Conservation of biological diversity of rare animal species in the Boguchansky district

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Abstract. The paper states that biological diversity preservation involves maintaining the historically established habitats of various groups of living organisms, including rare species. A list of animal species found on the territory of the forestry, included in the Red Data Books of the Russian Federation and the Krasnoyarsk Territory, has been compiled. The recommendations for the of habitats and seasonal places of concentration have been proposed. The fauna is characterized by the uniqueness of complexes of taiga and subtaiga species. In this area, 29 species of mammals and 117 species of birds are recorded. Migrating and nesting birds as well as flying through the region are of great international importance. It is necessary to make recommendations to the forestry regulations of the forestry to preserve rare and endangered species of animals. It will create a legal basis for the preservation of key objects of biological diversity. The application of these unified measures in the Krasnoyarsk Territory, within the framework of the requirements of the legislation, will contribute to the preservation and restoration of biodiversity with an intense anthropogenic impact on ecosystems.

1. Introduction

Biological diversity is understood as an ecological complex formed by living organisms (including animals, plants and microorganisms), environment and a set of various ecological processes associated with them, including ecosystem diversity, species diversity and genetic diversity [1]. Biodiversity investigation involves the systematic study of various types of living organisms and technologies by which biodiversity can be maintained and used sustainably for the benefit of humanity [2].

The preservation of biological diversity presupposes the maintenance of the historically established habitats of various groups of living organisms [3, 4, 5, 6]. Anthropogenic activity in forests leads to the most large-scale violations of the functional organization of natural ecosystems.

Due to fires and loggings, the habitats of animals are changing, their usual food base is changing. This, in turn, reduces the number of species of aboriginal animals living in this area. Fires have the greatest impact on the structure of the forest stand, first of all, conifers (cedar, fir, spruce) suffer. The research data found that in Central Siberia the mortality rate after sustained fires from weak to medium strength was from 6 to 15% already in the second year of fire. In case of crown fires, forest stand burns out completely and a change in tree species occurs. Post fire recovery of the main stand is due to birch, aspen and pine, therefore, there is a reduction in the area of dark coniferous taiga [7]. The succession
period for the restoration of dark coniferous species in Siberia and the Far East takes from 100 to 300 years [8].

Loggings of large areas significantly reduce the ecological potential of forests. The accumulation of clear-logging areas worsens water quality, disrupts the hydrological regime, changes the microclimate, causes negative edaphic consequences, and has a negative impact on the biodiversity of the region. Due to the anthropogenic impact on forests, separate components of forest ecosystems fall out, diversity is lost, damage to the gene pool is caused, and evolutionary potential decreases [9].

2. Objects and methods of research

The Angara River crosses the territory of the Boguchansk District from east to west approximately in the middle. Natural conditions determine the distribution of pine and pine-larch forests on the territory of the region. The main forest-forming species in the study area are pine (it occupies 23.1% of the area), followed by birch (20.3%), larch (16%), cedar (15.2%), spruce (14%), fir (7%), aspen (2.8) and other species (1.6%).

In 2020-2021, flora and fauna records were carried out. The identification of rare and endangered species of animals was carried out according to the information taken from the Red Data Book of the Krasnoyarsk Territory [10] and the Red Data Book of the Russian Federation [11].

3. Research results and their discussion

The fauna of the region is characterized by the uniqueness of the complexes of taiga and subtaiga species. In this area, 29 species of mammals and 117 species of birds are recorded. Migrating and nesting birds as well as flying birds through the region are of great international importance. A wide range of flyways have been recorded for birds. They "connect" the region with central and eastern Africa, Europe, India and China. Due to the high mobility of animals, different species are present in a number of habitats. As a result, all habitats of any particular massif and its environs make up a single ecosystem [12]. Therefore, the impact on one of the components of the ecosystem will more or less affect the entire ecosystem. Hence, it is imperative to take into account this circumstance in order to avoid undesirable consequences when planning and implementing forestry activities.

A list of rare and endangered species of animals inhabiting the territory of the Boguchansk district of the Krasnoyarsk Territory and their conservation status are given in table 1.

| Table 1. Rare and endangered species of animals living in the Boguchansk district of the Krasnoyarsk Territory. |
|---------------------------------------------------------------|
| Family | Species | Preservation status. The Red Data Book of the Krasnoyarsk Territory // The Red Book of the Russian Federation |
|---------------------------------------------------------------|
| Insects                                               |                                             |
| Sallowtail butterfly – Papilionidae | Old World swallowtail (Papilio machaon Linnaeus, 1758) | Category – III Status: rare and vulnerable species, although a widespread species |
| Brush-footed butterflies – Nymphalidae | Scarce heath (Coenonympha hero Linnaeus, 1761) | Category – III Status: rare species of the Krasnoyarsk Territory, was listed in the Red Book of the USSR |
| Owlet moths – Noctuidae | Blue underwing (Catocala fraxini Linnaeus, 1758) | Category – III Status: rare species of the Krasnoyarsk Territory |
| Birds                                                  |                                             |
| Grebes – Podicipedidae | Horned grebe (Podiceps auritus Linnaeus, 1758) | Category – IV Status: undefined by status easily vulnerable species of water bodies of the region |


| Category          | Status                                                                                     |
|-------------------|--------------------------------------------------------------------------------------------|
| Herons – Ardeidae | Category – IV  Status: undefined by status easily vulnerable species                      |
| Storks – Ciconiidae | Category – III  Status: rare widespread species with a narrow ecological amplitude / Rarity category: 3 - rare |
| Water birds – Anatidae | Category – III  Status: vulnerable subspecies, listed in the Supplement to the Red Book of the Russian Federation. |
| Whooper swan (Cygnus cygnus Linnaeus, 1753). | Category – III  Status: groups with varying degrees of vulnerability and knowledge |
| Baikal teal (Anas Formosa Georgi, 1775). | Category – IV  Status: rare species with undefined status // Rarity category: 2 – dwindling |
| Falcated duck (Anas falcate Georgi, 1775). | Category – IV  Status: a rare species on the periphery of the range with a status uncertain for the edge |
| Ospreys – Pandionidae | Category – III  Status: rare widespread species with a narrow ecological amplitude / Rarity category: 3 - rare |
| Pawks – Accipitridae | Category – II  Status: vulnerable species, with a steadily dwindling number // Rarity category: 2 – dwindling |
| Golden eagle (Aquila chrysaetos Linnaeus, 1758) | Category – IV  Status: undefined by status // Rarity category: 3 – rare |
| White-tailed eagle (Haliaetus albicilla Linnaeus, 1758) | Category – III  Status: rare widespread species // Rarity category: 3 – rare |
| Bearded vulture or lammergeier (Gypaetus barbatus Linnaeus, 1758) | Category – VII  Status: a rare endangered species with an unexplained nature of stay // Rarity category: 3 – rare |
| Falcons – Falconidae | Category – IV  Status: a rare species with an undefined status for the region // Rarity category: 2 – dwindling |
| Red-footed falcon (Falco vespertinus Linnaeus, 1766). | Category – II  Status: rare species with dwindling numbers // Rarity category: 2 – dwindling |
| Cranes – Gruidae | Category – IV  Status: vulnerable species with undefined status for the edge |
| Sandpipers – Scolopacidae | Category – IV  Status: undefined by status sporadically common // Rarity category: II  Status: dwindling (for populations of the southern and middle zone of the European part of Russia) |
Typical owls – Strigidae

- Eurasian eagle-owl (Bubo bubo Linnaeus, 1758) Category – III
  Status: rare and vulnerable species // Rarity category: 2 – dwindling
- Eurasian scops owl (Otus scops Linnaeus, 1758).
  Status: vulnerable species with undefined status for the edge
- Eurasian pygmy owl (Glaucidium passerinum Linnaeus, 1758).
  Status: poorly studied species with an undefined status for the region

Kingfishers – Alcedinidae

- Common kingfisher (Alcedo atthis Linnaeus, 1758).
  Status: stenoecic species with an undefined status for the region

Shrikes – Laniidae

- Great grey shrike (Lanius excubitor Linnaeus, 1758).
  Status: poorly studied species with an undefined status for the region

Mammals

- Fraternal myotis (Myotis frater G. Allen, 1923).
  Status: rare poorly studied species with an area requiring specification.
- Ikonnikov’s bat (Myotis ikonnikovi Ognev, 1912).
  Status: undefined by status poorly studied species.
- Mouse-eared bars (Myotis petax Hollister, 1912)
  Status: undefined by status poorly studied species.
- Pond bat (Myotis dasycneme Boie, 1825)
  Status: poorly studied species at the periphery of the range with the indeterminate status for the region.
- Northern bat (Eptesicus nilssoni Keyserling et Blasius, 1839).
  Status: poorly studied species at the periphery of the range with the indeterminate status for the region.

Deers – Cervidae

- Reindeer (forest subspecies) (Rangifer tarandus valentinae Flerov, 1933).
  Status: dwindling.

It is necessary to preserve biological diversity and restore the number of animal species listed in Table 1 on the territory of the Yenisei Siberia:

- creation of the protected areas network;
- strengthening of environmental education work with the population, promotion of the protection of rare species;
- preservation of buffer zones along streams and rivers during deforestation;
- identification of the territory of nesting birds and the prohibition of economic activity in these territories;
- creation of an interregional wetland network;
- hanging birdhouses in the river floodplain.

4. Conclusion
Rare and endangered animal species inhabiting the Boguchansky district of the Krasnoyarsk Territory were identified in the result of this work. It is necessary to make recommendations to the forestry
regulations of the forestry to preserve them. It will create a legal basis for the preservation of key objects of biological diversity. The application of these unified measures in the Krasnoyarsk Territory, within the framework of legal requirements, will contribute to the conservation and restoration of biodiversity with intensive use of forests, increase the efficiency of sustainable forest management and simplify the procedure for checking compliance with legal norms.

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References

[1] Adom D, Umachandran K, Ziarati P, Sawicka B and Sekyere P 2019 The concept of biodiversity and its relevance to mankind: a short review J Agric Sustain 12 (2) pp 219–31
[2] Xu Z et al 2020 Assessing progress towards sustainable development over space and time Nature 577 pp 74–8
[3] Gleason H A 1922 On the relation between species and area Ecology 3 158–62
[4] Smith J R et al 2018 A global test of ecoregions. Nat Ecol Evol 2 1889–96
[5] Laura E D, Cowles J 2019 When Do Ecosystem Services Depend on Rare Species? Trends in Ecology & Evolution 34 746–58
[6] Danilina D M, Konovalova M E, Stepanov N V, Gosteva A A, Konovalova A E, Buyanov I Yu 2021 Measures for the conservation of biological diversity in the implementation of logging operations (on the example of the Krasnoyarsk Territory) Modern problems of biology and ecology: materials of reports of the III International Scientific and Practical Conference pp 285–8
[7] Buyanov I Yu, Zarubin D S and Bornyakov G A 2020 The influence of forest fires on the habitats of the sable (Martes zibellina L.) in central Siberia Bulletin of hunting studies 17 (4) pp 246–53
[8] Sedykh V N 2014 Dynamics of the lowland cedar forests of Siberia (Novosibirsk: Nauka) p 232
[9] Bizyukin V V, Veyola P and Miettinen P 1999 Actual problems of forest biodiversity conservation in the Baikal region Biodiversity of Baikal Siberia pp 192–9
[10] Savchenko A P 2012 The Red Data Book of the Krasnoyarsk Territory (SFU, Krasnoyarsk) p 205
[11] Website “The Red Data Book of Russia” Retrieved from: https://redbookrf.ru
[12] Wallace A R 1876 The Geographical Distribution of Animals: With a Study of the Relations of Living and Extinct Faunas as Elucidating the Past Changes of the Earth’s Surface (Harper and Brothers, New York)