

The regional determinants of developing the net of specially protected natural areas

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Abstract— The article examines the possibilities of using the networks approach in organizing the regional structure of specially protected natural areas (hereinafter referred to as SPNAs). The authors propose ways for improving traditional ways of identifying and evaluating the most important and valuable areas to ensure their protection. The modern state of objects with the assigned conservation status on the territory of Volgograd region have been analyzed in order to develop ways for maintaining their stable functioning. The authors pay special attention to creating the evaluation system, to clarifying the content, to analytical understanding of the processes in building vertical management, that ensures the unity of regulatory methods throughout the net space. They have also analyzed the role of cadastral registration, which is viewed as a system of ordered and regularly updated data, and which is necessary not only to ensure the target functionality of SPNAs, but also for land management, zoning, urban development, that is, in all cases connected with the use of natural resources and environmental impacts. The authors have developed a scheme of work organization in forming the net structure of SPNAs in the region and the structure of the evaluation matrix of the regional SPNAs.

Keywords — *specially protected natural areas, potential evaluation, cadastre case, networks approach, zoning*

I. INTRODUCTION

Increased attention to managing the specially protected natural areas in regions is steadily associated with working laws of ecodevelopment, which can not be ignored in the current environmental conditions.

As a result of the current state policy, in recent years protection imperatives have been established for many territories in order to preserve the ecological model of regions and the functionality of ecosystems, but limiting the anthropogenic impact on such territories often leads to disbalance of administrative and economic interests at different levels of state regulation.

The presence of the territories with different levels of significance (federal, regional, local territories) within the boundaries of the same region does not provide an opportunity to determine the common content, purposes and objectives for managing both such territories and the administrative entities within which the territories are located.

For scientific research all aspects of studying this problem are in demand nowadays. There are many unresolved problems remained despite many years of methodological, methodical and applied work experience in the field of researching regional determinants of forming the system of specially protected natural areas (hereinafter referred to as SPNAs) and their management mechanism. In particular, the complex of relations arising in the process of creating, functioning and developing SPNAs in regions has not been fully explored until now. The value of the territories is not always correctly determined while assigning a conservation status. And in some cases unified approaches and ways of improving management systems for such territories have not been worked out or they are poorly described in the scientific literature.

II. MATERIALS AND METHODS (MODEL)

Today the scientists have formed the basic directions, fully reflecting the accumulated interdisciplinary and intersectoral experience of specialists and scientists studying the classification and typification of SPNAs; organization of activities, management of the SPNAs system and their individual types; cadastral registration and planning of development of SPNAs nets; financing of SPNAs; coordination of SPNAs regulation by authorized authorities at different levels; organization of scientific activities on the territories of SPNAs, etc.

The implementation of the accumulated experience is now extremely necessary in realizing the networks approach to

organizing SPNAs, which allows preserving the value of natural complexes within individual regions in the long term.

The net formation assumes the identification of all the most important and valuable territories for conserving the territory biodiversity and the provision of their protection within the framework of a single functionally and territorially related system [1]. Management of such a system can be based on the ecological and economic harmony of decisions made, regardless of subordination and location of the regulated object. Some scientists describe the formation of a single space on the basis of a single evaluating system, single content, an analytical understanding of the processes that allow us to build a vertical management meeting the priorities of sustainable development in their works [2, 3, 4, 5]. It is the single regional net of SPNAs that can become a testing ground for creating conditions smoothing down negative tendencies in the process of choosing economic preferences. And this regional net can ensure the implementation of more effective projects.

The process of identifying the most important and valuable territories in order to ensure their protection along with specifying the existing SPNAs boundaries and establishing the practicality of retaining the previously assigned conservation status to the territories that have lost their original value is the basis for forming the net of SPNAs at the regional level. In fact, this process is continuous and must be based on adequate sources of information and evaluation methods [6, 7, 8, 9].

One of the traditional procedures the results of which can be used to evaluate the current status of SPNAs is an inventory check. An inventory check as an element of primary observation makes it possible to confirm, clarify the actual presence, change, absence of objects or any of the qualities typical for them before. The inventory process makes possible to confirm the available information or to collect the missing information for cadastral registration; to detect the lack of environmental expert reports; not to use the economic methods for evaluating natural resources in the process of external and internal zoning; to identify the presence, preservation or loss of the characteristics which are the basis for assigning the conservation status and defining the category of territories; to collect the information about alternative ways of developing SPNAs and the possibility of their economic use in the defined status.

To clear the evaluation of the current state of SPNAs, it is advisable to supplement the traditional inventory procedures by measuring the absolute and relative values of some components that greatly influence the judgment about the possibility of natural objects economic development or about value that is not related to their economic use. Of course, the full list of such components is not limited, but for the purpose of disclosing the evaluation methodology, we will only present the most significant ones of them, for example:

- a set of natural resources according to the species that are known during the inventory period and which can be technically developed in the medium term (mono-purpose natural resources: minerals, fuel and energy resources, etc.);

- a set of multi-purpose and environment-forming resources which include water, forest resources, biodiversity and microclimate, as well as recreational, health, educational and scientific resources;

- the assimilation capacity of the territory, that is the maximum capacity of the SPNAs natural environment in the process of absorption, processing of emissions and waste without damaging the ecosystems state. It is supposed that evaluating the assimilation capacity will allow us to make an informed management decision in the conditions when the territory evaluation by the first two indicators is the same, or, conversely, the opposite [10].

We propose to carry out the evaluation of the listed components in points. The scale of received points will be from one to ten. Minimum and maximum points correspond to the minimum and maximum values of absolute or relative indicators which characterize natural, environment-forming resources and assimilation capacity.

The structure of the evaluation matrix of the regional SPNAs on the basis of three proposed components and a ten-point scale is presented in Table 1. The results of the evaluation allow identifying SPNAs with low, medium or high development potential, as well as the SPNAs, the conservation of which is not economically and environmentally proved. And their further use requires further preparation and adopting an alternative management decision.

If we use the intervals from one to five and from six to ten for selecting a group of objects when evaluating the selected components, according to the average component score it's possible to identify eight groups of SPNAs and to formulate the priority management objectives and work organization for each group.

Here is the list of possible types of work organization in the groups that have been formed: 1. works dealing with the remediation of the territory or closing down SPNAs; 2. the remediation or the change in the status of the SPNAs; 3. organizing the effective functioning and development of the territory; 4. organizing the effective functioning and development of the territory with a view to change the status of the territory; 5. preparation for the change in the status of the SPNAs, closing down SPNAs and active economic development of territories; 6. preparation for the change in the status of the SPNAs, closing down SPNAs and active economic development of territories, industrial and civil construction; 7. preparation for the change in the status of the SPNAs and development of the territory with applying a strict management regime; 8. preparation for the change in the status of the SPNAs [10].

If the list of evaluated components changes, the number of gradations will increase or decrease accordingly. This means that the number of groups increases or decreases and, consequently, the number of decisions made also varies. It should be noted that the qualitative and quantitative criteria for evaluating these indicators from two to nine points are established by experts and specialists in the relevant field of knowledge.

TABLE I. THE STRUCTURE OF THE EVALUATION MATRIX OF THE REGIONAL SPNAs

SPNA of the region	Number of Points								
	Natural Resource				Environment-Forming Resource				The assimilation capacity
SPNA 1	n^1	n^2	n^j	n^r	er^1	er^2	er^j	cp^r	AC
SPNA 2									
SPNA ...									
SPNA ⁱ									

^a The source: G. I. Starokozheva, E. N. Koronova, Fundamentals of forming and developing specially protected natural areas: the Publishing House of the Volgograd State University, Volgograd, 2006.

The calculation of the total number of points of the natural, environment-forming resources and the assimilation capacity of SPNAs can be presented by the following formula:

$$NA = \sum(NR_1+NR_2+\dots+NR_n)/n + \sum((ER_1+ER_2+\dots+ER_m)/m) + AC \quad (1)$$

where: NA – the total evaluation of a specially protected natural area, in points;

NR – mono-purpose natural resource evaluation, in points;

ER – multi-purpose and environment-forming resource evaluation, in points;

AC – the assimilation capacity evaluation, in points;

n – the number of registered mono-purpose natural resources for evaluation purposes

m - the number of registered multi-purpose or environment-forming natural resources for evaluation purposes [5].

It is possible to expand the empirical basis for making more specific programs for developing the areas taking an inventory according to the ten-point scale of evaluation by changing the number of intervals, for example, from one to two, from three to four, from five to six, and so on. The smaller the interval, the clearer are the signs of the evaluated territories, and thus it means that their individual characteristics and priority management objectives for each group can be determined more accurately and correctly [10].

Summarizing the given data, we should note that as a result of the inventory and evaluation we can collect the information about the actual state of the object in question at specific times. Completeness, scope and content of specific activities depend on the observation goals and objectives, subsequent processing and generalization of data.

The final stage of primary monitoring is the systematization, description and registration of the collected information in documents. For this purpose, the Ministry of Natural Resources of the Russian Federation has established the requirements for maintaining state cadastral registration in relation to SPNAs. The cadastral cases of SPNAs are, in fact, a collection of systematic and regularly updated data necessary for managing SPNAs and ensuring their targeted functionality. The cadastral information is intended not only for making managerial decisions regarding SPNAs, but it also should be taken into account when planning the development

of administrative territorial entities: land management, zoning, urban development, that is, in all cases related to the use of natural resources and environmental impact.

III. RESULTS AND DISCUSSION

The identification of areas which are most important for establishing the security arrangement is only the initial link while using the networks approach to forming the SPNAs regional structure. The single regional chain of SPNAs should be formed according to the principles of spatial, functional, organizational unity within the framework of a united management system. In the process of implementing these principles, there are quite objective difficulties associated with existing conceptual, social, economic, administrative contradictions regarding the establishment, consolidation of basic functions, organization and regulation of activities, the strategy of the SPNAs development.

It is essential that the net of SPNAs is formed in order to ensure sustainable development of the regions. And this fact leads to the principal contradiction, which is based on the need to protect the natural environment in order to maintain their environmental, resource, assimilation capacity and the need to use them for economic purposes. The networks approach should ensure the formation of the single framework for interconnection of all SPNAs categories, regardless of their subordination. For this purpose, the net must have a sufficient size and a variety of protected natural components, which allow providing a self-sustaining effect for a long time taking into account the permissible regime of anthropogenic impact.

Some researches seem to be convincing. They are the studies where the authors state that the net effective development is possible while creating an ecological framework, when the SPNAs area make up 25-60% of the area taken as a planning unit [11]. At the same time, they also distinguish central zones that fulfill the basic objective functions, and transit zones that provide interconnections of the central zones and protection zones that prevent external negative effects on the first two zones.

Let's consider the potential use of a networks approach to the SPNAs organization, having studied the SPNAs current state in Volgograd region. In this region the continuous work to create objects with the special conservation status has been carried out for more than forty years.

According to the official information of the Committee for Natural Resources, Forestry and Ecology of Volgograd Region, cadastral cases had been formed by the beginning of 2017 and sixty-one natural objects with a conservation status had been registered with the cadastral registration.

In table 2 the specified objects are grouped according to their status and levels of significance. As can be seen from the table content, SPNAs of six statuses have been established within one region. There are differences in defining the purpose of their creation and their value, the regime of protection and use for the territories of each status.

According to the SPNAs significance there are three levels of SPNAs in Volgograd region. They are federal, regional and

local specially protected natural areas. The area of federal protected areas in the total area of SPNAs is 0.21% (2,051 ha), regional ones account for 99.65% (998,195.5 ha) and the local SPNAs make up only 0.14% (1423.2 ha). In terms of the number, the share of protected areas of federal significance in the total number of SPNAs in Volgograd Region was 7%, the areas of local significance accounted for 8%, and the ones of regional significance made up 85% in 2017 [12].

TABLE II. THE GROUPS OF VOLGOGRAD REGION SPNAs ACCORDING TO THEIR STATUS AND LEVEL OF SIGNIFICANCE FOR THE BEGINNING OF 2017

Status of SPNAs	The Level of Significance, Number		
	<i>federal</i>	<i>regional</i>	<i>local</i>
Nature Parks		7	
State nature sanctuary		8	1
Natural monuments	4	18	2
Especially valuable areas		18	
Protected landscape		1	1
Protected stream systems			1
Total:	4	52	5

^b Source: Cadastral Cases of SPNAs

If we consider the levels of significance according to the SPNAs status, we can see from table 2 that nature parks have only regional significance. Nature sanctuaries have regional and local significance; natural monuments have all three levels of significance; especially valuable areas have only regional significance; protected landscapes are of regional and local significance; protected stream systems have only local significance.

TABLE III. LOCATION AND THE TOTAL AREA OF STATE NATURE SANCTUARIES OF VOLGOGRAD REGION

<i>The Name of a Sanctuary</i>	<i>Location, municipal district</i>	<i>The area, in hectares</i>
Zadonskiy	Ilovinskiy district	29639,86
Kulanskiy	Kamyshevskiy district	23038,61
Kumylzhenskiy	Kumylzhenskiy district	35558,68
Leschevskiy	Leninskiy district Svetloyarskiy district Srednehtubinskiy district	20801,90
Olhovskiy	Olhovskiy district	11871,90
Razdorskiy	Danilovskiy district Frolovskiy district	43968,91
Drofiny	Staropoltavskiy district	50000,00
Chernopolyanskiy	Serafimovicheskiy district	40749,29

^c Source: Cadastral Cases of SPNAs

As can we see from the data given, in Volgograd region, SPNAs of regional significance prevail both in terms of area

and in terms of number. The largest share in the total area of the protected areas of regional significance is occupied by natural parks (713307.4 ha) and state nature sanctuaries (245667.1 ha) [13].

These nature parks are located on the territory of eleven municipal districts of Volgograd region (Leninskiy, Svetloyarskiy, Srednehtubinskiy, Ilovinskiy, Pallasovskiy, Alekseevskiy, Kumylzhenskiy, Nekhaevskiy, Chernyshkovskiy, Kamyshevskiy, Serafimovicheskiy). For managing a nature park, the State Budget Institutions "Nature Park" have been established in every institution.

State nature sanctuaries operate without the formation of legal entities. In table 3 you can see their area (in hectares) and location.

The total area of SPNAs of all the levels of significance within one region accounts for about 9% in the total area of Volgograd Region.

If we accept Volgograd region as a unit for planning the SPNAs net, then according to the described procedure, we can refer the existing categories of SPNAs to the central zones, taking into account their physiographic, landscape and biogeocoenosis features.

As in Volgograd region, most of the SPNAs are subordinated to the same executive authority (regional significance), in the process of forming transit zones for creating ecological corridors between SPNAs of adjacent administrative entities, it is sufficient to identify those cases when the connection between territories is important for conservation of bioresources. The basic qualities of transit zones are close to the characteristics of central zones. And they must ensure the relationship between these zones. In addition, transit zones may also have their own environmental value.

Protective zones, as multifunctional objects created for organizing rational nature management near the central and transit zones, are designed to provide conditions for the reproduction of protected bioresources. As objects of social and environmental interests integration, protective zones can provide modes of use established in accordance with the categories assigned to the central zones. These modes of use provide prohibited, limited and permitted activities.

The degree of protective properties and forms of protective zones should meet the requirements for protecting certain types of resources, take into account the levels of vulnerability of natural communities, the intensity of negative impacts from adjacent territories and the features of the landscape.

The three-step zoning allows developing the regional net of SPNAs and maintaining a stable state of the ecological framework primarily due to the reorganization and increase in the area of existing SPNAs.

In the process of the three-step zoning, it will be necessary to perform an additional set of works on collection, accumulation, systematization of cadastral information about the created zones, inventory and confirmation of information about existing SPNAs, analysis of their status, functioning efficiency and their development prospects.

Figure 1 provides a brief scheme of organizing the work in the process of forming the SPNAs net structure in the region.

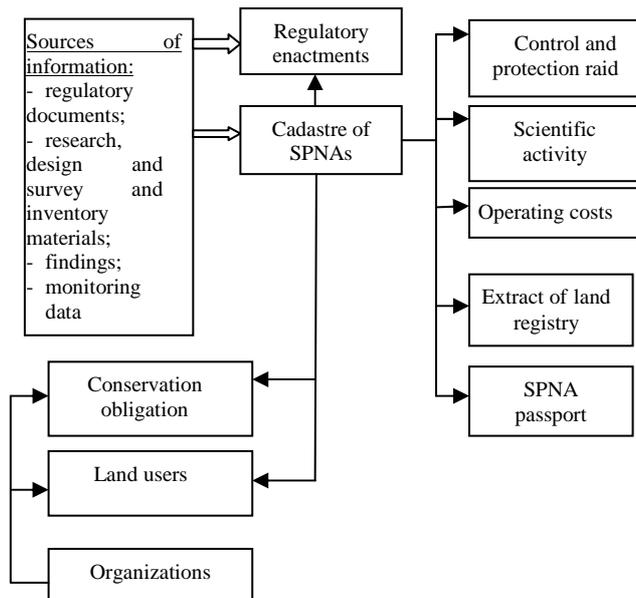


Fig.1 The Scheme of Organizing the Work in the Process of Forming the Structure of SPNAs Net in the Region.

The initial block in this scheme is the sources of primary observation information: regulatory documents, research, design and survey materials, inventory materials, results of surveys and monitoring the state of valuable natural complexes. On their basis, the cadastral information is updated and the regulatory and legal framework is adjusted. As a result, security obligations are formed, the boundaries of zoning are indicated and this information is revealed to the maximum possible number of persons involved (or potentially involved) in economic activities within the protection zones. According to the specified data, protection, raids, inspections are organized, scientific and research activities are coordinated, maintenance costs are calculated. Provision of an extract from the rapidly updated cadastre enables interested persons to make objective decisions, to carry out the certification of territories, which serves to maintain the stable functioning of the regional net of SPNAs.

IV. CONCLUSION

Thus, the implementation of the networks approach to organizing SPNAs is one of the key factors that can ensure the preservation of the natural complexes value within individual regions in the long term. For this purpose the following measures should be taken:

to improve methods of identifying and evaluating the territories value constantly while assigning the conservation status. And the improvement of relations that arise in the process of creating, functioning and developing SPNAs is also necessary;

to provide their protection within a single functionally and territorially linked system [15];

to determine the single content, goals and management tasks for both such territories and administrative entities in the boundaries of which they are located.

As a result, the single regional net of SPNAs should be placed in the conditions that smooth down negative tendencies as much as possible in the process of choosing economic preferences. The process of evaluating the status of SPNAs should be flexible and coordinated, regardless of the subordination level, and traditional methods of primary monitoring should be developed taking into account the current achievements of science. That is why the process of searching the most effective approaches to the problem of protecting natural objects is still going on in order to maintain their environment-forming, resource, recreational potential. The three-step zoning according to which we can divide the territories into the central zones (that fulfill the basic targeted functions), the transit zones (providing interconnections of central zones) and protective zones (which prevent external negative impact on the first two zones) gives the possibility to increase the areas of SPNAs without disrupting the existing configuration.

As for Volgograd region, the current state of SPNAs within this region allows us to consider the use of the networks approach as a potential opportunity to improve relationships in protecting natural areas.

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