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# The Landscape Method of Analysis and Assessment of Ecotourism Destinations in the Republic of Kazakhstan

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## Introduction

Global environmental changes call for alternative solutions in natural resources management and for the development of ecologically safe industries for the global economy. These changes affect the tourism industry as well. Every year the growing number of tourists has an influence on natural environment. High concentrations of people in popular tourist attractions result in the destruction of landscapes, waste and noise pollution, and the contamination of the environment by transportation exhaust gases.

Mass tourism without consideration given to the ecological consequences has caused the gradual degradation of natural habitats and environments. One of the causes is high tourist demand which leads to overcrowding in popular tourist attractions. Considering these factors, planning of tourist flows and tourist load balancing can not be underestimated.

According to "Conception of the Development of Tourism in the Republic of Kazakhstan", the growth of the world-wide tourism industry will occur due to the appearance of new tourist attractions, since the traditional tourism markets have already reached their maximal capacity. For that reason Kazakhstan has a unique opportunity to occupy a niche in the global tourism industry.

Considering the fast and steady growth of tourism and its great influence on the environment, society, and all sectors of economy, the government of Kazakhstan has identified the tourism sector as one of the priorities of its long term development programme. Therefore, the need for the scientific justification for tourism in Kazakhstan is vitally important in order to avoid irreversible consequences that could occur as a result of tourist impact (degradation of natural complexes or landscapes and their improper use).

Kazakhstan is the second largest territory in the Newly Independent States (after Russia) and the ninth largest territory in the world occupying 2.7 million $m^2$. The country's landlocked location in the centre of Asia determines its physiographic characteristics, hydrographic features, soil and plant cover, fauna and landscapes.

Presently, the development of management techniques for tourist flows in protected areas in the Republic of Kazakhstan is not receiving adequate attention. This is due to the inadequacy in the existing regulating system, and the fact that the tourism market is at its early development stage. There is no well-defined solution to this problem because different types of landscapes from forest-steppe to glacial-nival have different degrees of stability.

## Methods

Standard methods of landscape analysis include: cartographical, cartometrical methods, methods of landscape profiling, landscape-indication methods, statistical methods, methods with the use of GIS and remote sensing.

The method of landscape analysis for scientifically based ecotourism planning is geared towards the complex evaluation of ecological conditions, and the recreational potential of landscapes. This is a

multiple-step method to the assessment of natural-territorial complexes that are linked by one main goal – the thorough assessment of characteristics of ecotourism destinations.

The diversity of landscapes of the plain and mountain areas of Kazakhstan and their use for recreational purposes determines the need of the strict following of landscape-ecological requirements for recreational reclamation. The management of tourist flows on protected territories must be done according to the types of landscapes with the consideration of their spatial structure and with the use of coefficients.We propose a new method for research and management of tourist flows with the use of the landscape method for the preservation of the unique destiwwnations of ecotourism and protected areas.

By landscape we understand a specific territory, homogeneous in origin and evolution of development and indivisible by zonal and azonal char-

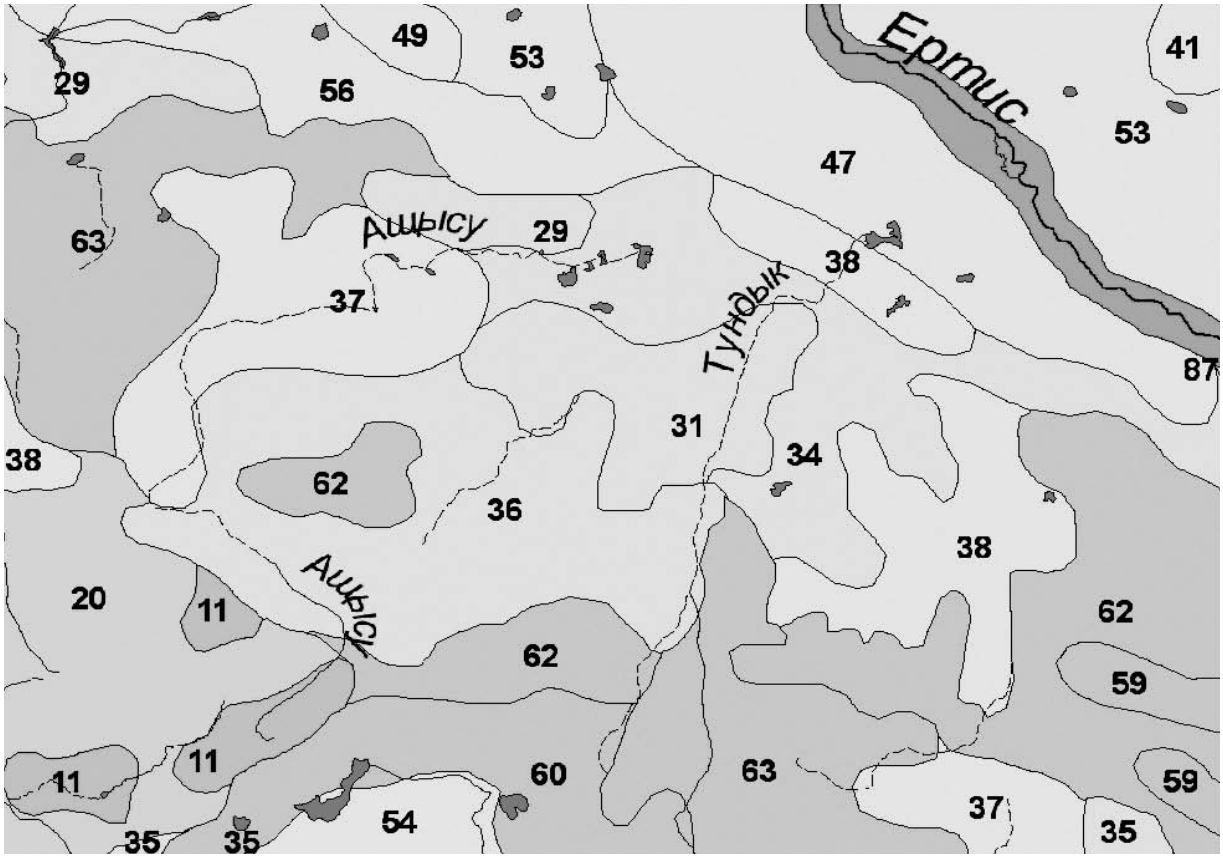


Figure 1[1]: Fragment of Landscape Map of Kazakh SSR, scale 1 : 5 000 000, Edited by Chupakhin, special content by Veselova L.K., Geldyeva G.V. Bayan Aul National Park

1 Legend
Landscapes of Plains
Steppes
11 Deluvial-proluvial plain in carbonate black earth soils
20 Hummocky topography in black southern carbonate black earth and dark-hazelnut solonetz soils
29 Peneplain in dark-hazelnut soils with solonetz
31 Denudation plain in hazelnut normal and underdeveloped soils
34 Denudation plain in hazelnut normal soils with solonetz
35 Denudation plain in dark-hazelnut solonetz soils
36 Denudation plain in dark-hazelnut underdeveloped soils
37 Deluvial-proluvial plain in dark-hazelnut soils with solonetz
38 Deluvial-proluvial plain in hazelnut normal soils
41 Deluvial-proluvial plain in dark-hazelnut carbonate soils and meadow-hazelnut with solonetz soils
47 Fluviolacustrine plain in dark-hazelnut soils with solonetz
49 Fluviolacustrine plain in meadow solonetz and solonchaks and dark-hazelnut soils
53 Fluviolacustrine plain in dark-hazelnut soils
54 Fluviolacustrine plain in dark-hazelnut soils
56 Aluvial-proluvial plain in dark-hazelnut and and meadow-hazelnut soils
59 Hummocky topography in dark-hazelnut soils
60 Hummocky topography in dark-hazelnut solonetz soils
62 Hummocky topography in hazelnut carbonate and underdeveloped soils
63 Hummocky topography in hazelnut normal soils
Semi-deserts
87 Fluviolacustrine plain in light-hazelnut soils

acteristics. It has a united geological fundament, same-type relief, climate and uniform combination of hydrothermal condition, soils and biocenose and similar combination of geosystems.

Natural landscapes and ecotourism are closely interrelated. An analysis of landscape heterogeneity of ecotourism destinations is a required step of the development of tourism industry. The landscape-ecological approach to the planning of ecotourism routes includes the assessment of heterogeneity and stability of specific landscapes that are valuable tourists' destinations and allows the calculation of an optimal ratio between landscapes and tourist loads. Scientific and methodological bases of ecotourism include the analysis of the landscape structure of the territory and comprehensive characterization of natural and natural-anthropogenic landscapes. They differ from each other by zonal conditions and their recreational potential.

Specific landscape research that includes the assessment of natural territorial complexes and natural resources as ecotourism sites, takes into account the analysis of natural components (relief, climatic conditions, soil and vegetation cover etc.) in their interrelationships and complex consideration of landscape characteristics of the tourist destination. Therefore, an analysis of geological-geomorphologic, hydro-geologic, climatic, zonal soil and land conditions is essential for ecotourism planning and development. The landscape-ecological approach would also include the assessment of aesthetic attractiveness of the landscape and the carrying capacity of each individual landscape.

The issues of ecotourism planning and their solutions differ, depending on the native zones and physiographic regions. The main task of planning and designing the network of ecotourism routes is to obtain reliable data on landscape resource potential and thorough exploration of landscapes.

The analysis of natural settings of the Republic of Kazakhstan shows that all physiographic processes and phenomena in landscapes closely follow the general tendency of the evolution of modern landscapes. The regional structure of natural landscapes of Kazakhstan is represented by individual morphostructural elements: plains of the Western-Syberian platform, lowlands, plains and plateaus of the Turan platform, high plains, plateaus, hummocky topography and insular mountains of the Kazakh sheet, and intermountain troughs and epiplatform mountain ranges of South-Eastern Kazakhstan.

Plain landscapes are found on a vast territory of the country and are represented by the following types and subtypes: forest-steppe region with subtypes of southern and atypical forest-steppe; steppe with subtypes of northern and southern steppes; semi-desert and desert. Mountain landscapes are represented by nival, mountain-meadow, forest, forest-steppe, steppe, semi-desert and desert types of landscapes. Each of the mentioned types of landscapes is an area with high tourism potential.

Local physiographic conditions and processes linked to the geological structuring and display of modern tectonic movements, features of relief, soil and vegetation cover determine the landscape kinds. The diversity of natural properties of the Republic of Kazakhstan is the cause for a great number of kinds of landscapes in plains as well as in mountains. There are 201 kinds of landscapes on the territory of the country with arid natural territorial complexes prevailing (more than 50%).

The modern landscape structure of Kazakhstan has a definite latitudinal differentiation of the types of landscapes due to the extension of the country in meridian direction. The amount of solar heat increases from north to south and the atmospheric pressure decreases, both factors affect the soil-vegetation cover. Close interrelationship of natural factors leads to the isolation of different types of landscapes – from forest-steppe landscapes in the North to steppe- and dry-steppe in the South.

Mountain type of landscape occupies 17% of the country and is highly diverse. The structure of mountain type of landscape is determined by the following factors: by the location of mountains in arid zone of intercontinental deserts, by absolute height of mountains (up to 7 000 m) and by latitudinal and longitudinal extension. These factors assisted the formation of the specific spectrum of altitudinal zonality of landscapes. Mountain types of landscapes also include the landscapes of mountain ridges, submontane and intermontane troughs. They were formed within the limits of orogen-

ic morphostructures that are drastically different from platform ones, and comprise a whole natural system equal to plain landscapes.

The issue of typological classification of landscapes by the degree of stability towards recreation loads is one of the most important issues among methodological approaches on analysis and assessment of landscapes.

The degree of impact of tourist loads on landscapes is an important index that can be used by ecotourism planners. The level and the depth of influence of tourist factor on landscapes is determined by: the primary characteristics of landscape (background and zonal), its age, its condition, its dynamics, its stability, its potential for adaptation and self-balancing, by the structure of tourist influence, by socio-economic aspects of tourism industry and by the duration of impact.

We distinguish five levels of landscape organization of the territory for tourism activity. The main criteria are:

- correlation between natural, background, zonal landscapes and anthropogenically disturbed complexes
- the degree of landscape modification within the limits of one invariant
- the structure and the condition of anthropogenically disturbed landscapes
- ecological changes in spatial-time aspect
- the degree of ability to stabilize at different tourist loads

The advantage of using the landscape approach to ecotourism planning is the provision of coordination and combination within the whole system of territorial structures of natural complexes. The study of the links between the structure of natural territorial complexes and the territorial organization of ecotourism assists in the right planning of projecting tourist destinations. The landscape approach has characteristics of regional approach and is valuable when used to research specific regions. The cartographic-mathematical method of landscape structure of physiographic regions is one of many methods used in landscape analysis. This method can be used to determine the different types of landscape structures of ecotourism destinations, to conduct physiographic zoning and to assess the degree of complexity of landscape structure of the territory.

According to Nikolayev, cartographic-mathematical methods can assist in defining the many features of landscape structures and assess measures of their inner differentiation and connections.

The cartographic-mathematical analysis uses following indexes:

- coefficient of landscape fragmentation
- coefficient of landscape heterogeneity
- coefficient of landscape organization

Coefficient of landscape fragmentation (Клр) is a ratio of the mean of the area of individual landscapes to the area of physiographic region. It characterizes the measure of differentiation of landscape structure of the territory and depends on the number of individual landscapes in regional aspect. The coefficient of landscape fragmentation is calculated by the following formula:

$$К_{лн} = 1 - \frac{M}{P},$$

where M is the mean weighed area of landscape contour in the region and P is total area of the region.

The measure of differentiation is dependant, first of all, on the number of individual landscapes in the region, i.e. the number of “elements” and “system”. If there is only one landscape in the region (P=1), then the coefficient becomes zero, because landscape fragmentation is absent. When P increases, then M becomes smaller and smaller and coefficient of fragmentation comes close to 1, its maximum.

When we studied the correlation between the coefficient of landscape fragmentation and the area of physiographic region and the number of landscape contours, we found that when only the area changes and the number of landscape contours stays the same, the coefficient of landscape fragmentation stays constant. When we switch from physiographic region to the units of higher taxonomic unit, the degree of landscape fragmentation of the region increases. It is important to note that the coeffi-

cient of landscape fragmentation is not related to zonal differentiation of the territory but depends on the geologic-geomorphologic peculiarities.

An important characteristic of the structure of physiographic regions is the measure of their landscape heterogeneity. The following formula is used to calculate the coefficient of landscape heterogeneity:

$$Клл = \frac{\sum_{i=n-1}^{i=n} in\ j \sum_{j=n}^{i} i+1\ m^{i} m\ j}{C_n^2},$$

Where S is the area (%) of the particular group (kind) of landscapes in the region, n is the number of landscape groups, Cn2 is the number of combination of groups in two.

The coefficient of landscape heterogeneity shows not only the degree of the complexity of different kinds of landscapes that comprise the structure of the region, but also the correlation between their areas. The coefficient of landscape heterogeneity increases in those regions, where there is a great diversity of kinds of landscapes and a great number of landscape contours. The last characteristic is the most important element in landscape fragmentation of the region. Therefore, landscape heterogeneity correlates not only to the kinds of landscapes but to fragmentation of landscape structure as well.

When we analyzed the values of coefficients of landscape heterogeneity of physiographic regions, we found that their values somewhat increase during the transition from the units of low taxonomic rank to the units of high taxonomic rank. However, this increase is insignificant and therefore is not compared to the variations of the coefficient of landscape fragmentation.

Geographic variability of the coefficient of landscape heterogeneity of physiographic regions is an interesting one. The dependence of Клн from vertical and horizontal partition of the relief, lithologic complexes of rocks and the degree of drainage of the territory was established. Maximal values of the coefficient are present in those regions of the Republic of Kazakhstan, where forest-steppe and steppe fractured natural complexes dominate. Low values of coefficients of landscape heterogeneity are found in regions with alluvial and aeolian plains. The heterogeneity of landscape structure usually increases where its fragmentation decreases and vice versa.

The coefficient of landscape organization enables us to analyze the inner regularity of the landscape structure of the region. It is calculated by comparison of Клнлр and K and provides data on interrelationships of geosystem elements and structural order. The higher the landscape fragmentation of the region and lower landscape heterogeneity, the more regulated is its structure. On the other hand, when values of fragmentation and heterogeneity come close, the organization of landscape structure falls.

Conjugated analysis of values of landscape structure shows the degree of organization of natural-territorial complex. The experiments revealed that the lowest indexes of landscape organization are linked to rapprochement of values of landscape fragmentation and heterogeneity.

Cartographic-mathematical characteristics of landscape structure provide tools for comparative analysis and classification of physiographic regional units on their degree of complexity and zonal structure.

## Results

The issues of tourist flows regulations for different types of landscapes include a broad scope of ecological tasks for determining the carrying capacity limits. The management of tourist flows should be based on the precise carrying capacity numbers of the particular landscape. Our research showed that the least ecological tolerance to recreational loads have desert landscapes (for example Barsakelmes Reserve). The landscapes of insular low lands of the steppe zone of Kazakhstan are the most tolerant to tourist loads. (Bayan-Aul National Park, Kurgaldzhin State Reserve).

## Conclusion

The method of landscape analysis provides complex evaluation of ecological conditions of the area and the recreational potential of landscapes. This multiple-step method can be employed for ecotourism planning.

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