Economic management of anthropogenic impact on bioresources of natural protected areas

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Abstract. The comparative study of monetary assessment of negative anthropogenic impact on different groups of biological resources at natural protected areas of regional level was done for two natural reserves in North-West Russia, belonging to the two most often damaged kinds – coastal ecosystem and old-grown taiga forests. It is shown that before changes in the Red List of Russia in 2020 the most economic damage was caused to migrating hunted species of animals, and after it – to non-hunted species.

1. Introduction
Growing anthropogenic press on biological resources (BR) and their habitats in Russia is caused both by an increase in their industrial use and by reducing their reserves due to inevitable negative impacts from developing economic activities. According to one of the principles of Russian nature protection legislation, one should pay for nature use, including use of BR [1]. However, at present, this principle is not fully implemented due to legal and regulatory difficulties [2]. The damage assessment to wild animal resources is an obligatory part of any project documentation. It includes the monetary assessment of expected natural resources loss, carried out by two legal ways: monetary payment to the State and compensation of the damage by restoration. In both cases, the assessment of damage is calculated for each group of biological resources separately [3]. The assessment of inevitable harm to habitats of animals is usually estimated using the following legislatively approved techniques [4, 5]:
- order of the Ministry of Natural Resources of Russia of December 8, 2011 No. 948 “On approval of the methodology for calculating the amount of harm caused to hunting resources”;
- order of the Ministry of Natural Resources of the Russian Federation of April 28, 2008, No. 107 “On approving the methodology for calculating the size of harm caused to wildlife objects recorded in the Red Book of the Russian Federation and other wildlife objects not related to hunting and fishing objects and their environment”;
- order of the Ministry of Natural Resources of the Russian Federation of August 01, 2011, No. 658 “On approving the tax for calculating the size of harm caused plant objects recorded in the Red Book of the Russian Federation and their habitats owing to violation of the law in the field of environmental protection and environmental management”;
- order of the Federal Agency for Fisheries of November, 25, 2011 No. 1166 “On approval of the methodology for calculating the amount of damage caused by water biological resources”.

Those methods are used for monetary assessment of the negative impacts on animals and their habitats in case of decisions made regarding planned human activities and in case of calculating the payments for already caused damage to animals and habitats.
The highest wildlife damage may be expected when industrial activity occurs in natural protected areas (NPA) or near them [6].

The current study is aimed at identifying non-working economic instruments regulating the anthropogenic load on the most valuable BR – compounds of ecosystems of natural protected areas [7].

2. Methods

The regulatory prerequisites for the inefficiency of regulation of some BR groups were analysed. A monetary assessment of non-compensated damage to BR and their habitats was made for two model objects – NPA with a different specialization: coastal type (reserve “South Coast of the Neva Bay” of St. Petersburg) and forest type (reserve “Uftyugo-Ileshskii”). Investigated NPA have similar properties regarding animals:
- they contain migrating ways of animals and feeding areas on the ways;
- they include the intact areas of animals’ reproduction;
- the biodiversity is much higher than on the adjusting territories;
- the rare species of animals included to the Red Lists reproduce on the territory;
- the wetland ecosystems and the old grown forest ecosystems and presented;
- the adjusting areas are significantly transformed by human activity.

For calculating of the economic damage to different groups of animals, the following state-approved methods were used:
- order of the Ministry of Natural Resources of Russia of December 8, 2011, No. 948 “On approval of the methodology for calculating the amount of harm caused to hunting resources”;
- order of the Ministry of Natural Resources of the Russian Federation of April 28, 2008, No. 107 “On approving the methodology for calculating the size of harm caused to wildlife objects recorded in the Red Book of the Russian Federation and other wildlife objects not related to hunting and fishing objects and their environment”;
- order of the Federal Agency for Fisheries of November, 25, 2011, No. 1166 “On approval of the methodology for calculating the amount of damage caused by water biological resources”.

The highest wildlife damage may be expected when industrial activity occurs in NPA or near them. The analysis of regulatory requirements has shown that at present, the monetary assessment of the damage to BR from planned human activity is not carried out for the following groups of BR and their habitats: hunting resources; animals that are not classified as hunting objects; soil invertebrates; non-wood forms of vegetation; mushrooms and lichens; food and pharmacological resources. Due to the instructions of the Ministry of Natural Resources of 2013 [9], the use of existing approved methods for calculating damage to these groups of BR in the design of industrial facilities and other economic activities is prohibited, while these methods remain applicable just for cases of control and supervisory.

There are no methods for calculating damage to these BR groups for the design and planning stages of human activity developing. According to Article 3 of the Federal Law “On environmental protection” of 10.01.2002 No. 7-FZ, in the absence of approved methods, the calculation of the damage should be made based on real costs for restoration. This requirement is practically not applicable to slow-recovering ecosystems due to the impossibility of determining inflation rates for a period longer than

3. Results

BR of NPA have a special status and their loss due to economic activity is either unacceptable [8] or is estimated higher when developing an environmental monetary assessment of economic activity projects. The analysis of regulatory requirements has shown that at present, the monetary assessment of the damage to BR from planned human activity is not carried out for the following groups of BR and their habitats: hunting resources; animals that are not classified as hunting objects; soil invertebrates; non-wood forms of vegetation; mushrooms and lichens; food and pharmacological resources. Due to the instructions of the Ministry of Natural Resources of 2013 [9], the use of existing approved methods for calculating damage to these groups of BR in the design of industrial facilities and other economic activities is prohibited, while these methods remain applicable just for cases of control and supervisory.

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the Federal budget law is approved. Also, the technologies for the natural ecosystems reconstruction are currently poorly developed even on a global scale, especially for northern latitudes. The current situation entails the fact that most of the damage caused to BR of the considered groups remains uncompensated.

The lack of the economic regulation of anthropogenic damage to these BR groups in the economic activities development is especially critical for BR of NPA containing complicated ecosystems with high biodiversity. The monetary assessment of the profitability of projects implemented in the NPA or affecting the components of NPA, taking into account the damage to BR, is the most representative approach for all participants in the process of planning the economic activity projects.

In the current study, the comparative evaluation of the non-compensated BR damage structure was done for two regional NPA, one coastal and another situated in old grown forests. Both NPA are biodiversity-rich and are situated on the animals’ seasonal migration ways, and both have the permanent influence of economic activities in adjacent territories. For the coastal NPA (the reserve “South Coast of the Neva Bay”), this is the port activity, and for the forest NPA (the reserve “Uftyugo-Ileshsky”) – harvesting of timber (clear felling). At the coastal reserve, the largest non-compensated damage was observed for the group of hunted species of migrating aquatic birds (more than 60 % of total damage), the smallest one – for the other groups of BR (Fig. 1).

In the case of the forest NPA, the largest damage was revealed for the group of hunted species of mammals (Fig. 2), primarily due to the decrease in the biotopes quality in the forest reindeer migration corridor. In both cases, the most endangered groups of BR were migrating animals.

**Figure 1.** The average structure of the anthropogenic damage to biological animal resources of the ecosystems of NPA Southern Coast of the Neva Bay in the Finnish bay in Baltic Sea with comparative high risks of negative impact.

**Figure 2.** The average structure of the anthropogenic damage to biological animal resources of the old grown taiga ecosystem of NPA “Uftyugo-Ileshskii”, Archangelsk region with comparative high risks of negative impact.
Both investigated NPA have a similar specifics of the damage to animals, linked with the developing of human activity:
- the most part of total damage to animals of NPA is linked with destroying the biotopes with high value for migrating animals;
- more than 50 % of total damage to animals in monetary terms is associated with the damage to hunted animal species;
- the most part of damage is connected with transformation of the animals’ habitats.

4. Conclusion
According to the study results, there is an urgent need to develop and implement monetary methods for calculating the expected damage to the BR groups of regional NPA for the stages of planning and designing of economic activities: for hunted and non-hunted species of animals, non-wood plants, fungi and lichens, taking into account the inseparability of the local populations within the protected areas and adjacent territories.

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