Protection of the Biodiversity of The Republic of Altai in Connection with Economic Development: Regional Experience

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Abstract. In this paper there have been analyzed problems of biodiversity conservation in the Altai Republic in the context of economic development of the territory. The main types of economic activities have a different impact on the biodiversity of the region. The authorities and environmental services take measures to preserve the natural environment, flora and fauna, including the organization of specially protected natural areas, the study of biodiversity and the publication of regional Red Data Books, the elaboration of projects for the artificial cultivation and breeding of certain species of plants and animals, including the Red Data Book ones. It has been shown that the problem of preserving medicinal plants included in the Red Data Book of the Altai Republic has been unsolved for more than 20 years. This can lead to the almost complete disappearance of these species outside the borderlines of specially protected natural areas of the federal level.

1. Introduction

The Altai Republic is located in the south of Western Siberia and is a sparsely populated and poorly industrialized region. With an area of 92,6 thousand km², the population of the Republic at the beginning of 2020 is 220 thousand people. The population density is 2,3 people/km², while more than 96 thousand people (43,6 %) live in the northern part of the Republic on the territory of the city of Gorno-Altaiisk and the Maiminsky administrative region, the total area of which is 1376 km² (1,5 % of the total area of the region). Consequently, in the rest of the region the population density is only 1,36 people/km². In addition, in the southern part of the Republic most of the villages are located within large intermontane basins – Chuiskaya and Kuraiskaya in the Kosh-Agachskiy region; Uymonskaya, Abayskaya and Katandinskaya in the Ust-Koksinsky region, and in the rest of the territory there are only separate settlements and seasonal livestock pastures. The sparsely populated territory contributes to the presence of large areas of undeveloped or underdeveloped territories and, respectively, the preservation of natural complexes in their natural form [1].

The rich biodiversity of the Altai Republic is facilitated by the natural and climatic conditions of the region. According to G.S. Samoylova [2], in terms of the uniqueness of landscapes and natural resources, Gorny Altai has no equal not only in Siberia, but also in Central Asia.
A.D. Armand [3, p. 51] notes that in Altai “a number of plant formations converge – the boreal Ural-Siberian (spruce, cedar, fir, larch), Trans-Volga-Kazakhstan (forb-fescue-feather grass steppes), Mongol-Chinese (ridge, wormwood-feather grass and shrub steppes) and Central Asian ones (semi-shrub-solonchak deserts). /…/ Consequently, the fauna of Altai is also full of contrasts. There are representatives of the forest-steppe and steppe complex with the East Siberian inhabitants of the taiga, and from the south, the fauna draws its representatives from the Central Asian zoogeographic subregion.”

The flora of Gorny Altai numbers more than 2136 higher vascular plants, including 124 endemic and relics, 1622 lichen species and 700 types of cap fungi. The region is home to 93 species of mammals, 312 species of birds, 33 species of fish, 7 species of reptiles and 4 species of amphibians [4].

More than 200 species of valuable medicinal, food, fodder and industrial plants growing on the territory of the region are of great economic interest; 160 species of plants with exceptional medicinal value are included in the State Pharmacopoeia. The objects of hunting are 34 species of mammals and 29 species of birds [5].

The last, third edition of the Red Data Books of the Altai Republic [6-7] includes 180 species of plants, lichens and fungi, and 135 species of animals.

The leading sectors of the region's economy are agriculture and tourism, which has been actively developing over the past two decades. Forestry, mining, food, light and processing industries are of subordinate importance. It should also be noted the traditional crafts of the rural population, which include gathering, hunting and fishing.

2. Materials and Methods
Considering the history of the economic development of Gorny Altai, it can be noted that in the southern part of the region by the end of the XIXth century, a semi-nomadic livestock-commercial type of land use was formed, the basis of which was distant-pasture livestock raising with vertical migration within the intermountain basins and watershed plateaus. Traditional crafts played a leading role in the northern part of the region [8].

During the period of collectivization there was a forced transition to a sedentary lifestyle and the concentration of the predominant part of the indigenous population in medium and large villages. With the organization of large collective farms (collective farms (sovkhozes and kolkhozes)) distant-pasture cattle breeding retained its leading role - in the structure of commercial agricultural products the share of livestock breeding was more than 90 %.

In the post-Soviet period, under the conditions of the socio-economic crisis, most collective and state farms were liquidated or reorganized into small agricultural enterprises. There was a decrease in the number of most types of livestock, so in 2002 the number of cattle was 65 % in comparison with the 1989 level, sheep – 40 %, goats – 42 %, horses – 68 % [9]. At the same time, the decrease in the livestock was due to a decrease in it in the public sector, but in personal subsidiary plots (personal farm householding) it increased significantly. In 2006 within household plots there was contained 70,1 % of the total livestock of cattle, 57,9 % of sheep and goats, 58,9 % of horses [10]. In recent years, there has been a gradual increase in the livestock population.

At present, agricultural land occupies 28,5 % of the region's territory; also, the lands of the forest fund are partially used for grazing and hay harvesting. The share of arable land is 5,1% of the total area of agricultural land or 1,4 % of the entire territory of the region. In the structure of agriculture, animal husbandry still plays a leading role, and agriculture mainly serves to meet the needs of animals for fodders [4].

Agriculture has a multifaceted impact on the natural environment, including biota. The leading role is played by cattle grazing, while in some cases this has a significant impact on the animal world. For example, the displacement of argali, included in the Red Data Books of the International Union for Conservation of Nature and Natural Resources (IUCN), of the Russian Federation and the Altai Republic, from their original habitats by herds of domestic animals is the main anthropogenic factor
affecting the abundance of this species [6]. In addition, shepherds, the work of which is organized in isolated way, as a rule, have weapons (officially for protection from wild animals), which are often used for illegal hunting [11].

Maral breeding also influences the fauna, it is well developed in the Altai Republic. Fencing of nurseries for marals leads to the withdrawal of winter stations and disruption of the migration routes of this species of ungulates.

Mass tourism in Gorny Altai has been developing since the early 1960s, and the total number of tourists in the 1980s was more than 300 thousand people [12]. With the collapse of the USSR and the onset of the socio-economic crisis, the number of tourists dropped to 40 thousand in 1992-1993, but by the end of the 1990s it again reached the indicators of the Soviet period [13]. Since then, the number of tourists has increased every year and in 2019 the Republic of Altai was visited by 2,171 million people [4]. The main negative impact on biota from tourists is the disturbance factor and the collection of “Red Data Book” plant species. It should be noted that in recent years more and more remote territories of Gorny Altai have been involved in the tourism sector.

Industry in the Altai Republic is poorly developed and does not significantly affect the biota. One can note the pollution of individual small rivers, which are influenced by mining (placer gold mining) and partially food (creamery) industries. The most polluted river in the region is the river Mayma in its lower reaches, which is vinculated with the negative impact of the agglomeration of the republican center - the city of Gorno-Altaysk [4].

Logging affects biota primarily through habitat alteration and destruction, and also as a disturbance factor.

A much more serious impact on the flora and fauna is exerted by the traditional crafts of the local population, and in recent years also by visitors. As noted above, gathering, hunting and fishing can be attributed to traditional crafts in the Gorny Altai. Their preservation and distribution in the region is facilitated by the rich species diversity of flora and fauna, the presence of significant reserves of certain types of natural resources, unemployment and a high level of self-employment of the population, the presence of demand for certain types of products, and an insufficient level of control over compliance with environmental legislation.

In recent years, the preservation of traditional crafts has been based on socio-economic reasons. In the late Soviet period, traditional crafts were combined with work on collective farms. In conditions of guaranteed employment of the population, some types of traditional nature use, in particular, hunting, fishing and, to a lesser extent, gathering, for example, picking mushrooms or berries, acted more as a kind of recreation than a significant source of replenishment of the family budget. It is noted [8, 14] that at the end of the Soviet period the share of gathering, hunting and fishing in the structure of the family budget of rural residents of Central Altai was about 4-5 %.

Gathering played the greatest role among traditional crafts in Soviet times. This was facilitated by the development of a system of consumer cooperation with procurement offices, which received medicinal and technical raw materials from the population. It is noted [15] that in the Altai Krai, which at that time included the Gorno-Altai Autonomous Region, in 1984 about 60 species of medicinal plants were procured in one volume or another.

Already at that time, a number of environmental problems appeared in the field of biodiversity conservation, primarily of valuable medicinal plants. So, it is noted [16, 17] that in 1970 - early 1980 in Altai, the reserves of the golden root (Rhodiola rosea) and the maral root (safroloid raponticum) have significantly decreased.

In the post-Soviet period, in the context of the socio-economic crisis, the emergence of unemployment and the demand for certain types of natural resources, the share of traditional crafts in the formation of the family budget of rural residents increased to 15-25 % [5]. The impact on biota has increased dramatically.

Thus, N.A. Nekratova [18] notes that the procurement of medicinal raw materials in Altai is mostly spontaneous and threatens with the extinction of populations of intensively used species (primarily maral root and Rhodiola rosea) in many mountainous regions accessible to procurers.
In the Ust-Koksinsky region, where significant reserves of golden root are concentrated, the practice of illegal procurement using hired labor from local residents and visitors has long been established. This is noted by the famous in Altai herbalist S.A. Pirogov [19, p. 35]: “Local entrepreneurs bring whole teams of illegal migrants, homeless people, etc., to our region, who are digging roots mostly illegally. /.../ Such a scale of illegal procurement leads to a rapid reduction in stocks of medicinal plants.”

The volume of seizures of illegal products also testifies to the scale of illegal procurement. So, in 2017, the Border Department of the Federal Security Bureau of Russia in the Altai Republic seized 4.7 tons of medicinal and technical raw materials, including 1.4 tons of Rhodiola rosea roots and almost 1.5 tons of maral root. Most of the illegally procured raw materials were seized on the territory of the Ust-Koksinsky district [4]. And in 2019, border guards seized more than 8 tons of gold root alone [20].

In recent years, due to the increased price of cedar cones, not only residents of the Altai Republic, but also visitors from other regions, primarily the Altai Krai, participate in its harvesting. Some families can earn up to 300 thousand rubles from harvesting cedar cones per season and more.

This has a varied impact on the socio-political and socio-economic life of the region. For example, in the elections of the head of the Altai Republic and deputies of the regional parliament that took place on September 8, 2019, the turnout was slightly more than 40 % of voters (in previous years, more than 70%). Many mass media, including the central ones (see, for example, [21]), linked this with the high season of harvesting cedar cones. Another negative aspect is the fact that many workers of agricultural enterprises in the region literally run away from work during walnut harvesting.

In addition, the regional and local press regularly publishes messages about searches for local residents and visitors from other regions who disappeared after leaving to harvest cedar cones or medicinal herbs.

Among the environmental consequences, it should be noted that the harvesting of cedar cones is often carried out in barbaric ways, the branches and trunks of trees are damaged, there is a factor of concern, and non-observance of fire safety rules leads to forest fires.

Hunting and fishing in the late Soviet period did not play a significant role in the life of the region's population and for the most part were a kind of recreation. The situation has changed in the post-Soviet period. Unemployment and a lot of free time lead to the development of poaching of all kinds. In the 1990s, the “Red Data Book” species of animals, such as the snow leopard, argali and musk deer, were significantly affected [6]. It should be noted that musk deer was included in the regional Red Data Book only in 2017. Hunters actively prey on this animal because of the musk gland of males. According to expert estimates, the poaching of musk deer in 2005-2008 estimated at 6000 heads per year [22].

In general, in recent years, traditional crafts have often been carried out in violation of environmental legislation. In gathering, it is, first of all, the procurement of “Red Data Book” plant species. In hunting - illegal production of hunting and commercial, less often "Red Book" species, hunting without licenses and with unregistered weapons. In fishing - catching fish in prohibited ways, violation of the timing of fishing (fishing during the spawning period).

Thus, it can be stated that in the process of economic development and use of the territory of the Altai Republic in recent years, traditional crafts of the local population have the greatest impact on biodiversity.

3. Discussion
Regional and municipal authorities, nature conservation organizations, scientific and public organizations take certain measures to preserve flora and fauna. There are several areas of activity here:

1. Organizations of specially protected natural areas (SPNA) in the Altai Republic.

The region has one of the most developed SPNA networks in the country, which includes two biosphere reserves, one national park, four natural parks, two biological reserves, one botanical garden
and 44 natural monuments of regional importance. The total area of these protected areas is 2.36 million hectares or 25.4% of the territory of the Republic.

In most cases, the organization of protected areas was a consequence of the response to the increasing impact on the natural environment, including biota. So, organized in 1932, the Altai Reserve was created, among other things, to preserve the sable population. The largest argali population in the Russian Soviet Federated Socialist Republic (RSFSR) lived on the territory of the Kosh-Agach nature reserve, organized in 1965. As a reaction to the development of tourism and the strengthening of anthropogenic impact on certain natural objects, natural monuments of regional significance were organized in 1978. In 1981, the Shavlinsky and Sumultinsky reserves were organized, on the territory of which almost all types of the hunting fauna of the region are represented. In 2010, the Saylyugemsky National Park was organized, consisting of three clusters. It partially included the territories of the former Kosh-Agach and the current Shavlinsky reserves. The national park was organized primarily to preserve the snow leopard and argali, included in the International Red Data Book.

It should be noted that all natural parks of the region were organized at the initiative of local residents. For example, the “Ukok Quiet Zone”, and later the “Ukok Quiet Zone natural park”, were organized after the protests of the residents of the Kosh-Agach region against the excavation of burial mounds. The fact is that in the summer of 1993 in Ukok, in a layer of permafrost, mummified bodies of people with tattoos were found, including the mummy of a young woman named by journalists the Altai princess or princess of Ukok. Many local residents demanded to bury the body of the "princess" back and generally prohibit such excavations in the future, since this territory was considered sacred by the Telengits, representatives of the indigenous ethnic group. The organization of a nature park with certain environmental restrictions was a compromise between the authorities, public organizations and local residents [23].

2. Study and preservation of rare and endangered species of plants and animals, including maintaining regional Red Data Books.

In 1996, the first regional Red Data Books, separate volumes on plants and animals, were published in the Altai Republic. In 2007, the 2nd edition was published, supplemented and revised, also separately for plants and animals. In 2017, the third edition came out, the latest at the moment. The Red Data Book of the Altai Republic (plants) [7] includes 180 species of plants, lichens and fungi of Altai, and the Red Data Book of the Altai Republic (animals) [6] includes 135 species of animals. The publication of the Red Data Books took place thanks to the efforts of scientists from the Gorno-Altai State University, scientific institutions of the Siberian Branch of the Russian Academy of Sciences, Altai and Katunsky reserves and a number of other organizations.

In recent years, through the efforts of specially protected natural areas of the region and charitable nature conservation funds (WWF), a monitoring system has been organized for the Red Data Book species of animals, primarily the snow leopard and argali. This is the conduct of regular counts of the number of animals, the use of camera traps, anti-poaching raids, attraction of the local population to cooperation in the study and preservation of the Red Data Book species. These efforts have led to an increase in the number of snow leopards and argali in the region.

Nevertheless, the state of knowledge of the biota of the region in general leaves much to be desired. For example, the analysis carried out by the authors showed that of 135 animal species included in the Red Data Book of the Altai Republic [6], for 34 species (25.2%) the main limiting factors affecting the populations of these species have not been studied.

3. Elaboration of projects for artificial cultivation and breeding of certain species of plants and animals, including the Red Data Book species.

So far, this is only an initial experience without widespread implementation into practice. Nevertheless, the Gorno-Altai Botanical Garden, which is a branch of the Central Siberian Botanical Garden (in Novosibirsk), has developed methods for growing rare, endangered and endemic plant species (including the golden root) and their introduction into the wild. Experiments are also being
carried out on the possibilities of growing wild plants in the conditions of personal subsidiary and peasant farms in the region.

Among the projects aimed at preserving objects of the animal world, there should be noted the experiments on breeding musk deer in captivity [24, 25] and projects for the stocking with fish of small and medium-sized lakes in the region [5].

Among other areas of activity, it should be noted the organization of environmental education among the population of the Altai Republic and the need to strengthen control over the conservation and use of flora and fauna, including the help of societies of hunters and fishermen.

In recent years, there has been the creation of enterprises and organizations, including individual entrepreneurs, in the field of procurement and processing of products of gathering, fishing and hunting. This will create additional workplaces, as well as stimulate local entrepreneurs to conserve and rationally use natural resources. Regional and municipal authorities need to support these processes.

4. Results
It should be noted that over the past years, the authorities and environmental organizations in general have responded quite promptly to the existing problems in the field of nature protection, including biodiversity. But the practice of illegal procurement of medicinal plants, which has developed for more than 20 years, many of which are included in the Red Data Book of the Altai Republic, can lead to the almost complete extinction of these species. In reality, they are protected only within the boundaries of protected areas of the federal level – Altai and Katunsky reserves, the Sailyugemsky national park, the total area of which is only 1151,3 thousand hectares (12,4 % of the region's territory).

In recent years, traditional crafts have played an increasing role in the life of the population of the Altai Republic, at the same time, they are often carried out in violation of environmental requirements. The low standard of life affects the mentality of local residents and leads to the fact that poaching of all types is a common and extremely stable form of life of the population, which is practically not condemned by the local community.

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