in the overall rating on the basis of a single integrated indicator; allows to evaluate the results of activities for a certain period (assessment of the dynamics of development) and compare its position in the ranking among other objects;

- comparative analysis based on comparing the values of individual groups of similar indicators of environmental safety with each other. The most common are comparisons with industry-wide environmental safety indicators, comparisons with competitors' environmental safety indicators, comparisons of reporting and planned environmental safety indicators;

- balance, which provides for the formation of material, raw materials, energy balances for the enterprise as a whole, individual shops, sections, technological processes;

- normative, based on the application of scientifically sound standards of consumption of raw materials, energy, specific norms of waste generation within the adopted policy of enterprise resource management or resource security policy;

- instrumental, which involves the use of the results of measuring the qualitative and quantitative characteristics of emissions of pollutants using certified devices and approved methods of analysis;

- estimated, which provides a quantitative assessment of environmental safety based on a system of indicators obtained both theoretically and empirically.

These methods are the basis of approaches to assessing the level of environmental safety. Despite the differences in the application of different systems of indicators and indicators, the fundamental difference is determined by the criterion underlying the methodology. Such techniques are:

- methodology based on the calculation of possible damage to the population and natural objects;

- methods of direct measurement of the level of environmental safety;

- comparative methods, which provide for the comparison of the actual level of pollution with standards, with a loss from the activities of other economic systems;

- method of absolute assessment of the level of environmental safety, based on the calculation of damage to the population and NPS in a certain area for a certain period of time;

- method of relative assessment of the level of environmental safety of the enterprise, which involves determining the contribution of the enterprise to the total pollution of the NPS.

The synthetic approach is based on the system of socio-ecological and economic security of an enterprise, the methodological foundations of which have been developed (Cherchik LM 2016). risks of eco-destruction, make forecasts of changes in the natural environment under the influence of economic activity, assess opportunities for economic development and ensure acceptable quality of living conditions of people, human development with natural resource and environmental constraints. The paper (KOLENDA NV, 2013) defines the basic provisions of the concept of forming a system of socio-ecological and economic assessment of objects:

1. The economic system is a component of social system, its security subsystem, so economic activity should be aimed at producing socially useful goods and services, ensuring material prosperity, well-being, comfort and security of people, which is possible not only with high economic, but also social and environmental safety.
2. The social system is formed and developed within the natural system. Their interaction deforms the natural system and creates a certain ecosystem, the quality of which is dynamic and largely determined by human economic activity, i.e. there is a close relationship and interdependence between them, which necessitates preservation of ecosystems, prevention of degradation and therefore environmental security.
3. The ecological system is the environment of the population, largely determining the quality of life, as well as the environment of economic activity, which draws on natural resources, uses spatial and assimilation potential, which are limited and therefore require efficient use, and thus requires finding innovative

technologies. technological and managerial solutions to ensure a high level of man-made, as part of economic security.

E.C. Harrington in his work (The Desirability Function. Industrial Quality Control, 1965) studied the effect of quality control system on the state of biodiversity and desirability function. The scientist believes that effective control is the right method to prevent or reverse harm to the global ecosystem.

The authors A. Yakymchuk, N. Popadynets, A. Valyukh, T. Skrypko, K. Levkov in their scientific work (Rural "green" tourism as a driver of local economy development in the process of decentralization of power, 2021) emphasize that the natural resources of the nature-preserves remain invaluable financially, as a result of which the economy loses its income every year. These scientists confirm the thesis of ecologically balanced tourism, which should be developed in national nature parks and other categories of nature-protected fund. It is tourism that is able to bring significant revenues to the budgets of local communities. It is also a tool for economic development. The analysis of the works showed that each of them takes into account the influence of factors specific to a particular area, direction of activity, a certain aspect of safety, the level of the object of study. For enterprises of the forestry industry, L.M. Cherchyk proposed her own approach to the assessment of environmental and economic safety (Cherchyk L., 2019), which is based on the choice of performance indicators of enterprises, their standardization and calculation of relevant indices.

Methodology

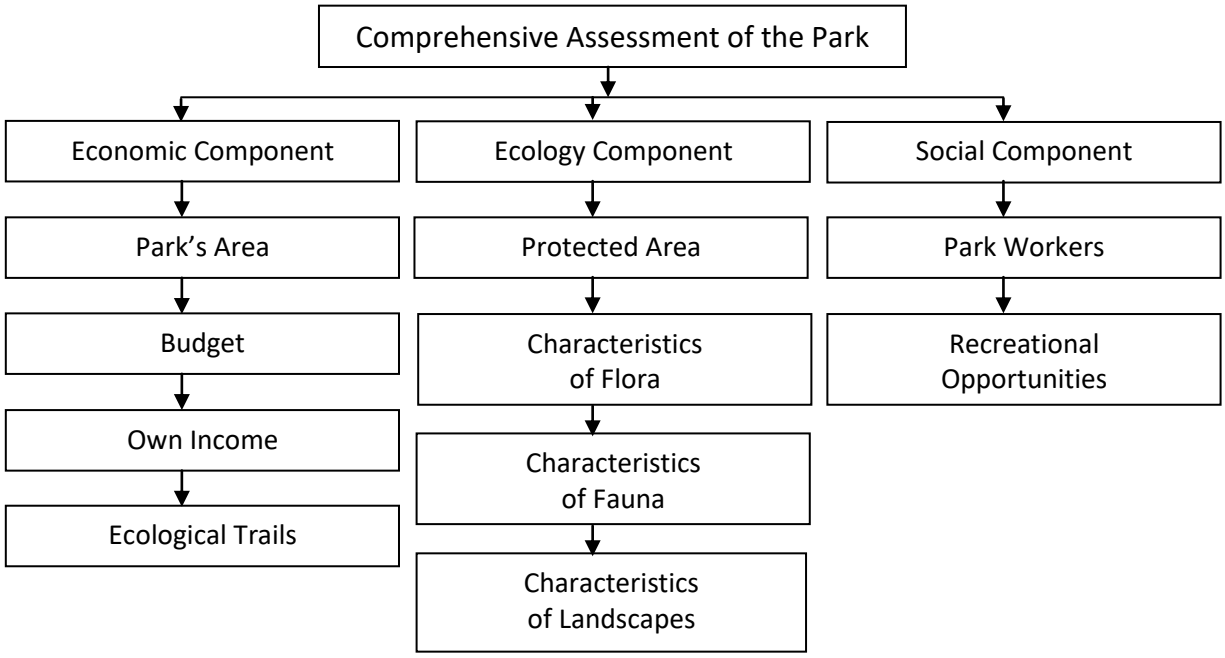
The methodological basis of the study is the publications of domestic and foreign scientists in the field of nature reserves and environmental protection. The methodological basis of the study is the publications of domestic and foreign scientists in the field of nature reserves and environmental protection. We have used a new synthetic approach to study the work of national nature parks, as a set of the following scientific approaches: system-structural, process, institutional, hierarchical and functional. The economic system is a component of social, its security subsystem, so economic activity should be aimed at producing socially useful goods and services, ensuring material prosperity, well-being, comfort and security of people, which is possible not only with high economic, but also social and environmental security. The social system is formed and developed within the

natural environment. Their interaction distorts the natural system and creates a certain ecosystem, the quality of which is dynamic and largely determined by human economic activity, i.e. there is a close relationship and interdependence of each of them, which necessitates preservation of ecosystems,as well as prevention of degradation and therefore environmental safety.

In Ukraine, when zoning national natural parks, four zones are distinguished: a protected zone, a zone of regulated and stationary recreation, and an economic zone. In the protected zone, any economic activity is prohibited, it is impossible for tourists to visit natural objects there, the protection regime must be strictly observed there. Such zones can partially be used for educational work, educational activities among schoolchildren and young people, students, based on the observance of ecological paths. Many researchers and scientists pay attention to this (Polsun J., 2017; Yakymchuk A., 2021).

The ecological system is the living environment of the population, largely determines the quality of life, as well as the environment of economic activity, which draws on natural resources, uses spatial and assimilation potential, which are limited and therefore require efficient use, amd thus requires innovative technological management decisions to ensure a high level of man-made, as part of economic security.

Figure 1. Comprehensive assessment of the work of the national nature park.



Source: own research.

Our analysis of the work of national nature parks made it possible to identify the following features:

- economic security – protection of economic interests from possible threats; sustainability and stability of the park, which is realized through ensuring a decent standard of living for employees; the possibility of development that allows to quickly adapt to internal and external threats;
- social security – dependence on personal needs, interests and desires of park employees; focus on avoiding, preventing, reducing threats and risks to the social component of public life; focus on the effective functioning, reproduction and development of the social system; focus on obtaining relevant results, including the comfort of living in society in all its aspects;
- environmental safety - preservation of nature reserves; protection of interests from threats caused by natural and anthropogenic factors; ensuring the reproduction of natural resource potential; guarantee of minimal anthropogenic impact; maintaining health and ensuring safe living in the NPC.
- Components of socio-ecological and economic security:
- environmental – safety of living conditions and the absence of environmental risk as a guarantee of protection of nature reserves and the absence of hazards associated with the state of the environment;
- social – employment security, which will determine the guarantee of human employment; food security as an opportunity to buy and consume quality, safe food; housing security, the opportunity to improve their living conditions; safety of health, education, culture, recreation; economic – as a guarantee of preservation and improvement of the material condition of micro-, meso- and macro-level objects.
- The methodology for comprehensive NPP assessment should include:
    1. identification of groups of indicators that should be included in the assessment;
    2. definition of approaches to standardization of indicators;
    3. standardization of indicators in order to move to indices (for each group);
    4. definition of approaches to calculation of group indices;

5. assessment of environmental and economic safety of NNP by its main components (groups, indicators);
6. determination of the integrated indicator of socio-ecological and economic security;
7. verification of the reliability of evaluation results and formulation of conclusions.

The authors propose to use the following indicators to assess the socio-ecological and economic safety of national parks (Table 1).

Table 1. Indicators of assessment of socio-ecological and economic safety of the park

Criterion	Indexes
Ecology	Number of plants listed in the Green Paper
	Number of plants listed in the Red Book
	Number of animals listed in the Red Book
Economy	The area is provided for use
	The cost of maintaining the park in total
	Own income
	Number of tourist routes
Social	Number of employees
	Number of visitors to the park

Source: own research.

To standardize the indicators taking into account the environmental criterion, the authors proposed to take into account:

K_{1i} – is the share of the number of plant groups KPZK_i, listed in the Green Paper per 1000 ha of park area F_i, provided to it for permanent use:

(1) $$K_{1i}=\frac{\mathrm{KPZK}_i}{F_i} * 1000$$

K_{2i} – specific weight of the number of plant groups listed in the Red Book KRChK_i per 1000 ha of park area F_i, given to him for permanent use:

(2) $$K_{2i}=\frac{\mathrm{KRChK}_i}{F_i} * 1000$$

K_{3i} – is the specific weight of the number of animal species KTChK_i. listed in the Red Book of Ukraine per 1000 hectares of park area, provided for permanent use.

(3) $$K_{3i}=\frac{\mathrm{KTChK}_i}{F_i} * 1000$$

To standardize the indicators, taking into account the economic factor, we calculated:

K_{4i} – total maintenance costs of the park BB_i, per 1000 ha of the park F_i, provided for use:

(4) $$K_{4i}=\frac{BB_i}{F_i}*1000$$

K_{5i} own revenues OR_i per 1000 ha of park F_i, provided for use:

(5) $$K_{5i}=\frac{OR_i}{F_i}*1000$$

K_{6i} – the number of tourist routes in the park KM_i per 1000 ha of the park F_i, provided for use:

(6) $$K_{6i}=\frac{KM_i}{F_i}*1000$$

K_{7i} – the share of own revenues OR_i y in total costs BB_i in maintenance of the park:

(7) $$K_{7i}=\frac{OR_i}{BB_i}$$

K_{8i} – is the ratio of the park area F_i, provided for own use to the total park area FB_i:

(8) $$K_{8i}=\frac{F_i}{FB_i}$$

To standardize sociological indicators were calculated:

K_{9i} – the amount of park area F_i, provided for use based on the number of employees in the park KP_i

(9) $$K_{9i}=\frac{F_i}{KP_i}$$

K_{10i} – the number of visitors to the park NV_i, per 1000 ha of park area F_i, provided for permanent use:

(10) $$K_{10i}=\frac{NV_i}{F_i}*1000$$

where *I* – serial number of the park.

The assessment of the ecological state of NNP can be determined taking into account the indicators of ecological state of NNP development P_i, their relation to the maximum indicator P_{maxi}, which is among NNP of Ukraine and taking into account the importance of this indicator γ_i.

(11) $$I_{ES}=\sum_{i=1}^{k}\frac{P_i}{P_{maxi}}\gamma_i$$

Assessment of the economic condition of the NNP :

(12) $$I_E = \sum_{i=1}^{n} \frac{E_i}{E_{maxi}} \alpha_i$$

where E_i – indicators of the economic condition of the NNP, E_{maxi} – the maximum indicator of the economic condition, α_i – the weight of the indicator.

We determine the assessment of socio-demographic status by the formula:

(13) $$I_{SDS} = \sum_{i=1}^{m} \frac{C_i}{C_{maxi}} \beta_i$$

where C_i – is the indicator of socio-demographic status, C_{maxi} – is the maximum value of the indicator of socio-demographic status, β_i – the weight of the indicator of socio-economic status.

Then the assessment of the socio-ecological-economic state of development of the national nature park is an integral characteristic of the state of the economic system, as the system includes a number of subsystems – social, environmental, economic components. That is:

(14) $$I_{NPP} = I_E + I_{SDS} + I_{ES.}$$

where I_{NPP} – integrated assessment of socio-ecological and economic condition of the National Nature Park, I_e – assessment of economic condition of NPP, I_{SDS} – assessment of social status, I_{ES} – assessment of ecological and recreational condition.

The model for determining the integrated indicator of environmental and economic security will work as follows: group indices are defined as the sum of individual indices divided by their number; The integral index of environmental and economic security of the enterprise is defined as the sum of group indices divided by their number. The results of the interpretation of the assessment imply the transfer of quantitative indicators to the qualitative safety of the feature (high, sufficient, low, critical).

Results and discussion

The higher the value of the integrated indicator, the higher the level of environmental and economic security of the enterprise. Based on the desirability function (Harrington, 1965), thresholds set out levels of environmental and economic security. The classic Harrington scale assumes a distribution of 5 level attribute quality: very high

1.00-0.81; high 0.80-0.64; enough 0.63-0.38 ; low 0.37-0.21; critical 0.37-0.21. S. Dovbnya, N. Gichova (Dovbnya S.B, Gichova, N.Yu., 2008) used a scale of four levels, which we took as a basis (Table 2). To use this scale of intervals, we use the given estimates to the maximum value.

Table 2. Scale of intervals of indices for levels of socio-ecological and economic assessment of the enterprise

Level of assessment	Values of indicators
High	1-0.75
Sufficient	from 0.75 to 0.5
Low	from 0.5 to 0.25
Critical	Less than 0.25

Source: (Dovbnya SB, Gichova N.Yu.. 2008).

Calculations of socio-ecological and economic security of all national parks of Ukraine, according to their activities in 2013 (Reserves and National Parks of Ukraine in 2013, 2014). The assessment of the socio-ecological-economic state of development of national natural parks and the assessment of the ecological, socio-demographic and economic state of the NNP are determined to the maximum value. The following values of weights were taken into account in the calculations

1=2=3=0,33
1=2=3=4=5=0.2
i=i=0.5.

Under such conditions, it was determined that 3 parks have a high level of socio-ecological and economic security – Holosiivskyi, Buzkyi grad, Dermansko-Ostrozkyi, sufficient – 10 parks, low – 26, critical 3 parks (Podilsky Tovtry, Dvorichansky, Kremenets mountains). In the table 3 the rating of the national natural parks of Ukraine has been given with the scores calculated according to the methodology proposed by the authors. (Table 3).

Table 3. The Results of assessment of the socio-ecological and economic state of development of National Natural Parks

High	Sufficient	Low	Critical
Holosiivskyi (1,00) , Buzkyi grad (0,84), Dermansko-Ostrozkyi (0,76)	Vyzhnytskyi (0,74), Holy Mountains (0,7) Velykyi Luh (0,62), Halytskyi (0,61), Azovo-Syvashskyi (0,61), Charivna Havan' (0,56), Pryazovskyi (0,55), Prypiat-Stokhid (0,52), Karpatskyi (0,51), Meotyda (0,5),	Yavorivskyi (0,48), Biloberezzia Sviatoslava (0,46), Gutsulshchyna (0,46), Zacharovanyi Krai (0,44), Shatskyi (0,43), Uzhanskyi (0,42), Desniansko-Starogutskyi (0,42), Cheremoshskyi (0,42) Pivnichne Podillia (0,41), Tuzlovski Lymany (0,41), Nyzhnosylskyi (0,41), Pyriatynskyi (0,41), Homilshanski Lisy (0,39), Verkhovynskyi (0,39), Karmeliukove Podillia (0,38), Nyzhniodnistrovskyi (0,37), Synevyr (0,36), Dzharylhatskyi (0,35), Mezynskyi (0,35), Dnistrovskyi Kanion (0,34), Skolivski Beskydy (0,32), Hetmanskyi (0,32), Khotynskyi (0,31), Oleshivski Pisky (0,29), Ichnianskyi (0,27), Slobozhanskyi (0,25)	Podilsky Tovtry (0,24), Dvorichansky (0,22), Kremenets mountains (0,19)

Source: own work based on the proposed methodology.

In addition, the ecological, economic and socio-demographic results of the maximum assessment of the state of development of each park were determined. Thus, the ecological assessment is the highest in Derman-Ostroh Park (0,76), socio-demographic – NPP „Holy Mountains" (0,7), economic – NPP "Vyzhnytskyi" (0,74). Since parks have their own zoning, regulation within these zones is necessary today. According to research by practitioners of biodiversity conservation, for effective protection of biodiversity, it is necessary to preserve at least 10% of the area of a certain ecosystem, biome, natural zone, landscape, plant group. In the national natural parks of Ukraine, the regime favorable to the preservation of biodiversity and landscapes is maintained only within the protected areas. Accordingly, for the preservation of landscapes and biodiversity, for example, forest-steppe and steppe pines, it is necessary that at least 10% of the entire area of this type of landscape should be included in the protected areas of national natural parks.

Summary, recommendations

The proposed approach to the socio-ecological and economic assessment of the work of national nature parks provides an opportunity for the park to assess the state of affairs and identify ways and prospects to improve its work. The assessment of the results of the park's activity includes the work of the national park according to three groups of indicators (ecological, social and economic) and takes into account 10 parameters of the park's work. A high rating of the park's work will be in the case when high group indicators are achieved. Such an author's approach is comprehensive and will help the park identify weaknesses and seek solutions to these problems. When designing and operating parks, it is necessary to take into account their zoning. The most important is the protected zone, where rare species of flora and fauna are preserved. Such zones should be quite large compared to the area of the park and commensurate with them at least 10-20% of the total territory of each individual park. There is no unified system of functional zoning of national natural parks in the world, although most environmental protection organizations dealing with these issues in different countries of the world refer to the recommendations of the International Union for Conservation of Nature (IUCN). In one of the reports of this organization, it is stated that in order to objectively combine the functions of nature protection and preservation of biodiversity and meeting the recreational needs of people, zones are created in which various management goals are established and the intensity of economic activity changes naturally.

The proposed approach provides an opportunity to evaluate the ratings of the park by a separate group of indicators. It is advisable to make such an assessment for each year, as there are indicators (economic status) that change every year. It is important to form a rating of parks, which would provide an opportunity to assess the effectiveness of each team. This is a common task of the country in global environmental policy. To this end, mechanisms and approaches have been developed to identify, confirm and monitor the state of national parks in the general system of nature protection. However, for most of the last 30 years, the debate has focused on conservation goals and focused on meeting the demand for funding for conservation programs and strategies, ie finding investment to activate certain conservation mechanisms and expand them to broader programs. There are many joint projects and grant programs between Ukraine and Poland that help

preserve the unique natural heritage and biodiversity of national parks. They are a significant financial incentive for nature conservation. In modern conditions, only significant investments in national natural parks of Ukraine will help preserve these valuable places for future enerations.

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