

HIKING TOURISM DEVELOPMENT IN PROTECTED AREAS AND NATURE HAZARD PREVENTION IN THE LAKE BAIKAL NATURAL TERRITORY

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Abstract: Since 2010, recreational development has been permitted in strict nature reserves (zapovedniks in Russia), the most highly protected category of Russian Federal Protected Areas. As zapovedniks comply with the 1b IUCN category for wilderness preservation, human activities within the reserves have been limited and, consequently, there has been little research on the natural hazard impact for tourism. The type of recreational use permitted in the territories and their buffer zones is called Educational Tourism. It is identified as “as a specialized type of ecological tourism where the main goal is an introduction to natural and cultural attractions”. Hiking is seen as one of these suitable types of tourism within the territories of zapovedniks, due to its low impact on natural features. As hiking trails are laid through natural landscapes, it is possible that natural disasters can both damage the infrastructure and cause fatal injuries for visitors. During the planning stages of trail construction, natural hazard monitoring should be conducted. Baikalskii Nature Biosphere Zapovednik in the Lake Baikal region is used as a model territory where scientific research and engineering are employed to better develop hiking tourism. Along with the monitoring of natural processes, several scenarios for trail planning, construction, and maintenance are being analyzed under the threat of mud slides, avalanches and floods.

Key words: educational tourism, Zapovednik, natural disasters

Introduction

Lake Baikal is the only Russian natural geographical object both under the international and strict federal protection because of its great significance as an area of pristine wilderness with a unique water reservoir, endemic species, and diverse landscapes. In 1996 Lake Baikal and its watershed were recognized as a UNESCO World Heritage Site. The Russian Federal Law “On the protection of Lake Baikal” was passed in 1999. Later in 2006 the Baikal Nature Territory (BNT) was established comprising of three zones: Central Ecological Zone (23%), Buffer Ecological Zone (57%) and Atmospheric Influence Zone (20%) (Antipov et al., 2002). Lake Baikal’s Central Ecological Zone has the strictest

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regime prohibiting most of industrial activities; it contains 12 protected areas occupying 23 percent of its territory including three national parks, three zapovedniks and two game reserves on the federal level. Most of these protected areas lie on mountains surrounding the Lake. The Primorskii, Baikalskii, Barguzinskii, Verkhne-Angarskii, and Khमार-Daban ridges are the main ones. The ridges are characterized by numerous earth cracks, rills and depressions formed as results of big earthquakes, therefore natural disasters such as mudflows, landslides, avalanches and floods occur constantly (Makarov, 2012). As these protected areas are currently aimed at development of ecotourism infrastructure and further increase in visitors possible natural risks in the mountainous zones should be taken in consideration.

Zapovedniks or nature reserves have been the main category of protection in Russia since 1916 when the first of currently functioning zapovedniks, Barguzinskii, was founded on the shores of Lake Baikal. Zapovednik, a unique concept of land protection, was formulated for the purpose of scientific research and environmental protection with total prohibition of any human activity. For the zapovedniks (matching the Ia Strict Nature Reserve category of the International Union for Conservation of Nature (IUCN), only with slight differences in the degree of protection and scientific research) natural hazard research for the recreational purposes is very new even within the Central Ecological Zone. Baikalskii Nature Biosphere zapovednik serves as an example of such need in research and prevention of natural hazards on its mountainous slopes for the certain types of tourism development.

Literature overview

For the manuscript more than 30 digital and paper sources were analyzed. However the lack of research on the topic in the area and absence of recent investigations resulted in 10 references in the text.

Baikalskii zapovednik: characteristics and natural hazards

The Baikalskii Nature Biosphere zapovednik was established in 1969 after long-term complex botanical research carried out in the southern part of the Lake Baikal area of the Republic of Buryatia. Its northern border stretches along the Lake Baikal shoreline for 40 km and the area totals to 165,724 square kilometers. It is located on the Khमार-Daban mountain ridge with larch and Siberian pine taiga forests. The relief of the zapovednik was formed approximately a million years ago during the upward shifting of the surface creating the mountain chain.

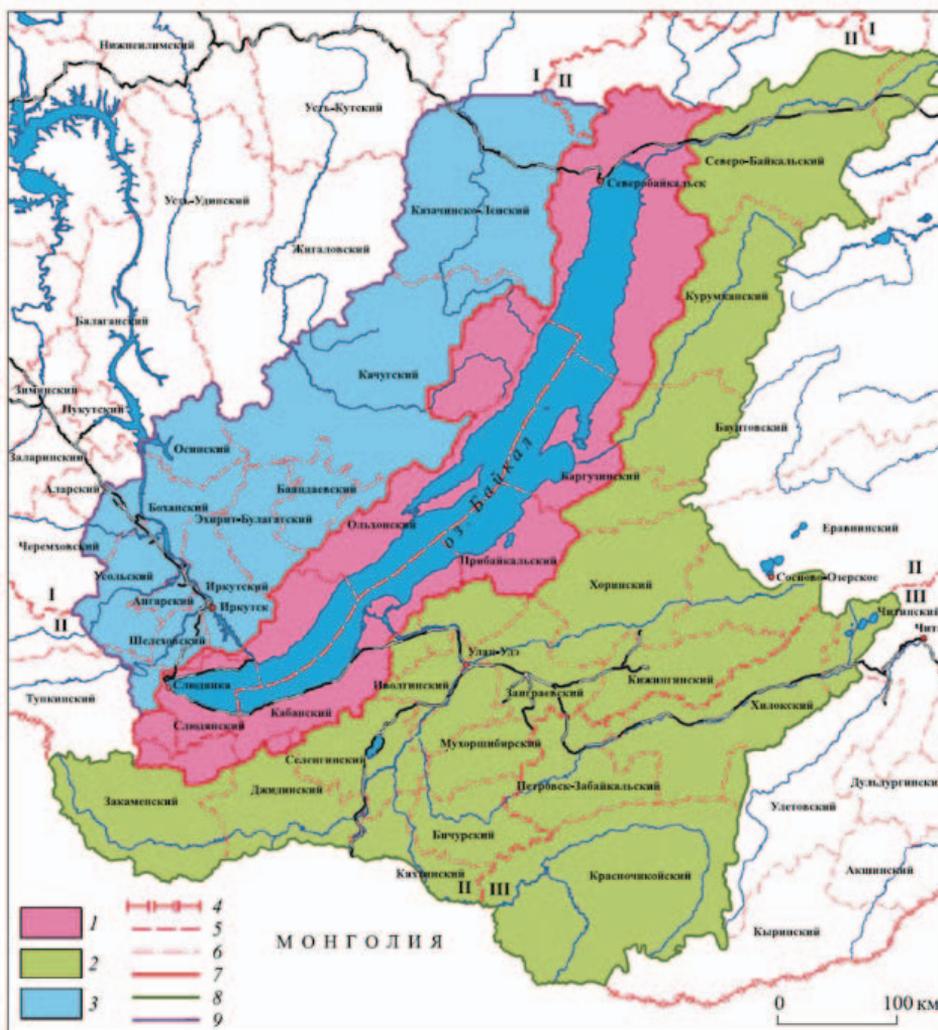


Figure 1. Baikal Nature Territory: 1 – Central ecological zone, 2 - Buffer ecological zone, 3 – Zone of atmospheric influence, 4 – country boarder, 5 – region boarder, 6- county boarder, 7 – boarder of the Central ecological zone, 8 – border of Buffer ecological zone, 9 - Zone of atmospheric influence (Baikal, 2011)

Water erosion, neo-tectonics, and valley glaciation of the Pleistocene era have affected development of minor surface landforms. The process of relief formations still takes place. Seismicity of the ridge is evaluated at 7 points. Avalanches play important role in the current relief formation. Approximately 130 active avalanche sites are identifies within the zapovednik. Along with avalanches landslides and mudflows take part in the relief formation. The

territory of Baikalskii zapovednik has severe topography where drops from watersheds to river valleys vary from 400 to 900 meters. The tallest peak Sokhor is 2316 meters high and the lowest area is 456 meters above the sea level. The zapovednik is divided into two macroslopes. The northern macroslope with the length of 35 km faces Lake Baikal. It is characterized with numerous deep and narrow river valleys, steep slopes with their platforms descending terraces. High mountain alpine landscapes with presence of clearly visible crests, sharp peaks and abrupt slopes are typical for this macroslope. The southern macroslope of the ridge is significantly shorter with the 12-15 km in length. Alpine landscapes are less defined. The height drop is different for both macroslopes with 1880 meters for the northern macroslope and 1550 meters for the southern respectively. The main watershed of the Khamar-Daban mountain ridge has plateau-shaped surface which breaks into narrow crests and gradually declines from west to east (“General information”, 2011).

Following natural hazards occur on the territory of Baikalskii Zapovednik: forest fires, mudflows, wash-outs, landslides, avalanches (Makarov, 2012; Karbaynov, 2000).

Appearance of fires in mountainous forests depends on the amount of flammable material, its distribution, wetness, and availability of fire sources. Fires near the northern border of the zapovednik started appearing due to industrial development since the Transsiberian Railroad construction in 1905. The most intensive fires were in 1950-1960. Most of forest fires on the territory of the protected area happen on the southern macroslope. The forest of the northern macroslope is damaged by fires less frequently due to high precipitation (Karbaynov, 2000).

The biggest avalanches are formed during periods of major snow accumulation in April-May in the Khamar – Daban ridge. Therefore, avalanche zones expand due to forest fall on their edges. Such avalanches received the status of catastrophic causing significant tree stand damage. 43 avalanche basins feeding 127 avalanches were identified (Figure 1). The most avalanche hazardous site is the valley of the Pereemnaya River in central part of the northern macroslope of the Khamar-Daban containing 56 avalanches. To evaluate the avalanche influence on the taiga forest within the zapovednik the periodicity of the disasters was investigated. For the period of 1936 – 1986 the forest damage had been caused during 11 winter seasons. Seismic activity is one of the main causes for catastrophic avalanche. The largest avalanches matched earthquake shocks (4-5 points) in the seasons of 1979-1980 and 1983-1984 (Karbaynov, 2000). Any results on the further avalanche research after 1986 has not been found.

The history of mudflows has been tracked in catchments of various mountain rivers from 1976 (Makarov, 2012; Karbaynov, 2000). It was proved that the average distance between mudflow centers was in direct dependence on the height of river's fall. The Figure 2 shows that the mudflow sites evidence in the period of 1976-1986. At the same time the most disastrous mudflows happened on the Khabar-Daban ridge in 1901, 1903, 1915, 1927, 1932, 1934, 1938, 1960, 1962, 1965, 1971 however there is no consistency in their frequency. The mudflow appearance is connected with high amount in daily liquid precipitation especially in humid summers. Rarely mudflow intensity is correlated with big earthquakes (8-11 points). Watershed basins within the ridge accumulate significant volume of friable fragmental matter and it can be entrained in mudflow stream. Mudflow sites in various developments of exogenous geological processes appear in forms of slipouts, rockslides, landslides, rock glaciers, side debris cones, etc. (Makarov, 2012). According to prof. Makarov, landslide can appear on any slope of the northern macroslope within the zapovednik due to their steepness of more than 40 degrees.

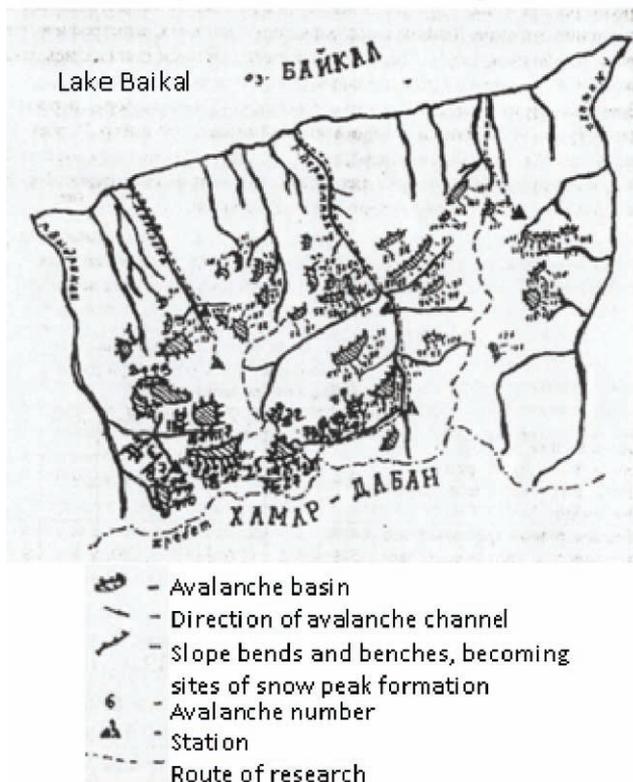


Figure 2. Avalanche appearance in Baikalskii Zapovednik (Karbaynov, 2000)

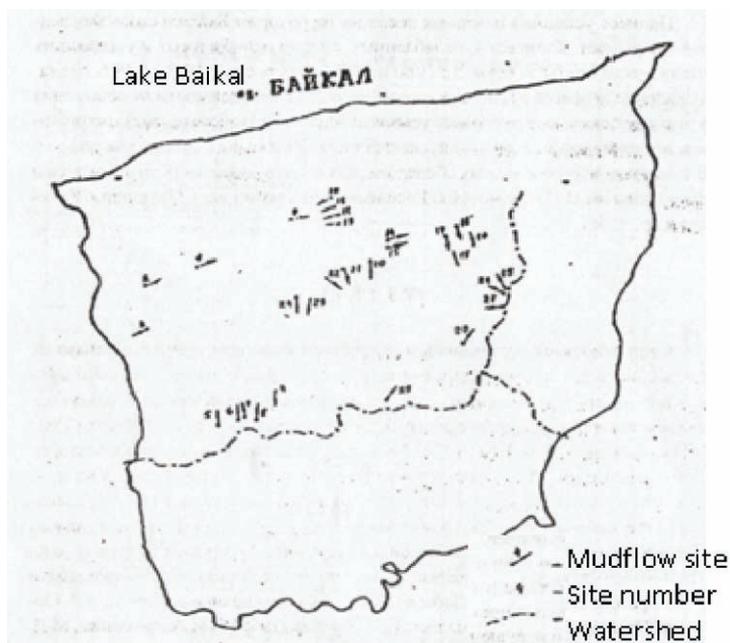


Figure 3. Mudflow appearance in Baikalskii Zapovednik (Karbaynov, 2000)

Tourism development

In 2011 nine Federal zapovedniks across the country were selected as model territories where the infrastructure for educational tourism had to be developed both within their restricted territory and in the buffer zone. In addition, 2.4 billion rubles (US\$800 million) were assigned to this program (“Project of support”, 2012). Each of the selected model zapovedniks has been guaranteed funding with maximum of 180 million rubles to develop infrastructure for 2011-2013. Later in December 2011 the Russian government issued “The concept of development for strictly protected nature territories on the federal level until 2020” that contained a definition and requirements of educational tourism. The law stated that “educational tourism is one of the specialized types of ecological tourism with the main goal of getting acquainted with natural and cultural attractions” (“Ministry of Nature Resources”, 2011). Thus, with the government’s approval, strictly protected nature territories were to become the main establishments in which to develop and implement ecotourism in Russia. Baikalskii zapovednik was selected as one of the model territories.

The management of the zapovednik discussed and considered several types of possible recreational activities. The largest objects of the infrastructure are be

located outside the territory and include four visitor centers, six cabins to be used as ranger stations, lodging cabins, and three museums. Hiking trails will form the main recreational activity infrastructure on the territory of the zapovednik. It is expected that there will be six trails with the total length of 77.3 kilometers (Figure 3). The hiking trails can be classified according to five different classes (1st class – extreme trails , 2nd class – trekking trails , 3rd class – walking or family trails, 4th class – excursion trails, 5th class – general access paths) in order to manage and maintain different trails depending on visitors’ recreational goals (Luzhkova, 2011). Besides, since 1986, it has allowed conducting ecological educational tours on two ecotrails within restricted parts of the main territory since due to the status of the Biosphere Reserve. These trails are (number 2 and 6 on Figure 3) are the main educational tourism objects now. With further development, hiking tourism can become the main type of recreational and educational use in the main territory.

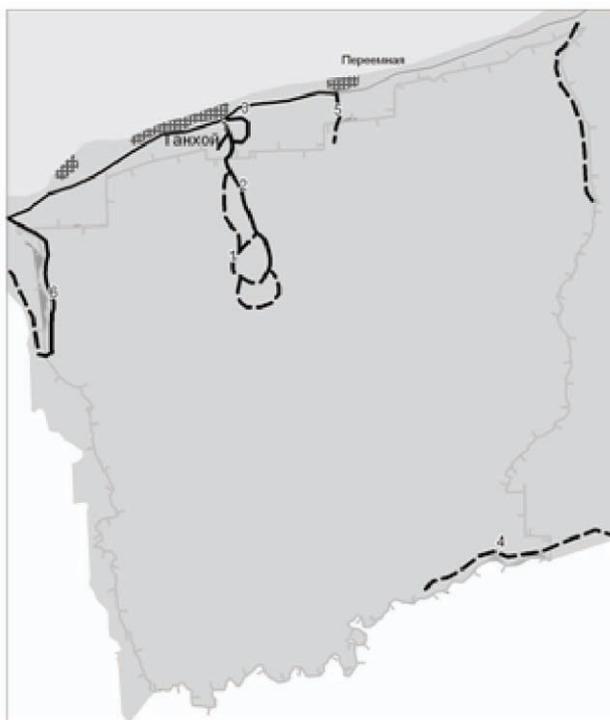


Figure 4. Hiking trails in Baikalskii zapovednik, 1,2 – along the Osinovka river, 3- along the Mishikha river, 4 – along the Temnik river, 5 – along the Pereemnya river, 6 – along the Vydrinnaya river

As on other protected areas, here creation of the hiking trail infrastructure has to follow a certain algorithm. The algorithm consists of ten stages: three for planning (trail concept, scouting, trail class choice), seven for constructions (general flagging, corridor clearance, detailed flagging, tread building, structures' installation, site cleaning, maintenance). The trail design includes development of the trail concept, geographical and engineering scouting, and choice of the trail class (Luzhkova, 2012).

After the determination of a trail's concept including its purpose, expected visitor experience and possible level of development it is necessary to conduct geographical and engineering scouting. For example, the analysis of the physical geographical conditions of the zapovednik with the special attention to features of relief, climate conditions, hydrography, soils, vegetation and animal life was conducted for the further development of hiking tourism in the territory. Before the major trail constructions within the Osinovka river catchment engineering and scientific scouting was done (Luzhkova, 2012). However, the natural hazard threat has never been seriously considered neither for the entire territory nor for a single trail. Mudflows, landslides and forest fires have direct influence on hiking tourism during summer season potentially damaging the infrastructure and creating fatal danger to trail users. On the other hand, avalanches may destroy trails, cabins, bridges and other constructions.

While laying the trail along the Osinovka River (Figure 3) a staff researcher joined the scouting group pointing out avalanche dangerous slopes and areas to avoid the further infrastructure development in the area. Avalanche risk was the only case of taking natural hazards in consideration for educational hiking tourism development. For this 13 km trail class 3 was selected meaning the 90 cm in width, 15 % of maximal grade for the trail bed, 2 meters in width for the trail corridor. On the stage of constructions the trail building project included the following types of works: 1 – construction of a trail itself (improvement of the existing trail thread or creation of a new one, construction of structures to improve the conditions of transportation - bridges, decks, stairs, fences); 2 – construction of elements and objects of small architecture along the trails (pavilions, picnic areas, benches, platforms for tents, etc.); 3 -construction of semi-permanent accommodation facilities (temporary shelters, winter shelters/huts); 4 – providing information (installation of marking interpretative signs and information boards) (Evstropeva & Luzhkova, 2012).

After the completion of constructions maintenance has to take place annually or when needed. The main threat on the trail, according to the specialists in geology Dr. Makarov, landslides may occur on any slope at any time within the

surrounding areas of the trail due to a number of reasons such as unstable soils and possible earthquakes. As the trail along the Osinovka river has been the first attempt to implement the constructions with the use of the ten-staged algorithm the estimation of natural hazards has to be added in the stage of to the geographical scouting. This practice has to be expanded to other trails, especially along the Peremnaya River where numerous avalanches have been reported.

In addition to the research on natural risks the official safety regulations of Baikalskii zapovednik were reviewed. Following rules were created for hiking for various purposes in the territory: hike in a group of at least two, information on the hiking route has to be given beforehand, wetlands have to be avoided. Passage of slipouts, rockslides, landslides, rock glaciers sites right after rain is forbidden. Plus, certain recommendations on how to move on hanging snow masses, moving rocks and near fire epicenters are given. At the same time, plans of action in case of active natural disasters are not mentioned. With the increasing interest in hiking and heavier usage of trails safety regulations have to be updated.

Conclusion

Baikalskii zapovednik foresees visitation growth within the next decade. As the main tourist flow will be directed to recreational objects in its buffer zone, still hiking trails will be available to tourists with average physical abilities on the main territory due to parameters of linear objects and constructed infrastructure along them. Been built under specifications for class 3 they are suitable for tourist groups with children and fit seniors.

First of all, for the further hiking tourism development additional natural hazard research has to be conducted on the mountain slopes including mapping of mudflow, landslide and avalanche zones. Second, monitoring of natural disasters has to take place and maps from 1980s should be updates. Third, based on such research the planning trail network has to be reconsidered and trails have to be place on sustainable landscapes.

Meanwhile following steps should be taken in order to minimize natural hazard risks for the trail users in the next seasons:

Trail infrastructure has to be checked on the damage from avalanches before the beginning of season.

Safety regulations have to include detailed plan of action in case of mudflows and landslides.

Trail guides have to be aware of possible risks and be prepared to take actions in case of their occurrence.

For the recreational development research and monitoring of dangerous natural processes have to be conducted by professional researchers working in this sphere who understand the difficulties of problem (Makarov, 2012) and can give qualified advice on the infrastructure development to the managers of protected areas.

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