Issues of preserving the natural environment of the Republic of Altai in the context of the agro-industrial complex development

Leonid Baylagasov¹*, and Irina Kapitonova²

¹Gorno-Altai State University, 1, Lenkina str., Gorno-Altaisk, 649000, Russia
²Peoples’ Friendship University of Russia (RUDN University), 6, Miklukho-Maklaya str., Moscow, 117198, Russia

Abstract. In this article are examined the issues of preserving the natural environment of the Altai Republic in the context of the agro-industrial complex development. It is shown that agriculture played a leading role in the economy of the region both in the Soviet and post-Soviet periods. The main factors of the impact of the agro-industrial complex on the natural environment of the region are associated with the fencing of maral nurseries, arable lands and hay lands, and, accordingly, with the violation of the migration routes of ungulates. The chemicalization of agriculture and overgrazing of livestock in some areas have a certain impact on the flora and fauna, water bodies and soil cover. At present, in general, the development of the agro-industrial complex does not have a significant impact on the natural environment of the region.

1 Introduction

The Republic of Altai is located in the south of Western Siberia on an area of 92.9 thousand km². This is one of the few Russian regions with a significant predominance of the rural population. With a population of 221,4 thousand people at the beginning of 2022, the share of the rural population is 156.8 thousand people or 70.8%.

On the territory of the region there are 10 administrative districts (municipalities) and one city, Gorno-Altaisk, which is a separate municipality.

The Republic of Altai is characterized by a low population density (2.38 people/km²), while more than 99 thousand people (44.9%) live in the northern part of the republic on the territory of the city of Gorno-Altaisk and the Maiminsky administrative district, the total area of which is 1376 km² (1.5% of the total area of the region). Accordingly, in the rest of the region, the population density is only 1.33 people/km². The sparsely populated territory contributes to the presence of large areas of undeveloped or underdeveloped territories and, accordingly, the preservation of natural complexes in their natural form [1].

The relief on the territory of the Altai Republic is represented by low, middle and high mountains, with absolute heights from 350 to 4500 m. Accordingly, in the agro-climatic zoning a low-mountain zone is distinguished (it includes Maiminsky, Choisky and

* Corresponding author: b061717@yandex.ru
Turochaksky districts), a middle-mountain zone (Shebalinsky, Chemalsky, Ust-Kansky, Ongudaisky, Ust-Koksinsky districts) and the high-mountain zone (Ulagansky and Kosh-Agachsky regions) [2].

The share of agricultural land is 26.5 thousand km² or 28.5% of the region area, but it should be noted that in the agricultural sector of the Altai Republic are also partially used forest fund lands (37.5 thousand km² or 40.4% of the total area of the republic) and reserve lands (16.5 thousand km² or 17.8%), primarily for livestock grazing [3].

2 Materials and methods

Considering the history of the agricultural development of the Altai Republic, it can be noted that in the southern part of the region, by the end of the 19th century, a semi-nomadic cattle-breeding and commercial type of land use was formed, the basis of which was transhumance with vertical migration within the intermountain basins and watershed plateaus. Such a system was the most uniform and rational, it increased the efficiency of pasture use and avoided its degradation. Livestock camps were located in isolation along separate river valleys and intermountain basins. During summer seasons livestock breeders were forced to send their herds to the mountains in the zone of subalpine meadows in order to save food for the winter in the valleys where their permanent homes were. In the grazing herd a certain ratio of animals was maintained, that ensured a more complete consumption of herbage [4].

A similar system of nomadic and semi-nomadic cattle breeding developed in the Altai Republic more than two thousand years ago, and, on the whole, has been preserved to this day. In particular, this is indicated by the coincidence of the ways of locating modern and 2000-year-old summer and winter livestock camps on the territory of the Kosh-Agach region [5].

In the Soviet period, in the process of collectivization, a forced transition to a settled way of life took place, as a result of which the predominant part of the rural population was concentrated in medium and large villages. With the organization of collective farms and state farms, transhumance retained its leading role - in the structure of marketable agricultural products, the share of livestock in the late Soviet period was 93-97%. Crop production was specialized in the production of fodder for livestock needs [2].

It should be noted that during the Soviet period, the majority of rural residents had a personal plot and were engaged in personal subsidiary farming (personal household plots). Alimentation of farm animals in household plots has always been limited. So, for example, in the Altai Republic during the Soviet period, one family was allowed to keep one cow, 10 sheep or goats and one working horse on a personal subsidiary plot. In certain periods, only pensioners could keep horses. Such restrictions were persisted until the end of the Soviet period [6].

In the late Soviet period, even in the absence of unemployment and guaranteed employment of the rural population in the public sector, the share of income from personal subsidiary plots of residents of small and medium-sized settlements was 25-35% in the total structure of the family budget [7; 8].

After the collapse of the USSR, in the context of the socio-economic crisis, most collective farms and state farms were disintegrated or were reorganized into small agricultural enterprises. There was a reduction in the number of most livestock species (except marals), thus, in 2002 the number of cattle was 65% of the 1989 level, sheep - 40%, goats - 42%, horses - 68% [9]. At the same time, the decrease in livestock occurred due to its reduction in the public sector, but in personal subsidiary plots it increased significantly.
In 2006, household plots kept 70.1% of the total number of cattle, 57.9% of sheep and goats, and 58.9% of horses [2].

Since the beginning of the 2000s, the growth of livestock began. It is noted [10], that in 2005-2015 there was an increase in the number of livestock: horses - by 2.5 times, cattle - by 93%, sheep and goats - by 42.8%, marals - by 7.2%. In the same period, there is a change in the structure of the livestock population, in particular, an increase in its share in peasant farms and a decrease in personal subsidiary plots. Thus, for example, the number of cattle in 2005 was distributed between farms of different forms of ownership as follows: agricultural organizations - 16.4%, personal subsidiary plots - 70.2%, peasant farms - 13.4%. In 2015, the distribution was as follows: agricultural organizations - 10.7%, personal subsidiary plots - 52.3%, peasant farms - 37%.

In recent years, the growth of the livestock population has slowed down, but has not stopped. There is also a decrease in the share of livestock in households (in private household plots) and an increase in peasant farms.

It should also be noted that in the conditions of weak industrial development, agriculture until recently was the leading branch of the national economy of the region. But in recent years in the Altai Republic there has been a rapid development of tourism. Since 2017, more than 2 million tourists have visited the republic annually, which is almost 10 times more than the population of the region [11]. Currently, tourism, along with agriculture, is the basis of the economy of the Altai Republic.

3 Results

Agriculture has a diverse impact on the natural environment, and primarily on the biota. As mentioned above, the share of agricultural land is 26.5 thousand km² or 28.5% of the area of the Altai Republic. In the structure of agricultural land, the share of pastures is 80.2%, arable land - 11.5%, hayfields - 8.1%, deposits - 0.2%. This proportion of the main agricultural lands is quite favorable for the conservation of wildlife, since the share of arable land is less than 1.5% of the total area of the region. Plowing of land plots leads to a radical transformation of the original landscapes, but small areas of arable land reduce the scale of anthropogenic impact on the natural environment.

In the 1960-1980s, agricultural land and partially populated areas were contaminated with organochlorine pesticides used for aerial treatment of crops from locusts and other pests, as well as from ixodid ticks. The total area of pollution above 1 maximum permissible concentration is 456 ha. Small areas of arable land on the territory of the Altai Republic contributed to a decrease in the use of pesticides in agriculture [12].

In the late 1990s and early 2000s, there was an active discussion in the Altai Republic about the advisability of using poison, in particular barium fluorite, to fight wolves. Supporters of the use of poison focused attention on the great damage to livestock from wolves. It is noted [13] that in 2004 wolves destroyed up to 500 heads of cattle, more than 5000 sheep and goats, and more than 100 heads of park marals. The economic damage caused by wolves to the region's agriculture in 2004 amounted to 16.57 million rubles. In 2002, 42 out of 407 wolves killed in the region were killed with the help of poisons, which is about 9.6% of the total number of wolves [14].

Opponents of the use of poisons to fight wolves, mainly biologists, argued that in addition to wolves, many other species of mammals and birds, including the "Red Book" species, also die from poisons. The discussion on the reasonability of using this poison against wolves was ended in 2005 after, after an inspection, the republican prosecutor's office issued an order to the head of the Department for the Protection, Control and
Regulation of the Use of Hunting Animals of the Altai Republic to ban the use of poisons and destroy existing stocks [14].

There is also overgrazing in the Altai Republic on the most intensively used pastures. This is expressed, first of all, in the destruction of undergrowth and the impoverishment of forest flora. A particularly large load falls on the outskirts of settlements within a radius of up to 5 km. E. G. Paramonov [15] determined the radius of visiting pastures by livestock of all types in 10 km from villages. These pastures are used primarily by private livestock belonging to private household farms.

With unregulated grazing, the water-physical properties of soils deteriorate as a result of their excessive compaction, which contributes to intensive erosional destruction of land plots, especially on mountain slopes. With a large pasture load, especially cattle and horses, many slopes, including those covered with forest, acquire a stepped microrelief from numerous paths that run parallel to the slope along its entire length.

In the Soviet period, the livestock was concentrated in large flocks and herds, which were kept at livestock camps, located at some distance from the villages. In winter, livestock in personal subsidiary farms was kept on a personal farmstead, in summer all private livestock (with the exception of dairy cows, calves up to 1 year old and working horses), along with collective farm herds, were grazed on distant pastures.

4 Discussion

The socio-economic crisis of the early 1990s led to the disintegration of most collective agricultural enterprises. This caused a massive increase in the unemployment of the rural population, a several-fold decrease in the number of livestock in the public sector and a sharp increase in the private sector (personal subsidiary plots). At the same time, there has been some change in the structure of pasture rotations, expressed in the incomplete use of remote distant pastures and a sharp increase in pressure on the surrounding pastures.

In the mid-1990s, it was not uncommon for some local residents not to send their sheep to distant pastures. In this case, they graze all summer in the vicinity of villages, increasing the already excessive load on the surrounding pastures. Working horses graze mainly at night. Thus, the herbage of pastures located near settlements experiences the greatest anthropogenic load. In the 1990s, this problem became relevant for almost all large (more than 200 households) settlements of the Altai Republic. Under these conditions, some rural administrations try to regulate livestock grazing through restrictive measures – at a village meeting they try to make a decision and oblige all personal subsidiary farms to lead livestock (with the exception of dairy cows, calves and working horses) to distant pastures [14].

At present, the problem of overgrazing in the vicinity of settlements has been largely resolved. Firstly, rural administrations strictly monitor the transhumance of livestock to summer distant pastures, and secondly, since the 2000s, there has been a decrease in the number of livestock in personal subsidiary plots, and its increase in peasant farms, which are located, as a rule, far from inhabited localities.

In a number of cases, farm animals on summer distant pastures act as direct competitors to wild animals, for example, argali, listed in the Red Book of the IUCN of the Russian Federation and the Altai Republic. The displacement of argali from their original habitats by herds of domestic animals is the main anthropogenic factor influencing the abundance of this species [16]. To solve this problem, in 2010, the Sailyugem National Park was organized in the Kosh-Agachsky district of the Altai Republic on the Saylyugem ridge. Due to the opposition of economic entities, the area of the park turned out to be smaller than that.
proposed for conservation; nevertheless, the organization of a new specially protected natural territory is a great success for ecologists and environmental organizations [17].

It should be noted that the Republic of Altai has two nature reservation parks, one national park, four natural parks, two wildlife sanctuaries, 44 natural monuments and one botanical garden. The total area of specially protected natural areas is 236,997 ha, or 25.5% of the region territory [3].

Livestock grazing poses another threat, since herdsmen, rather than working in isolation, usually have weapons (officially for protection from wild animals), which are often used for illegal hunting, including species listed in the Red Book [1]. Maral breeders of the Altai Republic are all hunters too. This was noted by G.G. Sobansky [18].

Herdsmen also almost always have dogs. Sobansky G.G. [19, p. 142] notes that "young roe deer become victims of dogs, primarily those belonging to shepherds and herdsmen. Most of them practically do not provide any assistance in grazing livestock, but all the wild animals that they can catch are regularly crushed".

The well-developed maral breeding in the Altai Republic also has an impact on the animal world. The fencing of maral habitats leads to the removal of winter habitats for animals, primarily ungulates, and disruption of the migration routes of ungulates.

Maral breeding is the only branch of animal husbandry in the Altai Republic, in which, under the conditions of the socio-economic crisis of the post-Soviet period, there was a sharp increase in livestock. From 1990 to 2005, the number of marals in farms of all categories increased from 21.2 to 51.2 thousand heads, i.e. 2.4 times over 15 years [2]. Subsequently, the growth rate slowed down. In 2020, the number of marals in the Altai Republic was 57.5 thousand heads [12].

The negative impact of marals on the animal world is manifested, first of all, in the fact that during the construction of maral protection areas (enclosures in parks) from the habitats of many species of wild animals, especially ungulates, lands are withdrawn - the winter habitats of these species. As a rule, maral breeding farms are located in areas where there is little snowfall, which facilitates the maintenance and animal feeding. These territories coincide with the optimal habitats for wild marals and roe deer in winter. In essence, wild ungulates were forced out into less favorable and more snowy tracts. Naturally, this could not but affect the number of wild ungulates. This has been repeatedly noted in the scientific literature, in particular, by G.G. Sobansky [18, 19].

Another significant problem is related to the fact that many kilometers of maral hedges block the migration routes of wild animals, again, primarily ungulates. G.G. Sobansky [18-19] notes that marals are located on all major roe deer migration routes in the Altai Republic. In recent years, metal mesh has been used to build high hedges, in which roe deer and even marals can often get stuck.

Also, since the Soviet times, the fencing of fields around settlements for protection from livestock has been widely developed. In this case, the fences are also made of metal mesh, but of a lower height (usually 1-1.2 m). In the grass, such hedge is hardly noticeable [18-19].

In the post-Soviet period, but especially after 2000, there is a massive fencing of its farmland by farmers, primarily arable land lots. This also leads to a significant disruption of the migration routes of wild animals, especially ungulates.

Agricultural activity also has an impact on the "Red Book" species of animals. 135 animal species are included in the Red Data Book of the Republic of Altai [16]. It is noted [20] that agricultural activities, namely grazing, the use of insecticides, soil pollution, and land reclamation work have an impact on 16 "Red Book" species of different taxonomic
groups. These are two species of annelids, five species of insects, five species and four species of mammals, including Altai mountain sheep or argali and manul (wild cat).

Considering agricultural activity as one of the factors of anthropogenic impact, it should be noted that this is not the main factor in the negative impact on the "Red Book" species. For example, 38 species (28.1% of the total) are subject to poaching of all kinds of living beings, including the capture of insects by collectors; habitat modification and destruction, including deforestation and forest fires, affects 20 species (14.5%); agricultural activities, as mentioned above, affect 16 species (11.85%).

5 Conclusion

The analysis showed that, in general, the development of the agro-industrial complex does not have a significant impact on the natural environment of the Altai Republic. This is facilitated by a number of factors, in particular, low population density, the presence of large areas of undeveloped or underdeveloped territories, a small area of arable land, and a developed system of specially protected natural areas.

The agriculture of the Altai Republic is characterized by the leading role of animal husbandry, whose share in the structure of marketable agricultural products is more than 90%, and crop production serves mainly as a fodder base for animal husbandry. This has an impact on the degree and volume of chemicalization of agriculture.

In recent years, there has been a rapid development of recreation and tourism in the region, which contributes to a decrease in the number of livestock in settlements near popular recreational sites and, accordingly, a decrease in pasture loads.

The main factors of impact on the natural environment of the region from the agro-industrial complex are now many kilometers of maral sanctuary hedges, fencing of surrounding pastures and agricultural land lots, primarily arable, peasant farms, which leads to disruption of the migration routes of ungulates and a decrease in their numbers. The chemicalization of agriculture, as well as overgrazing of livestock in some areas, has a certain impact on vegetation, wildlife, water bodies and soil cover.

References


2. Makoshev A P 2010 Issues of the territorial organization of the mining and livestock sector of Altai (Gorno-Altaisk: Library and Publishing Center of the Gorno-Altaisk State University) 264


8. Baylagasov L V 2013 Analysis of changes in the personal subsidiary farming of the inhabitants of the Altai Republic in the post-Soviet period. *Actual problems of agricultural production in the arid zone of the Central Asian region* (Novosibirsk) 57-61


10. Agriculture of the Altai Republic: Economic report / Territorial body of the Federal State Statistics Service for the Altai Republic 2016 (Gorno-Altaiak) 26


12. Robertus Yu V 2021 Report on the state and environmental protection of the Republic of Altai in 2020 (Gorno-Altaiak) 120


