The problem of forming a system of indicators for monitoring objects of specially protected natural territories

El problema de la formación de un sistema de indicadores en la supervisión de los objetos de las áreas naturales especialmente protegidas

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ABSTRACT:
The article analyzes the system of regional monitoring of specially protected natural areas of the Khanty-Mansiysk Autonomous Okrug - Ugra. A system of indicators for monitoring unique natural complexes of regional significance of the autonomous region is proposed.
Keywords: Specially protected natural territories, unified system of state environmental monitoring, regional monitoring, system of indicators

RESUMEN:
El artículo analiza el sistema de monitoreo regional de áreas naturales especialmente protegidas del Okrug Autónomo Khanty-Mansiysk - Ugra. Se propone un sistema de indicadores para monitorear complejos naturales únicos de importancia regional de la región autónoma.

Palabras clave: Territorios naturales especialmente protegidos, sistema unificado de monitoreo ambiental estatal, monitoreo regional, sistema de indicadores

1. Introduction
Specially protected natural areas play a crucial role in maintaining a favorable environmental ecological situation. Meanwhile, in the conditions of modern nature management, the fact of the organization of protected areas does not always mean a decrease in anthropogenic impact (Zaitsev, A. A., 2012).

Monitoring of protected areas is a mandatory measure to preserve biodiversity and maintain a favorable living environment, and therefore can be aimed at solving critical tasks, such as:
Systematization of the data on the components of the natural environment of protected areas, allowing us to draw conclusions about the state of the environment and provide timely measures for its protection.
Assessment of the degree of impact of natural and man-made factors on the object of protected areas and development of action plans to reduce the negative impact.
Informational support of state authorities, local governments, legal entities, individual entrepreneurs, citizens regarding the state of the environment within the boundaries of protected areas.

Providing relevant information to the state cadastre of protected areas of regional and local significance.

Consider the experience of other countries in relation to the management of protected areas (Table 1).

<table>
<thead>
<tr>
<th>A country</th>
<th>Authority managing specially protected natural territories</th>
<th>Main features of the functioning of protected areas</th>
</tr>
</thead>
</table>
| USA             | National Park Service (NPS)                               | - The system of protected areas is based on the organization of national parks, the main purpose of which is to obtain income from the implementation of the recreational potential of these territories and to create conditions for recreation of the population  
- GIS technology involvement in the scientific activities of protected areas  
- regular inventory and monitoring of the maximum possible range of various natural resources of protected areas  
- monitoring in the territory of protected areas is carried out in the following key areas: air and climate, geology and soil, water, biota, anthropogenic activities (including recreational activities), landscapes  
- a protocol containing information about the goals, objectives, applied methods and objects of monitoring, including map data, as well as a scientific report on the results of monitoring is available on the official NPS website for all users |
| Great Britain   | Natural England                                           | - private conservation organizations, as well as numerous private foundations and members of the public, who play an important role in the protection and conservation of protected areas  
- monitoring results are publicly available on the official website of Natural England  
- most protected areas are multipurpose  
- support for small farms located within national parks is an effective measure to preserve natural-territorial complexes |
| Spain           | Ministry of Environment                                   | Monitoring of protected areas is carried out at 3 levels:  
Level I - monitoring is carried out in all parks, includes programs for observing climate change, mapping the spatial distribution of natural resources and habitats of living organisms, tracking changes in forest ecosystems, monitoring the functioning of ecosystems, as well as general observations of avifauna  
II level - monitoring is carried out for groups of parks with similar climatic conditions  
III level - monitoring of a specific park taking into account its unique features  
- information on the spatial characteristics of specially protected natural areas is publicly available |
| Finland         | Forest Service of                                         | - the law on protected areas of wildlife does not contain any special                                                                                         |
Finland restricts on the use of these areas, with the exception of activities that could entail significant changes in nature or landscapes
- protected areas are predominantly formed in forest areas, within the framework of which protection regimes are established
- educated protected objects serve as a territory for the development of tourism
- regular inventory of biotopes and species is carried out
- monitoring of forests, fish stock, the most important species for hunting, flora and fauna, birds and environmental monitoring (water, air quality) is carried out by the Research Institute


Having the functioning of specially protected natural areas analyzed, as well as the organization of monitoring of unique natural complexes in foreign countries, leads us to the following conclusions:

A number of countries have developed a monitoring system for protected areas, which makes it possible to effectively manage these territories and to protect them. While conducting monitoring studies, geo-information systems contains large amounts of textual and graphic information about protected areas are effectively used.

Scientific reports on the state of protected areas, based on monitoring results, are publicly available.

In the USA, each interested user can create a researcher account and register his research program in the territory of any US national park on the official National Park Service (NPS) website, which allows interested groups to participate in managing a unique object and preserving its properties.

Significant financial resources are allocated for the maintenance of protected areas in these foreign countries, which allow effective monitoring studies, which in turn allow the unique properties of a particular property to be preserved, which contributes to the development of tourism within the boundaries of protected areas and the economic benefits that go to the country's budget.

Currently, in the Russian Federation, monitoring of protected areas of regional importance is carried out in accordance with the federal and regional regulatory framework, as well as the methodology adopted at the subject level. However, at the level of the Russian Federation, there is no single system of requirements for conducting monitoring studies of protected areas, which is why each subject is developing its own methodology, while in some regions it is completely absent.

Let us consider in more detail the existing system of managing protected areas on the example of the Khanty-Mansiysk Autonomous Okrug-Ugra. (Figure 1.)

From the presented scheme, it can be concluded that the main measures for the conservation of protected areas, as well as monitoring the regime and the state of natural complexes are carried out by the state authority of the Khanty-Mansiysk Autonomous Okrug - Ugra - the Department of Subsoil Use and Natural Resources and its subordinate institutions. This circumstance can be explained by the fact that the main part of protected areas objects have regional status (Decree of the Government of the Khanty-Mansi Autonomous Okrug - Ugra dated July 12, 2013 No. 245-p, 2013).

Assessment of the state of protected areas objects has of crucial importance for the development of the system of protected areas of the subject, because it allows us to conclude that the territory can fulfill its assigned function - preserving landscape, biological, geological, soil diversity, maintaining ecological balance, etc.

Figure 1
Protected area management system in the Khanty-Mansiysk Autonomous Okrug-Ugra
2. Methodology
Let us consider in more detail how environmental monitoring of environmental components is carried out within the boundaries of protected areas objects of regional significance in the Khanty-Mansiysk Autonomous Okrug-Ugra using the example of the Kondinsky Lakes natural park of regional significance located in the Sovetsky District of the Autonomous Okrug.

It should be noted that within the boundaries of the park there is a natural monument of local importance Lake Rank-Tur, which is managed by the V.V. Malaya Sosva State Nature Reserve Federal State Institution Raevsky ", while the functions of managing the territory of the Kondinsky Lakes park were entrusted to the budgetary institution of the Khanty-Mansiysk Autonomous Okrug - Ugra, the Kondinsky Lakes Nature Park named after L.F. Stashkevich (Government Decree of the Khanty-Mansiysk Autonomous Okrug - Ugra № 188-p, 2015).

The analysis of current approaches to monitoring of specially protected natural territories allowed us to identify indicators that characterize the state of the object.

3. Results and discussion
The Kondinsky Lakes Park has recreational significance and covers an area of 43,900 ha. The boundaries of the park are shown in Figure 2.
Also, one of the characteristics of the natural complex is that the natural park is located on the lands of the forest fund of the Soviet Forestry of the Arantursky district forestry, provided for permanent unlimited use. Figure 3 shows a fragment of a map of the forests of the Khanty-Mansiysk Autonomous Okrug-Ugra, which shows the quarters of Arantursky forestry, which are part of the Kondinsky Lakes Natural Park.

**Figure 3**
Fragment of the map-scheme of forests of the Khanty-Mansi Autonomous Okrug-Ugra and protected areas
The Nature Park "Kondinsky Lakes" is crucial for the conservation and study of valuable natural complexes, rare plants and animals, and objects of historical and cultural heritage.

Its valuable is also because of park has an international status and acts as a key ornithological territory intended for the conservation of rare and endangered bird species. This is because of the territory of the natural park has unique water system of the Kondinsky Lakes, which is the main ecosystem of the protected areas. A white-tailed eagle nests on the territory of the Nature Park "Kondinsky Lakes" this species of birds is listed in the Red Book of IUCN 96, the Red Books of the Russian Federation, the Tyumen Region and the Khanty-Mansi Autonomous Okrug-Ugra.

In accordance with the classification of the International Union for the Conservation of Nature, the Kondinsky Lakes Nature Park belongs to managed resource reserves (category VI). The classification of protected areas developed by IUCN is one of the most recognized throughout the world. In this international classification, 6 categories of protected areas are distinguished, depending on the purpose of their creation and management. Category VI includes protected areas with managed resources (Figure 4.), and by the level of protection, such natural complexes are between categories III and IV (Sobolevsky, V. G. The principles of the organization of specially protected natural territories in the Krasnoyarsk Territory).
So, the Kondinsky Lakes Nature Park fulfills not only the tasks of preserving the reference natural complexes, landscapes, biodiversity, but also provides the conditions for the development of tourism activities, as well as subsoil use. Within the boundaries of the zone of limited nature use of the park, the development and operation of the Talnik oil field is carried out.

Depending on the degree of protection, protection and use of the natural park, taking into account local natural, historical, cultural and social features, the following functional zones are established, presented in Table 2 (Decree of the Government of the Khanty-Mansi Autonomous Okrug - Ugra № 188-p, 2015).

### Table 2
The composition of the functional zones of the Kondinsky Lakes Natural Park

<table>
<thead>
<tr>
<th>№</th>
<th>Functional area</th>
<th>Territory composition</th>
<th>Purpose</th>
<th>Area, hectare</th>
<th>Share in the total area,%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conservation area</td>
<td>- a site located in the quarters of the forest fund of Arantur forestry: 10, 12, 14, 37-39, 44-47, 66-69, 87-89, 108-111, 131-133, 153-156; - the stretch of the Lemia river and the territory between the river and the northern border of the natural park;</td>
<td>Preservation in the natural state of typical mid-taiga natural complexes that perform water protection, water storage functions, preserving the biodiversity of the territory</td>
<td>22828</td>
<td>52%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- eastern section, including the southeastern part of quarters 50, 51, the northeastern part 9 of quarters 72 and 73 of Arantursky forestry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Protected</td>
<td>- a site located in the quarters of</td>
<td>Preservation of</td>
<td>11853</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4**
Some categories of IUCN protected areas

*Category III*
Natural monument
Protected area, managed mainly for the conservation of selected natural sites

*Category VI*
Protected area with managed resources
Territory including predominantly unchanged natural systems managed to ensure long-term conservation and maintenance of biological diversity while ensuring a steady flow of natural goods and services to meet public needs

*Category IV*
Habitat / Species Management Area
A land and / or sea area managed by active human intervention in order to maintain habitats and / or maintain other conditions necessary for the existence of certain species

Source: compiled by the authors
<table>
<thead>
<tr>
<th>Ecosystem Subzone</th>
<th>Description</th>
<th>Natural Ecosystems in the Process of Their Natural Development, Conservation of Biodiversity of Local Species of Plants and Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Environmental Regime Subzone</td>
<td>- plots located in the quarters of Arantursky forestry: 10, 12, 14, 37-39, 66, 87; -the stretch of the Lemia river and the territory between the river and the northern border of the natural park; -eastern section, including the southeastern part of quarters 50, 51, the northeastern part 9 of quarters 72 and 73 of Arantursky forestry</td>
<td>Promotion of self-regulation and restoration of natural landscapes 10975 25%</td>
</tr>
<tr>
<td>2 Recreation area</td>
<td>Northeast, Northwest, and Southeast Parts of the Natural Park</td>
<td>Ensuring optimal conditions for recreation of the population, the organization of recreation, combined with cognitive, tourist, sightseeing and other activities 12731 29%</td>
</tr>
<tr>
<td>3 The zone of protection of historical and cultural complexes and objects</td>
<td>More than 200 identified objects of historical and cultural heritage are grouped in 36 sites and allocated at the locations of archeological monuments</td>
<td>Preservation of historical and cultural monuments for use in scientific, educational and recreational purposes 878 2%</td>
</tr>
<tr>
<td>4 Restricted area</td>
<td>The northern part of the natural park, which includes: - areas where exploratory exploration drilling sites, cluster sites are located; - sections occupied by linear facilities — pipelines, power lines, infield roads, and other oilfield infrastructure facilities; - areas directly adjacent to the field facilities and experiencing the most pronounced anthropogenic impact</td>
<td>For the implementation of the tasks of nature users within the framework of a regime specially established during the work of the project, taking into account the assessment of the environmental impact within the boundaries of the land allotment 7463 17%</td>
</tr>
</tbody>
</table>

**Total** 43900 100%

Source: compiled by the authors
Figure 5 presents a map of the functional zoning of the natural park, developed on the basis of a full-scale study of the territory, landscape mapping, studies of the terrain features.

![Figure 5: Functional zoning of the territory of the natural park “Kondinsky Lakes”](image)

**Legend**

- Na: border of a natural Park
- Th: the border of the license area
- Tl: "Talnikova field"
- Pro: subzone of specially protected ecosystems
- Env: subzone of the environmental regime
- Rec: Recreational area
- Prot: Protection zone for historical and cultural complexes
- Lm: the zone of limited nature management

Source: Decree of the Government of the Khanty-Mansi Autonomous Okrug - Ugra dated June 26, 2015 № 188-p "On the provision of the natural park "Kondinsky Lakes"

Based on the data presented in table 2, we can draw the following conclusions:

1. On the territory of the Nature Park "Kondinsky Lakes", various special protection and regimes have been established depending on the ecological and recreational value of natural sites, a large part of the territory is occupied by natural protection zone, within the borders of which any activity involving changes or destruction of the natural environment of protected areas or its components is prohibited.

2. 29% of the park’s territory is used by the population for recreation, gathering wild plants, amateur hunting and fishing, while the developed limits for recreational nature management are not always respected. Also, roads were laid on the territory of the park to ensure transport accessibility, the use of which leads to the transformation of sections of the natural complex.

3. The development of oil field facilities within the boundaries of the restricted use zone leads to significant negative consequences for the entire territory of the park.

Implementation of monitoring studies allows you to respond in a timely manner to changes in the main indicators characterizing the monitoring object. However, as noted above, at the level of the Khanty-Mansi Autonomous Okrug-Ugra there is no single monitoring technique for protected areas, which leads to the degradation of such natural complexes.
Currently, it is necessary to develop a methodological approach to assessing the state of protected areas objects according to uniform criteria at the regional level.

As part of the selection of the main indicators for assessing the state of the natural park "Kondinsky Lakes" of the Khanty-Mansiysk Autonomous Okrug - Ugra, it is considered possible to distribute them into three main groups: quantitative, qualitative indicators, as well as indicators of the favorableness of the components of protected areas for the development of tourist and recreational activities (Buzmakov, S. A., 2011; Bogdanova, O.V., 2018; Budarova, V.A., 2018). (Table 3.)

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Estimated indicators for assessing the status of protected areas in the Khanty-Mansiysk Autonomous Okrug - Ugra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitoring object</strong></td>
<td><strong>Quantitative indicators</strong></td>
</tr>
</tbody>
</table>
| Fauna and flora (including forest vegetation) | - data on the number of rare and endangered species within the boundaries of protected areas  
- the dynamics of the number of rare and endangered species of fauna and flora  
- the ratio of species of different categories of rarity;  
- quantitative indicator of species listed in the Red Books | - degree of disturbance of vegetation  
- disturbance and damage to the stand  
- the sanitary condition of the forest stand  
- habitat quality | - wealth of species composition  
- the presence of rare species of flora and fauna  
- landscape diversity |
| Land resources | - total land area within the boundaries of protected areas  
- the area of land within the boundaries of protected areas occupied by utilities, road-path network, development, etc.  
- total area of sanitary and protective zones of objects  
- the area of the main functional zones within the boundaries of protected areas | - the level of soil pollution with oil and oil products, heavy metals, etc.  
- the degree of development of negative natural processes on lands within the boundaries of protected areas | - transport accessibility  
- the possibility of construction (from the point of view of urban planning, land, environmental legislation) of tourism infrastructure |
| Water objects | - area of water within the boundaries of protected areas | - quality condition of the water system  
- chemical composition of water | - convenience of coasts for recreational development  
- availability of open approaches to water  
- sanitary and hygienic conditions of water bodies |
<table>
<thead>
<tr>
<th>Objects of historical and cultural heritage</th>
<th>- the number of objects of historical and cultural heritage</th>
<th>- physical condition of objects of historical and cultural heritage</th>
<th>- the status of objects of historical and cultural heritage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- historical value</td>
<td>- the value of the object (memorial, architectural, urban planning, artistic and aesthetic)</td>
<td>- the authenticity of the object</td>
</tr>
<tr>
<td>Subsoil*</td>
<td>- hydrocarbon reserves</td>
<td>- assessment of hydrogeological, engineering and geological conditions</td>
<td>- the presence in the territory of unique places of geological nature with the possibility of visiting tourists</td>
</tr>
<tr>
<td></td>
<td>- the number of valuable geological objects</td>
<td>- groundwater condition</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- activity of geological processes</td>
<td></td>
</tr>
</tbody>
</table>

* if subsoil use is carried out within the boundaries of protected areas

Source: compiled by the authors

The presented criteria can be used by state authorities of the Khanty-Mansiysk Autonomous Okrug - Ugra, local governments, organizations engaged in economic activities within the boundaries of protected areas, organizations engaged in monitoring the environment and its individual components in order to assess the state of the natural complex.

4. Conclusions

As a result of the study, it becomes possible to formulate the following conclusions:

1. Monitoring of environmental components at the level of the Khanty-Mansiysk Autonomous Okrug - Ugra is carried out by authorized state authorities at the subject level, while several state institutions may be responsible for conducting monitoring studies, which often leads to inaccuracy and incomparability of information, as well as to questions which authority is responsible.

2. The organization of integrated monitoring and inventory of protected areas was entrusted to the Department of Subsoil Use and Natural Resources of the Khanty-Mansiysk Autonomous Okrug - Ugra. However, it is worth noting that the conservation functions of unique natural complexes, landscapes and objects are carried out by budgetary institutions subordinate to the Department, which do not always have sufficient resources (technical, material, labor) for conducting quality monitoring studies. Also a significant problem is the lack of an approved methodology developed taking into account the regional characteristics of the district, including taking into account significant anthropogenic impact and severe disturbance of the territory of the subject, which impedes the fulfillment of the assigned function of conservation of protected areas.

3. Environmental monitoring includes work on the observation, assessment, prediction of the state of various components of the natural environment. However, in our opinion, depending on the level of protected areas, its goals, significance in the system of protected areas of the subject, location, natural features, absence or, conversely, the development of economic activity within the boundaries of the natural complex and other characteristics, it is necessary to determine the significance of this or that component natural environment, as well as its degree of influence on the state of protected areas.

Bibliographic references
