

ECOLOGICAL ZONING OF THE NATURAL LANDSCAPES OF THE NORTHEASTERN SLOPE OF THE LESSER CAUCASUS

Purpose. The purpose of the research is to study the ecological zoning of natural landscapes of the northeastern slope of the Lesser Caucasus.

Method. During the writing of the article, historical, cartographic, mathematical-statistical, comparative analysis methods were used.

The northeastern slope of the Lesser Caucasus was chosen as the research *object*

Result. In the article, as a result of the research conducted for the ecological zoning of the natural landscapes of the North-Eastern slope of the Lesser Caucasus, the changes in the structural and functional characteristics of the natural landscape units of the area and the areas where they spread due to natural and anthropogenic influences were studied, landscape complexes were grouped according to the degree of anthropogenic transformation, new landscape types formed in the place of natural landscapes were investigated. At the same time, the main natural landscapes of the area, tugay forest-meadow-shrub landscapes, semi-desert landscapes, dry-desert landscapes, have changed their borders as a result of anthropogenic effects, and new areas where they spread have been studied. Opinions were discussed about the important role of determining a number of aspects of landscape-ecological zoning diagnostics, in revealing the future development trends of individual landscape units. Taking into account the relevance and modernity of the topic, a number of scientific-theoretical and methodological issues of landscape-ecological zoning for the region were analyzed in the area where the research was conducted. The basis of the work is that settlements and their functional farm areas are characterized by relatively high density in the immediate flat areas, terraced alluvial plains of river valleys, mountain depressions and smooth surface plains and the approximately equal distribution of settlements in the Ganja-Gazakh sloping plain throughout the territory, since the climate, lithological and hydrological conditions in the south-eastern part of the territory have changed sharply, the relatively low water supply in the location of settlements is a social and ecological problem, and therefore the location of settlements in the area along the river banks.

Scientific novelty. Based on the ecological zoning of landscapes in the area, it is analyzed that the correct assessment of their ecological potential, the preparation of appropriate zones and belts, the assessment of geoeological potential by dividing into zones taking into account the ecogeographical potential of the natural landscapes of the region and anthropogenic loading, is of great scientific and theoretical importance.

Keywords: Lesser Caucasus, ecological zoning, landscape complexes, anthropogenic load, environmental potential, natural and anthropogenic impact, ecogeography, geoecology.

ЕКОЛОГІЧНЕ РАЙОНУВАННЯ ПРИРОДНИХ ЛАНДШАФТІВ ПІВНІЧНО-СХІДНОГО СХИЛУ МАЛОГО КАВКАЗУ

Мета дослідження – вивчення екологічного районування природних ландшафтів північно-східного схилу Малоого Кавказу.

Методи дослідження. Під час написання статті використано історичний, картографічний, математико-статистичний, порівняльний методи аналізу.

Об'єктом дослідження обрано північно-східний схил Малоого Кавказу

Результат. У статті в результаті проведених досліджень з метою екологічного районування природних ландшафтів Північно-Східного схилу Малоого Кавказу встановлено зміни структурно-функціональних характеристик природних ландшафтних одиниць території та територій, де досліджено їх поширення внаслідок природних та антропогенних впливів, згруповано ландшафтні комплекси за ступенем антропогенної перетвореності, досліджено нові типи ландшафтів, що сформувалися на місці природних ландшафтів. При цьому основні природні ландшафти району тугайні лісо-лучно-чагарникові ландшафти, напівпустельні ландшафти, сухопустельні ландшафти внаслідок антропогенного впливу змінили свої межі, з'явилися нові території їх поширення. вивчав. Обговорювалися думки про важливу роль визначення ряду аспектів діагностики ландшафтно-екологічного районування, у виявленні перспектив розвитку окремих одиниць ландшафту. Враховуючи актуальність та сучасність теми, було проаналізовано низку науково-теоретичних та методичних питань ландшафтно-екологічного районування регіону на території проведення дослідження. В основі роботи лежить те, що поселення та їх функціональні господарські території характеризуються відносно високою щільністю в безпосередніх рівнинних районах, терасовими алювіальними рівнинами річкових долин, гірськими западинами та гладкими поверхневими рівнинами та приблизно рівномірним розподілом поселень у Гянджа-Газах. по всій території похила рівнина, оскільки

кліматичні, літологічні та гідрологічні умови в південно-східній частині території різко змінилися, відносно низька водозабезпеченість місць розташування населених пунктів є соціальною та екологічною проблемою, а тому розміщення поселень на території вздовж берегів річки.

Наукова новизна. На основі екологічного районування ландшафтів області проаналізовано правильну оцінку їх екологічного потенціалу, підготовку відповідних зон і поясів, оцінку геоекоекологічного потенціалу шляхом поділу на зони з урахуванням еколого-географічного потенціалу природних ландшафтів, регіону та антропогенного навантаження, має важливе науково-теоретичне значення.

Ключові слова: Малий Кавказ, екологічне районування, ландшафтні комплекси, антропогенне навантаження, екологічний потенціал, природно-антропогенний вплив, екогеографія, геоекоекологія.

Introduction: N.K. Karamov, B.A. Budagov, M.A. Museyibov, A.A. Mikayilov, Y.A. Garibov were the first to evaluate the regional differences of the vertical differentiation of landscape-ecological conditions on the northeastern slope of the Lesser Caucasus. The study of landscape zones shows that there are significant regional differences in the distribution of landscapes along river valleys from northwest to southeast. The reason for this is the diversity of the climate, geological core, relief forms, and overall environmental conditions in the river basins. Depending on the mentioned characteristics, there are differences in the occurrence of exodynamic and natural disasters in river basins. In order to manage each of them, to minimize the damage to the economy, it is necessary to take into account the regional characteristics. (Abbasova, 2021).

The relevance of the topic. One of the most modern problems of modern landscape science and physical geography as a whole is determining the ecological potential of regions and their individual parts and preparing its scientific theoretical foundations. Usually, after analyzing all parameters of the landscape, its modern structural-functional characteristics and future development trends are determined. Then, according to regional differences and individual characteristics, the work of zoning landscapes in the research region and separating their individual-regional units is carried out. The process of landscape zoning is based on a number of principles and criteria. First of all, the vertical differentiation of natural landscapes, future development characteristics, and anthropogenic transformation should be considered as the most important factors.

Methodology: Studying and correctly assessing the modern natural-anthropogenic ecological potential of the natural landscapes of the northeastern slope of the Lesser Caucasus is one of the urgent issues. The use of historical, cartographic, mathematical-statistical, comparison methods was preferred to study the ecological zoning of the area.

Scientific novelty: Based on the ecological zoning of landscapes in the region where we are conducting research, the correct assessment of their ecological potential and the preparation of appropriate zones and belts are of great scientific and theoretical importance. For this purpose, we have divided the natural landscapes of the region into several zones, taking into account the ecogeographical potential and anthropogenic load, and studied how tense the ecological condition of the landscapes of the area is.

Discussion: In order to study the modern state of landscape types, subtypes and smaller units in the landscapes of the northeastern slope of the Lesser Caucasus and their unique structural and functional characteristics, we have identified various landscape units that differ from each other in terms of their absolute height, morphological and typological characteristics. Each landscape type is distinguished by its own productivity, natural and anthropogenic transformation, and ecogeographical characteristics. The morphogenetic types of the selected landscapes (alluvial plains, foothills, interconical, streambed, slope, terraces, etc. complexes), relief forms, lithological characteristics of rocks, nature of soil-vegetation cover, species diversity, etc. are taken into account.

As a result of the study of the problems caused by the anthropogenic transformation of the natural landscapes of the area, it was determined that the risks and dangers caused by the change of landscapes, landslides are constantly activated in accordance with the increase of economic effects of people and accelerate the process of degradation of landscapes. As the anthropogenic transformation in the natural landscapes of the territories increases, the landscapes of the settlements, agrocomplexes, pastures and meadows of the region are also affected to varying degrees. (Abbasova, 2022)

Currently, the tugay forest-meadow-shrub complex, which is subject to continuous anthropogenic influences, has been preserved in the form of small areas of bushes that have changed their natural species composition. It is widely used as winter pastures along the banks of the Kura River. A large number of cattle beds were built here, and roads were built. Over-grazing of livestock in the destroyed forest areas, cultivation of various perennial agricultural plants, caused groundwater to surface, salinization of the soil, denudation of the area, swamping of riverside areas.

The semi-desert landscapes of the Ganja-Kazakh plain have been subjected to higher anthropogenic transformation, and are mainly used as irrigated agriculture, horticulture, and winter pastures. At the same time, the territory is distinguished by the development of industrial areas, urban and rural settlement, development of the road and communication system, as well as various types of anthropogenic transformations. Medicinal landscapes spread in the area with sloping plains - semi-desert, dry-desert landscapes and tugai forest-meadow-shrub landscapes spread on the banks of the Kura River are subject to all forms of anthropogenic appropriation, so natural complexes are poorly used, intensively used and fundamentally changed according to the degree of anthropogenic transformation. divided into man-made and irregularly used landscape complexes (Table 1).

Table 1.
Changed landscape complexes according to the degree of anthropogenic transformation

	<i>Complexes</i>	<i>Developed areas</i>
1	Poorly used landscape complexes	Tugai forest-shrub areas
2	Intensively used and fundamentally changed landscape complexes	Agrolandscapes and seliteb complexes of dry-desert and semi-desert complexes
3	Man-made landscape complexes	Reservoirs, industries, pipelines, transport, etc.
4	Complexes from its irregular use	Pasture and mowing fields

The landscape complexes on the gray-brown, chestnut soils with high filtration capacity of the foothill slope have changed their functional characteristics and turned into almost completely irrigated agrolandscapes. (Abbasova, 2022).

Based on the ecological zoning of landscapes in the region where we are conducting research, the correct assessment of their ecological potential and the preparation of appropriate zones and belts are of great scientific and theoretical importance. For this purpose, we have divided the natural landscapes of the region into 6 zones, taking into account the ecogeographical potential and anthropogenic load.

1. Landscapes of intermountain depressions, smooth and flat plains that are subject to sharp transformation with intensive and regular use.
2. Substantially transformed agrocomplexes of poorly fragmented foothill plains and bearing cones, used in irrigation and steam farms.
3. Irregularly used, poorly and moderately transformed mountain-forest complexes of the low and partly mid-mountains.
4. Mountain-forest complexes that practically preserve the natural structure of low and mid-mountainous areas.
5. Mountain-forest complexes that are transformed, grassy, bushy, and degraded to varying degrees, exposed to the irregular economic effects of medium and partly high mountains.
6. Mower and pasture complexes of irregular subalpine and alpine meadows of various degrees of fragmented, sharply and moderately transformed highlands.

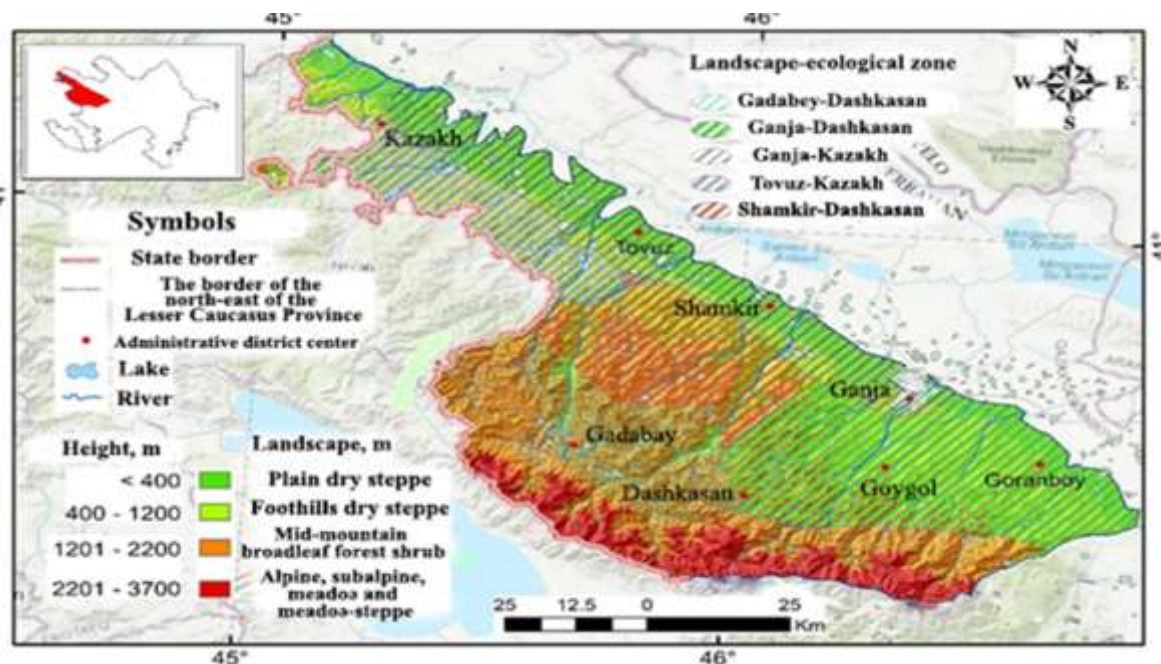
The landscapes of each zone that we have separated differ from others due to their vertical differentiation, anthropogenic transformation, inclination, vertical and horizontal division on hypsometric levels, the number and density of the population in the region, and the main development trends of agricultural areas. (Hajiyeva, 1965).

It plays an important role in determining a number of aspects of landscape-ecological zoning diagnostics, revealing the future development trends of individual landscape units. It should be noted that no special research work has been conducted in this aspect in our country. Taking into account the relevance and modernity of the problem, we tried to analyze a number of scientific-theoretical and methodological issues of landscape-ecological zoning for the region we are conducting research on this issue. The analysis of the scientific-theoretical concepts of landscape-ecological zoning shows that the following criteria should be taken into account when conducting landscape-ecological studies for specific regions:

Taking into account the mentioned criteria, a landscape zoning map of the northeastern slope of the Lesser Caucasus was prepared. These landscape ecological zones include:

1. Tovuz-Kazakh landscape-ecological zone covers the northwest of the region. It is a region whose territory has been mastered since ancient times and has undergone fundamental transformation.
2. Ganja-Gazakh plain ecological zone covers the sloping plain. This zone is distinguished by a chain of numerous and close-to-each-other village-type settlements, large-scale agricultural fields, especially

- agro-irrigated landscapes, streams of wide bringing cones, sparse stony-gravel bushes, distribution of settlements in forest and mountain-meadow belts, in addition to plains.
3. Ganja-Dashkasan landscape-ecological zone covers a large area. Here you can find the whole range of landscapes, from arid-denudation plateaus, lowland arid-sparse woodlands to high mountain complexes.
 4. Shamkir-Tovuz landscape-ecological zone intensive transformation of landscapes occurred more in lowland and foothill plains, especially in sloping plains. It covers densely populated river basins.
 5. Although the low and sparse settlement of the population in the highlands of Gadabey-Dashkasan causes a relatively poor transformation of landscapes, as we know, the ecological situation of the landscapes of the mineral extraction area is noticeable.



Picture 1. Ecological zoning of the landscapes of the northeastern slope of the Lesser Caucasus

The analysis of the modern natural-anthropogenic landscape structure of the northeastern slope of the Lesser Caucasus shows that anthropogenic factors affecting the unsystematic, uncontrolled destruction of natural landscapes are felling of trees and bushes for various purposes, overgrazing of landscapes without taking into account the norm of anthropogenic loading, development of agriculture, horticulture, gardening without considering the potential possibilities of landscape units

In modern times, fundamental changes have taken place both in the anthropogenic process of natural landscapes of the area and in the structure of landscape units. Anciently irrigated landscapes occupy a large area in the bringing cones of Ganjachay, Tovuzchay, Agstafachay, inter-cone hilly plains. The gray-meadow, light gray-brown, meadow soils here are characterized by high filtration properties, weak salinization and thick agro-irrigation horizon, large areas, homogeneous structure. The areas of grain, vegetable, vegetable garden and cotton crops have been expanded (Hajiyeva, 1965).

In recent times, the rapid growth of the population has caused the natural complexes in the plains and foothills of the area to be completely changed and replaced by agro-landscapes, and in relatively high areas, they have been transformed into secondary landscapes. According to scientific studies, it was determined that the settlement of the population on the northeastern slope of the Lesser Caucasus is subject to the height zone of the landscape. Thus, from the foothills to the highlands, the population and the number of settlements, respectively, decrease in a regular manner.

Residential areas and their functional farm areas are characterized by relatively high density in the immediate plains, terraced alluvial plains of river valleys, intermontane depressions, and flat surface plains. Settlements along the Ganja-Gazakh sloping plain are distributed almost evenly over the entire area. Since the climate, lithological and hydrological conditions in the south-eastern part of the area have changed dramatically, the relatively small amount of water in the settlements is a socio-ecological problem, and therefore the settlements in the area are mainly located along the river banks. (Garibov, 1990).

The analysis of the distribution of urban and rural settlements on the height-landscape zones shows that the location and functional activity of the population, settlements and farms were formed under the direct influence of natural-geographic conditions, depending on the height-spatial differentiation of the landscape on the northeastern slope of the Lesser Caucasus. From this point of view, depending on favorable relief, lithological, hydrological and hydrogeological conditions in the plain parts, the settlement of the population and the location of various farms are also related to the formation of a more favorable natural-geographical environment. This is also shown by the analysis of the distribution and density of the population and settlements by altitude zones.

Table 2.

The number of urban and rural population living in the north-eastern slope of the Lesser Caucasus, in thousand people

Administrative region	Number of population	City population	Village population
Ganja-Dashkasan	596,0	424,6	171,4
Ganja	330,3	330,3	-
Naftalan	8,6	7,3	1,3
Dashkasan	33,2	14,5	18,7
Goranboy	101,2	24,3	76,9
Goygol	64,5	25,6	38,9
Samukh	58,2	22,6	35,6
Kazakh-Tovuz	674,4	165,9	508,5
Agstafa	85,9	21,0	64,9
Gadabay	100,8	14,6	86,2
Kazakh	95,8	20,8	75,0
Shamkir	216,2	73,4	142,8
Tovuz	175,7	36,1	139,6

Source: ARSSC data, prepared on the basis of statistical compilation. Population of Azerbaijan 2023, p. 75-77.

The analysis of the data of the table we compiled shows that currently, according to the data of 2023, 216 residential areas (7 cities, 19 settlements, 190 villages) and 596,000 people (424.6 thousand urban population, 171.4 thousand rural population) living in them have been registered in the Ganja-Dashkasan economic district of the region. In Tovuz economic district, 345 residential areas (6 cities, 8 settlements, 331 villages) and 674,400 people (165.9 thousand urban and 508.5 thousand rural population) living in them were registered. This has led to the expansion of the area of settlements and seliteb complexes, the economic impact of people on landscape complexes and the transformation of natural complexes.

According to the analysis of the table, the urban population of the region is 590.5 thousand people, and the population living in rural settlements is 679.9 thousand people. As it can be seen, the vast majority of the population living in the region is concentrated in rural settlements. In the administrative districts included in the region, the share of the population living in rural settlements reaches 60-89% on average. This indicator has a significant regional difference in the area. Thus, 75.6% of the population of Agstafa, 66% of the population of Shamkir, 56.3% of the population of Dashkasan, 75.9% of the population of Goranboy, 61.2% of the population of Samukh live in rural settlements. Due to the increase in the population of the republic, the area of settlements is expanding every year. The number of seliteb landscape complexes in the cities of Ganja and Naftalan, Gazakh, Agstafa, Tovuz, Shamkir, Goygol, Samukh, Goranboy regions located in the study area is increasing every year. This leads to the replacement of natural landscapes with derivative man-made landscape complexes. The relatively high productivity of the sloping plains can be replaced by the less productive semi-desert-saline landscapes of the steppe landscape complexes. This is due to the annual increase in the sharp salinization processes in the irrigated chestnut lands of the plain, creating badlands in some places. Modern gully erosion breaks up the inclined (15-200) slopes of the wide gobos, causing the proliferation of unusable areas. The complete change of landscapes in the area requires the application of landscape-ecological planning measures.

Conclusion. As a result of the zoning of the landscapes of the northeastern slope of the Lesser Caucasus, the Tovuz-Kazakh landscape-ecological zone has undergone a major transformation. Although in the ecological zone of the Ganja-Gazakh plain, village-type settlements located close to each other, large-scale agricultural fields, especially agro-irrigation landscapes, the Ganja-Dashkasan landscape-ecological zone, the Shamkir-Tovuz landscape-ecological zone and the densely populated river basins cause intense transformation of landscapes, although the small and sparse settlement of the population in the highlands of Gadabey-Dashkasan cause the relatively weak transformation of the landscapes, as we know, mineral extraction is the areas exposed to the stress of the ecological condition of the landscapes of the area.

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