Ways of Recognizing the High Status of the Territory for the Biodiversity Conservation (on the Example of the Ichalkovsky Reserve in the Nizhny Novgorod Region)

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Abstract. The purpose of our study is to consider the possibilities of using different approaches to recognize the significance of the territory for the biodiversity conservation. The Ichalkovsky nature reserve (zakaznik) with an area of 1,442 hectares in the Nizhny Novgorod region was selected for analysis as a botanical and geological object unique for the Russian Plain. The criterion of various rare wildlife species records was used as a leading approach. Analysis of published materials and field research in 2020 allowed us to identify in the studied territory the habitat of 88 wildlife species listed in the Red Data Books of Russia and the Nizhny Novgorod Region. They are very different concerning their taxonomy and biology. This criterion shows the extremely high conservation value of the Ichalkovsky reserve. The territory under consideration is characterized by high biological diversity and a high degree of biota remained, as well as its weak human disturbance. It is shown that, in accordance with the approaches of international nature conservation programs, the Ichalkovsky reserve has the status of a territory of special nature conservation significance within the Emerald Network of Russia, as well as an Important Bird Area. This territory is the core of the environmental framework of European Russia and meets the criteria for identifying several categories of high conservation value forests. The proposed ways have shown high efficiency. Ichalkovsky reserve is very important to conserve the biodiversity, including at the international level. This natural area should have legal protection adequate to its nature conservation value. Such protection can be provided by the status of a cluster of a national park.

1. Introduction

Valuable natural areas require a high level of legal protection, which is guaranteed by the status of federal specially protected natural areas (PA). Additional arguments for the conservation of such territories are various international statuses, such as territories of special nature conservation value of the Emerald Network [1], Important Bird Areas [2, 3], UNESCO sites [4-6], etc. It should be borne in mind that the categories of international and Russian protected areas differ [7]. Giving a territory a high legal or international status requires serious justification. There are various approaches and methods allowing us to identify a valuable natural area, characterize the level of its environmental significance and use the data obtained to argue the need for legal protection [8-13]. Using the example of the Ichalkovsky reserve in the Nizhny Novgorod region, we consider the possibilities and results of applying methods for estimating the significance of a territory for the biodiversity conservation.
The Ichalkovsky reserve encompasses the area of 939 hectares located in the Nizhny Novgorod Pre-Volga region in the bend of the Pyana river. Considering the system of natural zones it is located in the forest-steppe [14]. According to the system botanical and geographical zones, it belongs to the European broad-leaved region, the Eastern European province, the Central Russian sub-province [15]. This old growth forest is a unique botanical and geological site for the Russian Plain, since karst landscapes are represented here on a rather small area, including limestone outcrops and caves. There are steppe, nemoral, taiga and mountain plant species growing in the Ichalkovsky reserve. Alekhin called it a mountain taiga island surrounded by steppe [16]. The combination of old growth deciduous and coniferous-deciduous forests, small areas of floodplain and continental meadows with fragments of meadow steppe, floodplain and karst ponds, limestone outcrops and caves cause a highly mosaic ecosystem and provides high species richness and diversity.

For a long time, the use of natural resources in this area was quite inessential. The idea of the need for state protection of this unique natural site was first expressed in 1912 [17]. Since 1965, the Ichalkovsky forest has been protected as a regional natural monument; in 1971 it was included in the hunting reserve [18]. In 2007, it was reorganized as a regional complex nature reserve with an area of 1,442 hectares [19]. The unique geological and geomorphological structure of the territory, high ecosystem and species diversity attracted the attention of various specialists [20-31]. The publications have shown a raw of essential records and unique discoveries, but the complex analysis of biodiversity has not carries out. Currently, this territory is considered as a perspective UNESCO geological park, as well as one of the possible cluster areas of the projected national park in the Nizhny Novgorod region. Therefore, the substantiation of its high conservation value for the biodiversity conservation is highly relevant. As a leading approach, we have chosen the use of the criterion for the various rare wildlife species records [32]. We declare as the conservation value of such a territory increases as the number of rare species inhabiting a certain territory and the their taxonomic, size and ecological diversity becomes higher. In addition, we relied on the approaches and criteria of a number of international environmental programs (Important Bird Areas, Emerald Network, High Conservation Value Forests) [2, 33-35], as well as the approaches and principles of developing the environmental framework [13, 36].

We have compiled a list of rare wildlife species listed in the Red Data Books of the Nizhny Novgorod Region and Russia, registered on the territory of the Ichalkovsky complex reserve, taking into account the results of field studies in 2020. We have analyzed the taxonomy of these species, divided them into three size classes, depending on the size of the individual site (large – more than 50 hectares, medium – from 1 to 50 ha, small – less than 1 ha), and also characterized their distribution over different types of habitats and trophic specialization.

2. Results and Discussion

2.1. Results of the application of the criterion for the number of various rare wildlife species
A total of 90 wildlife species, listed in the Red Data Books of Russia and the Nizhny Novgorod region have been encountered on the territory of the Ichalkovsky reserve by now. In terms of the number of rare species, the Ichalkovsky reserve ranks third among the protected areas of the Nizhny Novgorod region, second only to the Pustynsky reserve and the Kerzhensky Nature Reserve. At the same time, the density of rare species in the Ichalkovsky reserve is the highest (Table 1).

| Protected area            | Area, ha | Number of rare wildlife species | Number of rare wildlife species per 1,000 ha of area |
|---------------------------|----------|---------------------------------|------------------------------------------------------|
| Pustynsky reserve         | 19,700   | 177                             | 9.0                                                  |
| Kerzhensky Nature Reserve | 46,900   | 149                             | 3.2                                                  |
| Ichalkovsky reserve       | 1,400    | 90                              | 64.3                                                 |

Rare wildlife species of the Ichalkovsky reserve are characterized by high taxonomic and ecological
diversity. The distribution of these species into size classes is shown in Table 2, by types of habitats – in Table 3, by trophic specialization – in Table 4.

Table 2. Distribution of rare wildlife species according to their size classes.

| Size class | Mammals | Birds | Reptiles | Fishes | Insects | Spiders | Spermatophyta | Polypodiophyta | Lycopodiophyta | Bryophyta | Mycota | Total |
|------------|---------|-------|----------|--------|---------|---------|---------------|---------------|---------------|-----------|--------|--------|
| Large      | 7       |       |          |        |         |         |               |               |               |           |        | 7      |
| Middle     | 15      | 12    | 2        |        |         |         |               |               |               |           |        | 29     |
| Small      | 1       | 17    | 1        | 20     | 8       | 1       | 5             | 1             | 1             | 5         | 90     | 90     |
| Total      | 15      | 19    | 2        | 1      | 17      | 1       | 20            | 8             | 1             | 1         | 90     | 90     |

The area under consideration is inhabited by species of almost all size classes – from the highest to the smallest. Large size classes include only 7.8% of rare species (only birds), medium – 32.2%, small – 60.0%

Table 3. Distribution of rare wildlife species by types of habitats

| Habitats                                | Mammals | Birds | Reptiles | Fishes | Insects | Spiders | Spermatophyta | Polypodiophyta | Lycopodiophyta | Bryophyta | Mycota | Total |
|-----------------------------------------|---------|-------|----------|--------|---------|---------|---------------|---------------|---------------|-----------|--------|--------|
| Different                               | 2       | 2     |          |        |         |         |               |               |               |           |        | 6      |
| Different forests                       | 10      | 1     | 4        | 4      | 2       | 1       | 2             |               |               |           |        | 22     |
| Old growth forests                      | 2       |       |          |        |         |         |               |               |               |           |        | 4      |
| Taiga                                   | 1       |       | 1        | 1      | 1       | 1       | 5             |               |               |           |        | 5      |
| Broad-leaved forests                    | 3       | 3     | 1        | 3      | 2       |         | 12            |               |               |           |        | 12     |
| Pine forests                            | 3       |       |          |        |         |         |               |               |               |           |        | 3      |
| Old growth forests interspersed with open spaces | 3       |       |          |        |         |         |               |               |               |           |        | 3      |
| Old growth forests along waterbodies    | 1       |       |          |        |         |         |               |               |               |           |        | 1      |
| Forest edges                            | 6       |       |          |        |         |         |               |               |               |           |        | 6      |
| Meadows                                 | 1       | 2     |          |        |         |         |               |               |               |           |        | 3      |
| Cultivated lands                        | 1       |       |          |        |         |         |               |               |               |           |        | 1      |
| Forest-steppe                           | 2       | 1     |          |        |         |         |               |               |               |           |        | 3      |
| Steppe                                  | 2       | 1     |          |        |         |         | 9             |               |               |           |        | 12     |
| Floodplain willows and reed beds        | 1       |       |          |        |         |         |               |               |               |           |        | 1      |
| Watersides                              | 1       |       |          |        |         |         |               |               |               |           |        | 1      |
| Waterbodies                             | 1       | 1     |          |        |         |         |               |               |               |           |        | 3      |
| Limestone outcrops                      | 3       |       |          |        | 1       |         | 4             |               |               |           |        | 4      |
| Total                                   | 15      | 19    | 2        | 1      | 17      | 1       | 20            | 8             | 1             | 5         | 90     | 90     |
Table 3 shows a high level of the diversity of both rare wildlife species and habitats that they occupy, including such geographically distant from each other as dark coniferous taiga and meadow steppes, in the Ichalkovsky reserve. The share of eurybionts inhabiting a wide range of habitats is 6.7%. The highest share (24.4%) is the species preferring to inhabit different forests, 13.3% each comprise the species of broad-leaved forests and steppes. The complex of species associated with limestone outcrops is a rare phenomenon for the Russian Plain. Ichalkovsky reserve is the only place where Asplenium viride Huds grows on the Russian Plain [18,19].

Table 4. Distribution of rare wildlife species according their trophic specialization

| Trophic specialization | Number of rare species from different taxonomic groups: | Total |
|------------------------|--------------------------------------------------------|-------|
|                        | Mammals | Birds | Reptiles | Fishes | Insects | Spiders | Polypodiophyta | Lycopodiophyta | Bryophyta | Mycota |       |
| Euryphage              | 3       |       |          |        |         |         |                |               |           |        | 3     |
| Thermo- and ornithophage | 5      | 1     |          |        |         |         |                |               |           |        | 6     |
| Herpetophage           | 1       | 1     |          |        |         |         |                |               |           |        | 2     |
| Ichthyophage           | 1       |       | 2        |        |         |         |                |               |           |        | 2     |
| Insectophage           | 10      | 7     | 2        | 1      |         |         |                |               |           |        | 20    |
| Insect parasite        | 1       |       |          |        |         |         |                |               |           |        | 1     |
| Phytophage (with some invertebrates in the diet) | 1 | 4 | | | | | | | | | 5 |
| Phytophage             | 1       | 1     | 14       |        |         |         |                |               |           |        | 16    |
| Autotroph              | 20      | 8     | 1        | 5      |         |         |                |               |           |        | 34    |
| Saprotroph             | 1       | 1     |          |        |         |         |                |               |           |        | 2     |
| Total                  | 15      | 19    | 2        | 17     | 1       | 20      | 8              | 1              | 5        | 1      | 90    |

The range of trophic specializations of rare wildlife species in the territory under consideration is very wide. The maximum share, as expected, falls on autotrophs (37.5%); the shares of insectophages (21.6%) and phytophages (18.2%) are also high.

Thus, the application of the criterion for a large number of various rare species shows the extremely high conservation value of the Ichalkovsky reserve. This small area is characterized by great biological diversity, a high degree of biota remained, as well as its weak human disturbance.

The research level of the biota of this unique territory is far from complete. Special attention should be paid to the census of invertebrates, lichens and fungi. We shure the list of rare wildlife species of the Ichalkovsky reserve to be substantially enlarged. For example, our surveys carried out in 2020 has added 7 species to this list.

2.2. Results of applying the approaches of some international environmental programs

Earlier, we substantiated the Ichalkovsky reserve meeting to the criteria of territories of special nature conservation significance within the Emerald Network of Russia [37]. There are the following habitats of European importance:

- C1.25. Chara algae communities in mesotrophic water bodies;
- P.341. Euro-Siberian amphibiote perennial communities;
- E2.25. Inland meadows;
- E3.4. Wet and raw eutrophic and mesotrophic grasslands;
- F9.1. Riverine shrubs
- H1. Caves, cave systems, tunnels, underground water bodies
This territory is inhabited by 25 wildlife species of European importance, as well as 11 species listed in the Red Book of Russia. Thanks to these circumstances, the Ichalkovsky reserve was recognized as a territory of special nature conservation significance of the Emerald Network of European Russia.

Ichalkovsky reserve has the IBA status (A1 criterion) as the only breeding territory of the Imperial Eagle (Aquila heliaca Savigny) in the region [3, p. 185], the center of the environmental framework of European Russia, since a full-member biota represented here is determined by the criterion of a large number of rare species, including ones of the highest size class (Aquila heliaca Savigny, Bubo bubo L.) [19].

Following our estimation the Ichalkovsky reserve meets the criteria of high conservation value forests (HCVF) of several categories (Table 5).

| Criterion of HCVF                                      | Meeting to criterion | Comments                                                                                                                                 |
|--------------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| forest areas with biodiversity of global, national or regional significance | yes                  | Regional complex reserve; 88 species, listed in the Red Data Books of Russia and the Nizhny Novgorod region; 25 species of European importance |
| large forest landscapes of global, national or regional significance | no                   | The total forest area is 939 ha                                                                                                            |
| forest areas, including rare or endangered ecosystems  | yes                  | communities of living organisms of limestone outcrops and caves, old growth forests, fragments of the steppe along the forest edges         |
| forest areas with special protective functions         | yes                  | forests defending from erosion in the area of intense development of karst, water protecting, important for the conservation of groundwater and the catchment of the Pyana river |
| forest areas necessary to ensure the existence of the local population | no                   | the main occupation of the population is agriculture                                                                                  |

Thus, the use of the approaches of some international environmental programs has shown the international (pan-European) level of environmental significance of the area under consideration.

The project on approving the Ichalkovsky reserve as a UNESCO Geopark is implemented today. This international status, on the one hand, will increase the environmental significance of the territory, on the other, it will increase its recreational attractiveness. Now the recreational impact on the area is high and tends to grow. It is not possible to establish a reserve regime here. To maintain a balance between the interests of biodiversity conservation and regulated recreational use, it is necessary to determine limits of the permitted recreational impact, establish zones of permitted impact on the territory and plan recreational routes [38]. For this, it is advisable to conduct landscape research and draw up detailed landscape maps. There is experience of similar activity in the Nizhny Novgorod region [39, 40]. The status of a national park can provide optimal conditions for achieving a balance between the interests of nature conservation and tourism development.

3. Conclusion

Thus, the proposed ways have shown high efficiency. The use of the criterion for the number of various rare wildlife species is a fundamental approach in substantiating the high value of the territory for the conservation of biological diversity. This criterion is used to one degree or another by many international environmental programs.

The Ichalkovsky reserve, despite its small area, is a territory of high significance for the biodiversity conservation, including at the international level. This natural area should have a level of legal protection
adequate to its nature conservation value. Such protection can be provided by the status of a cluster of the national park.

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