Environmental conditions of the landscape functioning in the Pribaikalskii National Park: historical perspective

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Abstract. The history of the economic development of the valley complexes of the Goloustnaya River basin is considered. Forestry and agricultural activities are designated as the main activities developed by the local population. Fluctuations in the intensity of their implementation are highlighted, specifically. the slowly developing process of economic development of valley landscapes due to low population in the second half of the 17th century and until the first half of the 20th century; expansion of agricultural land and growth of industrial development of forest resources, starting from the middle of the 20th century until the end of the 1980s; and a decrease in economic activities since the end of the last century, which is connected both with the state reorganization of the country's economy and with creation of specially protected natural territories within the studied area. The valley complexes of the Goloustnaya River are at risk from the recreational development of coastal areas of Lake Baikal that have been actively developing in recent years. Taiga landscapes of the upper and middle reaches of the river are at risk of spreading forest fires. Negative consequences from economic activities have been contributing to a significant anthropogenic transformation of landscapes of the Pribaikalskii National Park for a long period.

1. Introduction

The Pribaikalskii National Park was established in 1986 in order to preserve the biological and landscaped diversity of the western coast of Lake Baikal. Despite the inclusion of the lake into a list of UNESCO World Natural Heritage and the Federal Law "On Lake Baikal" \cite{1}, natural complexes bordering on its water management, are areas with frequently arising environmental crises, the main causes of which are excessive anthropogenic load. Under the current conditions, there are relevant studies of the landscape-ecological orientation aimed at studying the current state of natural complexes and their sustainability of existing types of management.

In 2020, the Russian Foundation for Basic Research supported a joint project of the Sochava Institute of Geography of the Siberian Branch of the Russian Academy of Sciences (SB RAS) and Chinese colleagues from the Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, on the implementation of environmental management models for national parks. Currently, China has a lack of theoretical studies and practical work for the introduction of the scientific component in the environmental management system \cite{2, 3}. The
activities of the Pribyaikal’skii National Park provide grounds for applying the Russian experience in addressing environmental management issues in national parks with an emphasis on environmental education in the face of rising load of the constantly increasing population on the recreational resources of specially protected natural territories. Within the framework of this project, a chronological study of the anthropogenic factors for the formation of modern environmental conditions for the landscape functioning of the Pribyaikal’skii National Park was carried out in the process of understanding the mechanisms of response of the environment in the process of economic development.

2. Models and methods
An analysis of the anthropogenic impact on the landscapes of the Pribyaikal’skii National Park is presented using the example of the Goloustnaya river basin (Figure 1). Even though the Pribyaikal’skii National Park occupies only the mouth part of the basin, we consider the history of economic development of the entire catchment area. This will reflect the reasons for the transformation of coastal landscapes, which are a kind of transit core of production activities during the long history of nature management.

In the relatively small limits of the Goloustnaya coast of Lake Baikal, contrasting mountain-taiga dark-coniferous and light coniferous, sub-taiga light coniferous and foothill steppe landscapes are developed. So far, under the influence of the intensification of nature management, derivative complexes that reduce the degree of biodiversity and the resilience of landscapes to external influences represent significant areas of the basin. Against this background, our subject matter is the history of the economic development of the Goloustnaya valley complexes.
To assess the anthropogenic impact on landscapes, a diachronic approach was used, which involves considering the historical stages of economic activity as the main factor in the formation of the modern landscape structure [4]. The method of historical and geographical sections was adopted as a basis; the periods of economic development, characterized by socio-economic characteristics, are identified.

In the study of the stage of occupation and development, we applied the method of retrospective analysis, as well as statistical and comparative historical methods. The main information sources, along with current publications of a historical and geographical nature [5-7], were archival local history materials of the late 19th and early 20th [8-10].

3. Results and discussion

Intensification of anthropogenic influence on natural environment of the Goloustnaya basin is associated with the arrival of Russian immigrants in Eastern Siberia in the second half of the 17th century. The first Russian settlements in the study area were the points serving the cargo transportation. By the end of the 17th century, at the mouth of the river, a winter hut was built, which served as an intermediate point for transportation of goods from Irkutsk along the Goloustnaya through Lake Baikal [6, 7]. Somewhat later, the Customs Gate was built, established due to convenience of transporting goods along the Goloustnaya to Irkutsk, and further to the Yakutsk road [10]. At the beginning of the 18th century, approximately in 1710, the village of Tarbeev was founded, the locals here were engaged in distant pasture cattle breeding and subsidiary fisheries [11].

In the initial period of nature use development due to the settlement of Russian immigrants, the main factors, affecting the valley complexes of the Goloustnaya, especially in its estuary, were timber cutting to meet the needs for building materials and fuels, forests clearing for agricultural land, and taiga resources depletion because of local handicrafts development.

Cargo service and farming remained the main occupations of local population until the early 20th century. The largest settlement at the end of the 19th century was Bolshoe Goloustnoe, with 256 people engaged in arable farming and livestock breeding, as well as fishing and animal trade [9]. Near the mouth of the Nizhni Kochergat River there was a Tungus nomad camp. The Tungus owned grasslands in the valley exclusively for hunting and keeping livestock [8-10]. At the mouth of the Ilga Stream there was another Tungus settlement, whose inhabitants moved to the village of Tarbeev for winter [8]. The largest Tungus camp was Zoginskii Ulus (along the Zogi River), 65 people lived here on 13 farms [9]. Within the taiga territories of the basin, the main occupations of the settlers were hunting and gathering. For better management, the Tungus equipped a number of summer nomad camps and commercial stations along the Goloustnaya River and its tributaries [10].

Rapid population growth began at the end of the 19th century; in two decades at the turn of the century the Russian population of villages of Bolshoe and Maloe Goloustnoe had doubled from 102 people in 1893 to 212 people in 1909 [6]. In general, by 1926, more than 1000 people lived in the study area [11]. Then the population grew smoothly and formed a core of local residents: in 1939. 322 people lived in the village of Bolshoe Goloustnoe, 331 people in the village of Maloe Goloustnoe, and 70 people in the village of Zogi [7].

Since the 1930s, collective forms of economy have been developing. By 1936 in the village of Bolshoe Goloustnoe, two gangs were created: commercial hunting “Red Baikal” and commercial fishing “Red Idegol”, owning more than 80 hectares of arable land and more than 400 hectares of grassland [6]. Later, the gangs were merged into the collective farm “Path to Communism”.

Thus, the area in these years was specializing in agriculture and trade. The influence of this specialization manifested in the expansion of treeless territories in valleys and on their gentle slopes in the middle and lower reaches of the Goloustnaya River due to the expansion of residential, arable and forage lands. The expansion of horse-drawn road network connecting the settlements of the region with the hunting grounds also increased the load on the valley complexes along the roads.

In the middle of the last century, the timber industry became a priority industry when, in 1949, a large logging enterprise was relocated here [11]. Parallel to its development, there was a significant increase in the population due to migrants to the village of Maloe Goloustnoe, which became the
center of the logging industry. Therefore, in 1959 there were 922 people in the village and 1314 people in 1970. As logging had increased, the need for timber transportation increased consequently, which had led to the creation of a dense network of roads. At the same time, agriculture and commercial activities had been developing steadily, mainly to meet the needs of the local population.

The above-mentioned activities reached its maximum during that period, which negatively affected the landscape transformation of taiga ecosystems. Development of the timber industry had led to the forest area reduction in the catchment areas of tributaries of the Goloustnaya in its upper and middle reaches. Derived coniferous-small-leaved complexes developed in areas of the cedar and pine forests growing here earlier. The number of fires, increased as a consequence of forestry, also caused the expansion of secondary small-leaved forests area. Meadow-valley complexes in the Goloustnaya middle and lower reaches were still under pressure from increased agricultural activities due to the needs of the increased number of residents in this district.

With an increase in population in the study area, unauthorized hunting of wild animals has emerged here. In 1967, in order to prevent and protect the rare and endangered species of animals in the Upper and Middle Kochergat river basins (right tributaries of the Goloustnaya River), the Kochergatskii State Hunting Reserve of regional significance was founded [12]. In 1986, the Goloustnaya downstream entered the boundaries of the Pribaikalskii National Park, founded to ensure optimal conditions for economic and recreational activities, as well as for nature protection. Since 1987, after the inclusion of the territory in the coastal protection zone of Lake Baikal, final fellings were prohibited. As the volume of logging decreased, the population decreased as well. There was a concentration of residents in the village of Maloe Goloustnoe as the economic and administrative center of the lower administrative region, and in the village of Bolshoe Goloustnoe the number of residents decreased by more than 1.7 times [11]. Therefore, in 1997, 1485 people lived in Maloe, and 551 people in Bolshoe [13]. According to the 2010 census, Maloe Goloustnoe numbered 1262 people, and Bolshoe 583 people [14].

Currently, forestry is the leading economic activity; there is a repair and construction enterprise, as well as enterprises and institutions of the public sector. Agriculture develops only in personal subsidiary farms. The main pastures and grasslands are located in the middle and lower reaches of the valley of the Goloustnaya and its major tributaries, namely, Uruntin, Ekorlik and Nizhni Kochergat. The development of road network and improvement of road surface of the highway Irkutsk – Maloe Goloustnoe – Bolshoe Goloustnoe, running along the river valleys, resulted in frequent activities for the extraction of soils for road repair.

Recreational activities are also actively developing within the basin, in the mouthpart where tourist guesthouses are organized now. Aesthetically attractive landscapes of the Goloustnaya delta, contributing to the attraction of holidaymakers on the coast of Lake Baikal, were the criteria for the creation of a development center of a special economic zone of tourist and recreational activity “Gate of Baikal” in the village of Bolshoe Goloustnoe in 2007, where an all-season international resort was assumed. Start of construction was planned for 2009, but the project did not receive its implementation due to the low development prospects [5].

Currently, the main environmental problem is still uncontrolled enters to taiga for collecting wild plants and the associated risk of fire, discharge of untreated sewage by settlements and transport facilities, household waste, and unorganized and uncontrolled tourism, which result in littering, trampling and destruction of vegetation cover. Periodically recurrent forest fires lead to damage and partial destruction of vegetation, burning of bedding, damage to turf, and increased erosion on slopes of valleys because of windfallen trees [15]. Due to recreational activities, the natural species diversity decreases, forest stand is suppressed, and land cover is disturbed. Pathways affect the soil consolidation and destruct the sod horizon. Degradation of geosystems because of overgrazing on pastures results in the suppression of grass and bush cover and the change in its species diversity; soil cover is disturbed, and terracing by trodden paths is observed. In most small catchments crossed by roads, the processes of water exchange and water balance and moisture supply regime are disturbed. Transportation on the to-date existing auto-winter roads leads to the artificial reclamation of valley
bottoms and the degradation of permafrost soils [7]. Water exchange conditions deteriorate and the collector properties of alluvial sediments decrease.

Focusing on the current ecological situation of the Pribaikalskii National Park, we have revealed that the mouth section of the Goloustnaya river basin, adjacent to the water area of Lake Baikal, is a recreationally attractive place. At the same time, the danger of an unorganized and uncontrolled flow of recreational people is a concern of the transformation of unique landscape complexes that are not resistant to anthropogenic loads. The main environmental problems here are littering and, consequently, storage and removal of solid household waste, as well as trampling and driving off-roads, chaotic organization of picnic leisure activities with bonfires, which increase the risk of wildfires and a lack of environmental morality. Taking into account the recreational potential of landscapes adjacent to the water area of Lake Baikal - a UNESCO World Natural Heritage Site, the orientation of nature management towards the development of ecotourism, in order to minimize negative consequences on the natural environment, is relevant. As part of the sustainable development of the Goloustnaya coast, the exploitation of the cognitive (educational) resource of the natural environment is promising in order to increase knowledge about the specifics of natural conditions, as well as for the formation of environmental awareness and environmental responsibility. The organization of hiking trails along well-equipped ecological trails, considered as one of the main directions of ecotourism, contributes to the acquisition of knowledge of nature and ecology. The proposed activities can be implemented in national parks of China with similar environmental problems.

4. Conclusion
The retrospective analysis has revealed the main environmental problems caused by the effects of production activities in the Goloustnaya basin for more than 300 years of its development. Taking the period of settlement of this land by Russian settlers at the end of the 17th century as the initial stage of economic development, the chronological process of the formation and development of production activity was considered. The starting period of economic activity was characterized by minimal anthropogenic pressure on the valley complexes of the Goloustnaya, which was associated with low population, because a few settlements with developed agricultural lands were concentrated in the estuary part of the river.

Parallel to the increase in the types of economic activities developed in the study area, and to the increase in production volumes, the anthropogenization process and its “penetration” into the depths of the basin intensified. The valley complexes of the river middle course were affected by forestry and hunting activities. The economic development reached its maximum in the second half of the 20th century due to the commencement of the industrial exploitation of the forest resources, which had led to an increase in the area of derivatives of coniferous, small-leaved and small-leaved forests in the upper and middle parts of the Goloustnaya basin.

Current nature management is characterized by a decrease of anthropogenic transformation, which is connected, in the first place, with environmental protection measures by administrations of the Kochergatskii State Hunting Reserve of regional importance and the Pribaikalskii National Park; within its boundaries the lower reaches of the Goloustnaya are located. Nevertheless, the estuary part of the river is currently in the zone of adverse anthropogenic impacts, which are caused by the active recreational development of the coastal territory, causing significant environmental damage from uncontrolled and unorganized tourism. The taiga geosystems of the upper and middle reaches of the river are at risk of spreading forest fires, and they are caused by human activity. Thus, the impact caused by long-term economic development becomes one of the leading factors in the transformation of landscapes. Incidence and degree of anthropogenic transformation of the valley complexes of the Goloustnaya River require careful analysis to develop measures for improving environmental conditions. Within the framework of international cooperation, the Chinese colleagues consider the orientation of the nature conservation functions of national parks towards educational purposes in order to increase the level of ecological behavior of tourists.
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