Preservation of Forest Biological Diversity as an Activity to Ensure Environmental Safety in Forestry

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Abstract. It is necessary to ensure the ecological safety of forestry as a whole for maintaining the state of forest ecosystems. Taking into account the negative impact of human economic activity, activities for the preservation of individual forest objects that are of paramount importance for the functioning of the entire forest ecosystem are of particular importance. Such objects are called objects of forest biological diversity. Forest biological diversity exceeds that of other terrestrial ecosystems. Maintenance in forests of historically developed landscapes and ecosystems in general, which are not only a set of trees valuable for forest biological diversity, but also are the habitat of various groups of living organisms, is a prerequisite for ensuring environmental safety in forestry. The article examines the main problems arising in the preservation of forest biological diversity in Russia. Forest objects with different forest presentation duty (permissions, restrictions, prohibitions) are considered, difficulties with fixing such objects in the documents of users of forest services and on the ground are revealed. The article concludes with a number of recommendations for future studies of forest biological diversity in order to develop common approaches regardless of the state-owner of natural (forest) objects and peculiarities of national legislation.

1. Introduction

At the 1992 Earth summit in Rio de Janeiro, the Convention on biological diversity was developed, which considers biological diversity as an aspect of sustainability. This means that biological diversity preservation comes down to achieving sustainability [1]. In addition, the state of sustainability is characteristic of the state of environmental safety, in our case – the safety of forestry [2]. Ecological safety of forestry is the state of protection of the forest ecosystem from the possible negative impact of economic and other activities, natural and fabricated emergencies, their consequences. The object of ecological danger is the forest, both as a single ecosystem as a whole and as a set of forest resources and utilities.

The peculiarity of the object of ecological safety in the forest sphere is that the forest has global functions (forests have not only national, but also planetary significance). Forests are one of the most important carbon repositories on the planet; forest plantations play a crucial role in mitigating climate change by absorbing greenhouse gases, by creating more sustainable landscapes [3]. The Russian forest is the main resource of coniferous trees in the world. Its biospheric importance will tend to increase if its biological diversity is preserved [4].

A number of publications point to the accelerating rate of loss of ecosystems and biological diversity [5, 6]. The lack of measures to preserve forest biological diversity leads to negative reasons: reduction of forest cover and loss of typical landscapes; declining of the area of undisturbed forests (over the past three years, wild forests began to disappear 20% faster than in the period from 2000 to 2013; the fastest decline of wild forests in Russia – 90% faster than in the previous period (in Indonesia – 62%, and in Brazil – 16%)); change of age and breed structure of forests, growth of the share of deciduous young growth and multiple growth generations, decrease of species diversity of tree and shrub species;
lowering and loss of the ability to self-regeneration, diminishing of carbon-deponent properties of forests, reduction of forest resistance to adverse external factors, etc.

The purpose of this work is to develop recommendations for reducing forest diversity in order to ensure environmental safety of forestry.

In the course of the study, we studied the documents of the regions of Russia, establishing the regime of protection of objects that actually have signs of the object of forest diversity, but protected by different regimes (from the strictest - a ban on entering the territory, to the weakest - the absence of any restrictions).

2. Results and discussion

Forest biological diversity (biological diversity of forests) is an indicator of the heterogeneity, complexity of the forest ecosystem, which acts as a criterion for the ecological quality of forests and represents the diversity of biological objects or phenomena in the forest.

Diversity varies from local to global scale and can be defined in many ways [7]. Nevertheless, in any study of biological diversity the correct definition of the object is crucial. In the course of the study, we identified a discrepancy in the concepts that are used in legal documents - "objects of forest biological diversity", and in technical documentation and among forestry workers - "key sites". In order to establish compliance, we suggest using the following scheme (figure 1).

**Figure 1. Establishing compliance with legal and technical terms**

Thus, the concept that is used in practice - "key sites" for biological diversity preservation has a legislative form - "objects of biological diversity" (or species of biological diversity).

The protection mode of each biological diversity object includes a "buffer zone" mode. A buffer zone is an area surrounding a biological diversity object, where a special regime of economic activity is established, creating additional protection of objects in order to preserve and restore forest biological diversity. The sizes, borders of a buffer zone, and concrete measures of protection in economic documentation should be specified on the district: possible bans or restrictions of economic activity. These restrictions are especially necessary in the period of hunting, setting snares farming [8].

Investigating the peculiarities of buffer zones establishment in different regions of Russia, we have revealed the fact that the absence of specific minimum and maximum sizes of buffer zones of individual objects leads to the establishment of different sizes of such zones in different regions of Russia. For example, swamps in forests are an important biological diversity feature.
When protecting the swamp, not only the swamps themselves, but also the surroundings of the swamps, swamps with rare forest and forest areas among the swamps, forest areas characterized by obviously greater humidity, can be recognized as biological diversity objects. Such areas in the forest regulate the water regime and microclimate, contribute to the preservation of high humidity and soil, protect against waterlogging, and are the habitat of rare species of birds, capercaillie currents, reproductive ponds of amphibians, places of feeding and recreation of many mammals, flyways, temporary shelters for many animals. Due to the lack of the size of the protected area for the swamp in the legislation, the regions independently establish such zones.

| Region                              | Buffer zone size                                           | Forest preservation duty                                           |
|-------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------|
| Vologda region, Ulyanovsk region    | The size of the buffer zone with a width equal to the average height of the surrounding tree cover, but not less than 20 m around the swamp | Landing sites are planned taking into account the location of trees and shrubs listed in the Red Book, when there are trees with large nests on the site, during the bird-nesting season when the nest is inhabited, all types of felling on the site are suspended; a complete ban on deforestation within a radius of 20 m from large haufens (anthills) more than 0.5 m high |
| Krasnodar Territory, Republic of Adygea | Not less than 20 m                                         | All types of felling are transferred from the breeding season (March - May) to another time around plurannual fox and badger holes in the buffer zone 200 m wide |
| Arkhangelsk region, Komi Republic   | Not less than 50 m                                         | Forest preservation duty is not set                                |
| Republic of Tatarstan               | Not less than 50 m, however, if the swamp is a place of seasonal concentration and breeding of animals, then the size of the buffer zone should be increased | Forest preservation duty is not set                                |
| Saratov region                      | Buffer zone does not set                                   | Forest preservation duty is not set                                |

The specified differences in the protection of one object – the swamp – led us to the conclusions:
- the Federation shall establish minimum and maximum sizes, the mode of buffer zones centrally;
- the sizes of buffer zones can be adjusted by regional authorities depending on geographical and natural conditions of the region (the specific size and the mode of the buffer zone are established for each object of biological diversity taking into account its area, the location and measures of protection necessary for preservation of object of biological diversity).

Definitely, taking into account the natural features of the regions, the frequency of occurrence of biological diversity objects and their role in the forest ecosystem, such a difference in the size of buffer
zones is understandable, however, it seems that it is necessary to develop guidance (recommendations, comments, explanations) at the Federal level to establish the size of buffer zones of biological diversity objects.

In addition to the problems with the establishment of buffer zones, we also found that the same actual natural objects could be protected by different regimes, not only the regime of "biological diversity object", but also the regime of "specially protected areas of the forest" and the regime of "natural monument".

For example, in many forests of Russia there is such a special object as a place of courtship of birds (lekking ground). These places play a crucial role for the reproduction of many birds, and for birds listed in the Red book - lekking ground - a place of survival and preservation of the species. Therefore, it is critically important to preserve the sites of lekking ground, to protect them from human impact, especially from the felling of trees and illegal prey of birds. Incentives need to be developed to persuade forest users to conserve forest rather than deforestation their land for timber production and agriculture [9].

It is possible to save mating places of birds in a different way (mode): a mode of monuments of the nature, especially protective forest sites or a buffer zone of object of biological diversity. Each of these modes represents different rules, restrictions, and prohibitions for the current location. For example, in Russia, in general, all regions have the following rules.

As we can see, the "blurred" legal regime of protection of natural objects generates uncertainty of their protection on the spot. Since it is possible to establish a legal regime "weaker", in order to maintain any economic purpose, rather than environmental. The implementation of local environmental security policies is not simple and depends on the socio-environmental context [10]. The observations of many researchers show that the establishment of biological diversity regimes is dominated by scenarios focusing on the assessment of possible compromises with market forces, political reforms [11, 12]. Therefore, the first step in solving the problems is to enshrine in the law the features of the regime of protection of forest biological diversity. However, the legislative process alone will not solve all the problems. Clear guidance is needed to identify and protect local forest biological diversity sites.
Table 2. Differences in security arrangements of objects

| The natural monument | Especially protective forest sites | Object of biological diversity |
|----------------------|-----------------------------------|-------------------------------|
| **Definition**       | Forest sites, which are natural   | Forest sites of particular     |
| Unique natural objects and complexes that are valuable in environmental, scientific, historical - cultural, aesthetic and environmental - educational terms need special protection of the state | objects of particular value, and in respect of which a special legal regime is established for the use, protection and reproduction of forests | importance for the conservation of biological diversity and the maintenance of the environmental protection of forests properties |
| **Boundaries of protective zones** | The borders of the zone are within a radius of 300 meters around the currents at the rate of no more than 3 such forest sites per 10 thousand hectares of forests | The breadth of the buffer zone is recommended at least 200 m, depending on the bird species |
| Is carried out by resolution of the Government of the Russian Federation or by decision of state authorities of the respective regions of the Russian Federation | Isolation, establishment and change of borders, carried out by decisions of the authorized federal executive body | The object isolation of biological diversity occurs in the process of forest management fieldwork by forest management organizations (firms) |
| **Mode features** | **Prohibited:** | a) carrying out clean forest felling |
| a) all economic activities and other activities that threaten the state and safety of protected natural complexes and objects | a) carrying out clean forest felling; | b) farming; |
| | b) construction and operation of capital construction facilities. | c) construction and operation of capital construction facilities. |
| | | allowed: |
| | d) selective forest felling only for the purpose of cutting down dead and damaged forest range | d) selective forest felling only for the purpose of cutting down dead and damaged forest range |
| **Consequences in case of violation of the mode** | a) administrative sanction case, | a) administrative sanction case, |
| a) criminal prosecution, | b) upon compensation for damage, the amount of damage shall be increased 5 times | b) upon compensation for damage, the amount of damage shall be increased 2 or 3 times |
| c) upon compensation for damage, the amount of damage shall be increased 5 times | | a) administrative sanction case only if this biological diversity object, the size of its buffer zone and the measure of protection are indicated in the forest development project |

3. Conclusion

Based on the identified data, we can offer the following recommendations for preservation of forest biological diversity as an activity to ensure environmental safety in forestry:
- to establish a compliance between biological diversity and key sites;
- to produce preliminary key sites at the planning stage of the marking-cut a coupe;
- to fix biological diversity objects with the obligatory establishment of boundaries of buffer zones on the ground;
- to establish the minimum and maximum sizes of buffer zones at the federal level;
- to establish a clear forest presentation duty for the protection of biological diversity, common for all regions (prohibition on clear forest felling, for example).

The implementation of these and other measures will make it possible under the present conditions not only to stop the reduction of forest biological diversity, but also to preserve forest biological diversity, and create the opportunities for its restoration in order to ensure environmental safety in forestry.
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