

## NATURAL AND RECREATIONAL POTENTIAL OF LANDSCAPES OF THE TOBOL RIVER BASIN WITHIN THE KOSTANAY REGION

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**Abstract:** This article proposes criteria for a component comprehensive assessment of the recreational attractiveness of the landscapes of the Tobol River basin within the Kostanay region. It is proposed to apply the balance method to calculate the potential, which provides a basis for a comparative analysis of natural and recreational resources and the prospective possibilities of the territory, which has not previously been evaluated by natural and recreational resources. The method allows to get an idea of the availability and volume of natural and recreational resources and to determine the priority areas of recreational activity in the studied region. According to the results of the study, the districts of the region were ranked according to the degree of natural and recreational attractiveness and landscapes with high, medium and low natural and recreational potential were identified.

**Key words:** recreation, tourism, landscape, natural and recreational potential, landscapes of the Tobol River basin

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### INTRODUCTION

In recent years, due to changes in the overall socio-economic situation in Kazakhstan, interest in developing strategies for the sustainable development of regions with recreational resources has increased dramatically. In recent years, the landscape approach has been applied in the research of recreational systems, the essence of which is that the studied territory is considered as a set of interconnected and interdependent geosystems of various hierarchical levels. The final recreational assessment of the territory for each type of recreation is calculated by summing up the partial estimates multiplied by the significance of the characteristic. It should be emphasized here that the critical or close to it state of at least one particular assessment, in essence, reduces to zero the total recreational potential of the territory, which makes it impossible to «total» the methodology of its determination (Berdenov et al., 2021). Geographically, the territory of the Tobol River basin within the Kostanay region is located in the northwestern part of the Republic of Kazakhstan. The landscape of the basin territory is a plain of the West Siberian Lowland in the north and the Turgai tableland in the south, which differs from the northern and central ones in its dryness and diversity of vegetation cover. The territory covers different types of landscapes: forest-steppe, steppe, semi-desert. 14 deposits of therapeutic mud and 4 sources of mineral waters have been identified in this area. The forest-steppe on the territory of the region occupies small areas where birch and aspen-birch spikes alternate with meadow and rich grass-grass steppes. Large forests of the region – Borovskaya, Arakaragai, Kazanbasy forest, a small protected ribbon forest (Naurzum reserve) (Kazakh Soviet Encyclopedia, 1975; Medeu, 2010). The territory of the Tobol River basin within the Kostanay region has a huge potential for the development of ecological, cultural, adventure, and health tourism. Recreation and tourism play an important role in the use of natural resources, since recreational work does not cover individual parts of nature, but the entire landscape as a whole (Smith and Puczky, 2008). There are a number of methods for assessing the tourist attractiveness of the territory, which are discussed in the scientific paper (Orlova, 2006; Lisiak et al., 2016; Baryshnikova, 2016; Ziernicka-Wojtaszek and Lisiak, 2020; Kuchumov, 2020; Kerimbay et al., 2020). The purpose of this study is to assess the state and degree of the natural and recreational potential of the landscapes of the Tobol River basin within the Kostanay region for further use of the results obtained in determining the priority areas of recreational activity of the studied region.

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## MATERIALS AND METHODS

Based on the methods proposed by (Popov and Gulyaeva, 2003; Gudkovskikh, 2017), we have proposed criteria for a component-by-component integral assessment of the natural and recreational potential of landscapes. In the natural and recreational assessment of natural geosystems, it is important to take into account the indicators characterizing natural components (relief, climate, water bodies, vegetation cover and specially protected natural areas). Calculations of all indicators were carried out using standard tools of the geoinformation program ArcGIS 10.2. The operating system for assessing the natural and recreational potential is a previously compiled medium-scale landscape map of the Tobol River basin within the Kostanay region (Isachenko, 1991; Gvozdetsky, 1978; Tretiak and Marchenkova, 2020). The structural scheme of the study of the landscape and recreational potential of territories is presented in Figure 1. The main evaluation criteria are the degree of favorability of landscape components and their functional suitability (Mukayev et al., 2022). Most scientists believe that the morpho lithogenic basis is the leading component of the landscape. The relief, along with other natural components, determines the possibilities of tourist and recreational development of the region, increases or limits the variety of possible tourist and recreational activities, affects the aesthetics of the landscape. Relief is the totality of all the irregularities of the earth's surface, which are called «relief forms». They are distinguished by size, structure, origin, etc. Their involvement in the process of recreational activities may be different: landscapes can be perceived visually as an element of attractiveness; as a base for the placement of recreational facilities, they can be used without their direct expenditure, as a result of which geomorphological recreational resources are exposed, modified and degraded. The conditions of recreational activity are largely determined by the peculiarities of spelling. The nature of the relief (the degree of its vertical and horizontal dissection, the steepness and exposure of the slopes, the intensity of the manifestation of modern relief-forming processes) affects many types of recreational activities, determining the aesthetic properties of landscapes, conditions of sunlight, construction opportunities. Relief and its properties can act as both an indirect and direct recreational resource. As an indirect recreational resource, relief contributes to the formation of specific features of climate, soils, water bodies, fauna and flora. Direct recreational properties are manifested directly through the impact of relief on recreational activities.

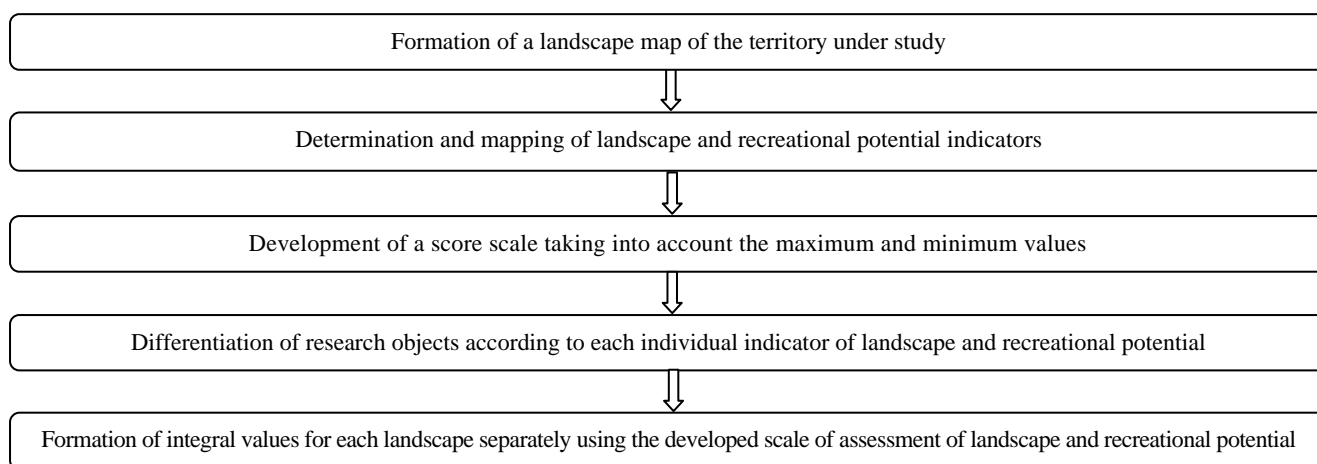


Figure 1. Block diagram of the study landscape and recreational potential of territories

Table 1. Scale of assessment of favorability by geomorphological indicators (Gudkovskikh, 2017)

№	Indicators	Score scale				
		1 p.	2 p.	3 p.	4 p.	5 p.
1	Absolute height, m	<160	180	200	230	250>
2	The angle of inclination of the surface, degrees	1	3	5	7	9

Scientists such as Nefedova et al. (1973) and Bredikhin (2004) assessed the favorability of the relief for recreation. The geomorphological indicators we have adopted to assess the natural and recreational potential are reflected in Table 1. The indicators are ranked by score relative to the maximum and minimum indicators. The absolute height and angle of inclination of the surface of the study region were determined using the SRTM digital Earth model. The relationship between types of recreation and geomorphological indicators manifests itself in different ways. For example, the presence of mountain systems of different heights with sufficiently high angles of inclination of the surface makes it possible to conduct tourist routes of various categories, and for the organization of medical and recreational tourism, the terrain with minor exceedances is most suitable (Weiermair et al., 2015). However, for both types of recreation, the rough terrain is aesthetically most favorable. Thus, the scales by which the relief is estimated, depending on the type of recreation, have different values.

One of the most important factors determining the spatial organization of recreation is the climate. Its impact on a person, his health is manifested through the latter's reaction to the weather, that is, a complex of geophysical (illumination, the arrival of total solar and ultraviolet radiation, air transparency, etc.) and meteorological (air temperature and humidity, wind speed, cloud cover, etc.) elements that either favor or hinder the implementation of various types of recreational activities. The climatic indicators we have adopted to assess the natural and recreational potential are reflected in Table 2. In the first case, climatic recreational resources act as therapeutic resources and in this form can be fundamentals for resorts. At the same time, special attention is paid to the quality of climatic medical resources, since the positive effect of

their use is manifested only in the case of their high quality. Unfavorable climatic medical resources will not only not contribute to the treatment process, but may also harm the health of weakened people. The therapeutic resources of the climate are manifested, first of all, in the possibility of heliotherapy. The latter is based on the physics biological effects of sunlight on humans, which is caused by ultraviolet, visible, and infrared components.

Table 2. Scale of assessment of favorability by climatic indicators (Gudkovskikh, 2017)

№	Indicators	Score scale				
		1 p.	2 p.	3 p.	4 p.	5 p.
1	Duration of sunshine h/year	2000	2200	2300	2400	2500
2	The average annual precipitation, mm per year	250	280	300	320	350
3	The average annual wind speed, m/s	3	-	4	-	5
4	The duration of the summer comfortable period from t .15°C, days.	130	-	140	-	150
5	The average long-term number of days with favorable weather in summer	16	17	18	19	20
6	The average long-term number of days with favorable weather in winter	5	-	6	-	7
7	The average height of snow cover, cm	18	20	23	25	28
8	The average duration of days with stable snow cover	130	-	140	-	160

The most important factor for the implementation of various types of recreational activities is water resources. Rivers, lakes, and reservoirs are widely used. Their recreational value is determined by a whole group of heterogeneous factors: coastal landscape, shape, depth, the slope of the shores, water temperature, distance from major cities, availability of access roads. In tourist and recreational activities, they provide great opportunities: swimming, kayaking, fishing, many people are attracted to just relaxing by the water from an aesthetic point of view. Mineral waters are essential for the organization of therapeutic and recreational recreation. These include «natural waters that have a therapeutic effect on the human body, due to either the basic ion-salt composition, or an increased content of biologically active elements and gases, and sometimes the presence of radioactive elements or high temperature, differing from freshwater by mineralization of more than 1 g/l» (Ovchinnikov, 1963, p. 242). Therapeutic mud is also used for therapeutic and recreational purposes. These resources are divided into 4 groups: peat, sapropel, silt, and hill. All therapeutic muds have a pronounced therapeutic effect and are used as prescribed by a doctor in the form of various procedures, as well as in the form of various mud preparations (Dirin and Madry, 2019; Gurova, 2018). We took into account the quantitative indicator of therapeutic mud for the assessment. All indicators for assessing the favorability of water resources are presented in Table 3.

Table 3. Scale of assessment of favorability for water resources (Gudkovskikh, 2017)

№	Indicators	Score scale				
		1 p.	2 p.	3 p.	4 p.	5 p.
1	The density of the river network km/km <sup>2</sup>	<10 000	30 000	50 000	60 000	80 000>
2	Average water temperature in July, °C	16	17	18	19	20
3	Availability of mineral springs, number of wells	1	-	2	-	3
4	The presence of deposits of therapeutic mud, units	1	-	2	-	3

Vegetation cover performs environmental and environmental protection functions, enhances the recreational, aesthetic significance of landscapes, is a direct source of food, a «supplier» of phytoncides, contributes to an increase in the oxygen content in the air and its ionization. The importance of vegetation cover as a recreational resource is great since forests enrich the air with oxygen and absorb carbon dioxide. In addition, they purify the air from various types of pollution and have a sterilizing effect on certain microorganisms due to volatile substances released by woody vegetation. The greatest attraction for tourists is dry light forests with a wide variety of species compositions.

When characterizing and evaluating vegetation cover, the following elements are analyzed: forest cover, %, and NDVI. The vegetation index is an indicator calculated as a result of operations with various spectral ranges of remote sensing data and related to plant parameters in a given pixel. All indicators for assessing the favorability of vegetation cover are shown in Table 4. We determined the indicator of the normal vegetation index using the ArcGIS 10.2 program using the 4th and 5th channels from the multispectral wood of the Landsat-8 satellite, an artificial Earth satellite.

Vegetation, especially woody, has health and healing properties. Botanical recreational resources can be used in tourist products both independently and in combination with other objects. They represent a living world, easily accessible for visual observation, photo, and video shooting. Recreational properties of vegetation are characterized by the following parameters: vegetation type, coloristic structure, patency, illumination, etc. Forest vegetation has the greatest recreational attractiveness and therapeutic value, in connection with which, in the thematic literature from the whole variety of botanical resources, the main attention is paid to forests. It is forests that contribute to improving the quality of the air environment through its ionization and phytoncidal properties. Coniferous forests (cedar, pine, fir) have the greatest recreational impact, lower indicators of recreational activity are characteristic of deciduous forests (birch, aspen) (Shalmina, 2006). The system of specially protected natural territories is a combination of functionally and geographically mutually complementary protected areas organized taking into account the natural physical and geographical structure of the region and interactions with various forms of economic activity. Their ultimate goal is to ensure conditions for sustainable socio-economic development based on the preservation and improvement of environmental conditions, conservation of biological diversity. As R.V. Bobrov notes, specially protected natural territories enable residents of the urbanized areas to relax in an undisturbed or slightly disturbed by anthropogenic influences natural environment (Bobrov,

1989). They perform, in addition to restorative - ecological, recreational, educational, and other functions. The indicator of specially protected natural territories is ranked by score relative to the maximum and minimum indicators, Table 5.

Table 4. Vegetation favorability rating scale (Gudkovskikh, 2017)

№	Indicators	Score scale				
		1 p.	2 p.	3 p.	4 p.	5 p.
1	Woodiness, %	<20	50	70	100	140>
2	NDVI	<0.10	0.20	0.30	0.40	0.50>

Table 5. Scale of assessment of favorability for protected areas (Gudkovskikh, 2017)

№	Indicators	Score scale				
		1 p.	2 p.	3 p.	4 p.	5 p.
1	Occupied area of protected areas, %	1	-	2	-	3

The integral assessment of the natural and recreational potential is the sum of the scores of those indicators that were used for its assessment, which was calculated according to the following formula. The present formula has been adapted according to Orlova's formula (Orlova, 2006):

$$LRP = I_s * 100 / B_{max} \quad (1)$$

Where: LRP is landscape and recreational potential,  
 I<sub>s</sub> - score of indicators,  
 B<sub>max</sub> is the maximum possible score.

In our studies, the maximum possible score is 85, since we have 17 indicators, where the highest score is 5. Then the values of the value of recreational attractiveness for each landscape were found.

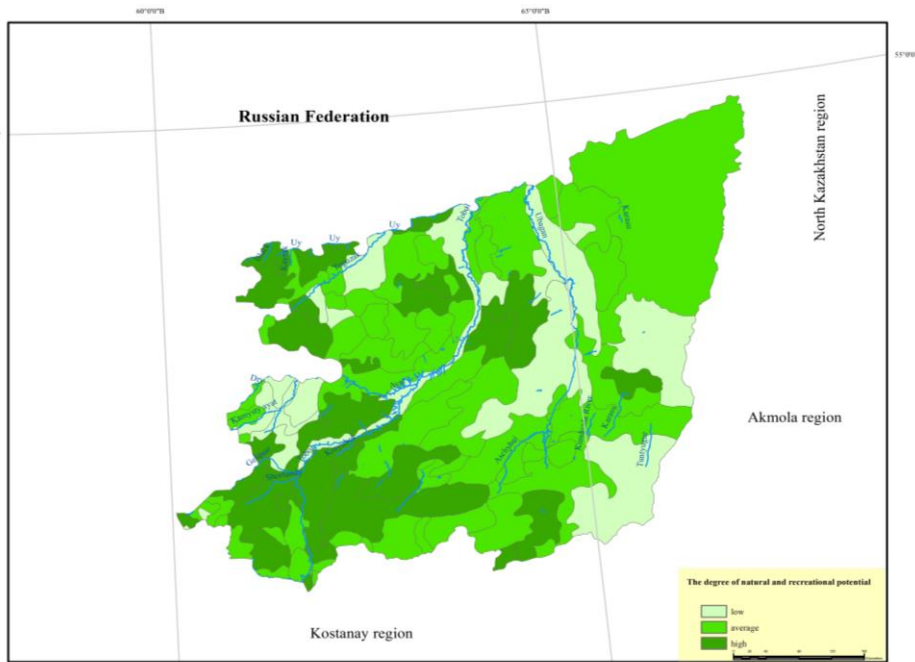


Figure 2. Zoning of the territories of the Tobol River basin within the Kostanay region according to the degree of natural and recreational potential (compiled by the authors in the ArcGIS program)

Based on the data obtained, a corresponding map was compiled. According to the results of the assessment of the value, three types of territories with different degrees of recreational attractiveness were identified.

### RESULTS DISCUSSIONS

To determine the indicators of the natural and recreational potential of the territory of the Tobol River basin within the Kostanay region, we studied stock materials, weather service data, and cartographic material. Based on the results obtained, we have compiled a map of the natural and recreational potential of the landscapes of the Tobol River basin within the Kostanay region (Figure 2). Landscapes of 18, 24, 42, 50, and others with a *low* degree of natural and recreational potential within the study region include landscapes that are more represented by slightly undulating ancient lake-alluvial and hilly-undulating plains with rich grass-red grass and sandy grass-grass vegetation on ordinary saline chernozems with salt. These areas include forest-steppe and steppe landscapes of the Tobol River basin. The least natural and recreational attractiveness of these landscapes is characterized by the absence of many indicators selected for evaluation (for example, the presence of deposits of therapeutic mud, mineral springs, etc.).

The areas with an *average* degree of landscape and recreational potential include landscapes No. 1, 2, 4, 6, 10, 30, 31, 72, 78, and others. The average annual precipitation is 310 mm. The duration of sunlight is 2245 hours per year. The average annual wind speed is 3 meters/sec. Unique natural objects are represented by state botanical monuments of nature: «Planting of birch and pine forest near Lake Borovskoye», «Planting of pine forests near the village. Borki», «Birch-aspen stake near the Brine lake», «Krivulin tract», «Relict larch-birch grove with Sukachev larch», «Aspen-birch spikes with viburnum vulgare». A distinctive feature of this group of landscapes is woodland (Korytny, 2001). As a result of the assessment of the landscape and recreational potential of the territories of the Kostanay region landscapes № 3, 5, 7, 9, 11, 20, 54, 55, 69, 74, and others have a high natural and recreational potential. The average amount of precipitation shows 315 mm. The average height of the snow cover is 23-24 cm. Of the unique natural objects in landscapes with high indicators: the Naurzum State Nature Reserve, the state botanical nature monument of regional significance «Kamenny Lake tract», the modern climatic and balneological sanatorium «Sosnovy Bor», located on the shore of the mineral lake, surrounded by magnificent coniferous forest, etc. The pearl of the Kostanay region is considered to be the Naurzum Reserve with its unique island pine forests and reference steppe ecosystems. Created to preserve the steppe landscapes of Northern Kazakhstan, it also included large lake systems and island pine and small-leaved forests with all the diversity of the animal and plant world. On July 7, 2008, at the 32nd session of UNESCO in Quebec City (Canada), the Naurzum Reserve was included in the UNESCO World Cultural and Natural Heritage Lists in the nomination «Sary-Arka - Steppes and Lakes of Northern Kazakhstan».

## CONCLUSION

The data obtained allowed us to draw the following conclusions:

According to the results of the study, the districts of the region were ranked according to the degree of natural and recreational attractiveness and landscapes with high, medium, and low natural and recreational potential were identified.

The natural conditions of the research region create the possibility of developing various forms of nature-oriented, rural, sports, and balneological tourism on its territory. The presence of a specially protected natural area is of scientific, cognitive interest and represents a resource base for ecological tourism. The chemical composition of mineral water deposits common in the rain makes the region promising for therapeutic recreation.

According to the study, landscapes that are represented by hilly-hollow, hummocky-wavy, and abrasive-accumulative plains with rich-grazed-red-and-white vegetation on ordinary saline chernozems have a high degree of natural and recreational potential, and on the contrary, landscapes that are represented by hummocky-ridge, hilly-wavy and ancient lake-alluvial plains with rich-grained- red-and-white vegetation on chernozems, ordinary, carbonate, saline with salt. Today, in landscapes with a high potential of natural and recreational resources, along with recreational resources, the technogenic type of nature management prevails, which is the most negative type of anthropogenic impact on the natural environment. For example, asbestos is being mixed in Kostanay Minerals JSC in Landscape number 13, which critically affects the natural and recreational resources of the landscape under consideration. The results of the assessment of the natural and recreational potential of the Tobol River basin within the Kostanay region can be used to determine the priority areas of recreational activity in the studied region.

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