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ECOGEOMORPHOLOGICAL ANALYSIS OF ANTHROPOGENIC TRANSFORMATION OF MODERN LANDSCAPES OF GANIKH-AYRICHAY VALLEY WITH SURROUNDING MOUNTAIN SLOPES OF REPUBLIC OF AZERBAIJAN

Aliyeva R. A.

Baku State University, Baku, Republic of Azerbaijan
E-mail: ramila-eliyeva@mail.ru

The article analyses the main issues of change and anthropogenic transformation of modern natural landscapes of the southern slope of the Greater Caucasus and the surrounding plains under the influence of eco-geomorphological factors. Analysis of the modern landscapes of the study area shows that the activation of exodynamic processes, degradation of landscapes, the formation of mudflows and landslides largely depends on the height of the ridges and on the exposure and steepness of slopes. Thus, more than 70% of landslides are concentrated in the southern and southeastern slopes of the mountains in the Girdimanchay and Aghsuchay basins. The southern slopes of the Greater Caucasus as well as the southwestern and southeastern slopes receive the greatest amount of insolation and solar radiation. In this connection, the most fertile forest-steppe and forest landscapes are formed in 500–1 500 meters of absolute heights of slightly sloping and slightly dissected slopes.

In the severely degraded forest landscapes of the middle mountains (Kurmuk, Dashagil, Balakanchay, Ayrichay, etc.), where floodplains are most prevalent, the maximum amount of precipitation is mainly formed on the southern and southeastern slopes, while most of the landslides are generated in the lowlands and foothills.

Keywords: landscape, transformation, differentiation, anthropogenic factors, ecogeomorphology, natural complexes, exodynamic, landslides.

INTRODUCTION

At present, the use of mathematical cartographic methods to give the correct mechanism of vertical and horizontal differentiation of natural and anthropogenic landscapes is of great practical and scientific importance. Although various aspects of this problem have been in the focus of attention of our country and world scientists for many years (Asanova G. A. [1], Babayev M. P. [2], Krupenikov I. A. [9], Kurakova L. I. [10], Maykonom T. [11], Snakin V. V., Alyabina I. O., Krechetav P. P. [14], Ramazanova F. M., Huseynova S. M., Babayev M. P. [15] and etc.), its most important problems have not yet been thoroughly studied. In the study of the distribution and transformation of landscapes, the development of maps of vegetation, inclination, surface and depth fragmentation helps to accurately determine the structural and functional characteristics of each landscape (Babayev M. P., Hasanov V. G., Eyubova S. M. [3], Budagov B. A., Mikayilov A. A. [4], Budagov B. A., Mamedov R. M., Alizade E. K. [5], Garibov Y. A. [6, 7], Kuchinskaya I. Ya., Tarihazer S. A. [8], World desertification Atlas [16] and etc.) These issues have not been the subject of special research in our country so far. In this regards, the article tries to solve certain problems of this issue.

1. RESEARCH METHODS

ArcGis 10.3 GIS software of the US ESRI company was used to compile the inclination and vegetation maps of the southern slope of the Greater Caucasus.

In the belt of high mountain meadows, high rainfall and humidity coefficients create the basis for subalpine, alpine meadow landscapes with high stability. As a rule, the maximum amount of precipitation is observed in most river basins (Kurmuk, Dashagil, Balakanchay, Ayrichay, etc.) in the severely degraded forest landscapes of the middle mountains, where floodplains are more prevalent. The share of groundwater on the southern and south-eastern exposure slopes, where landslides are widespread, is higher in the lowlands and foothills [4].

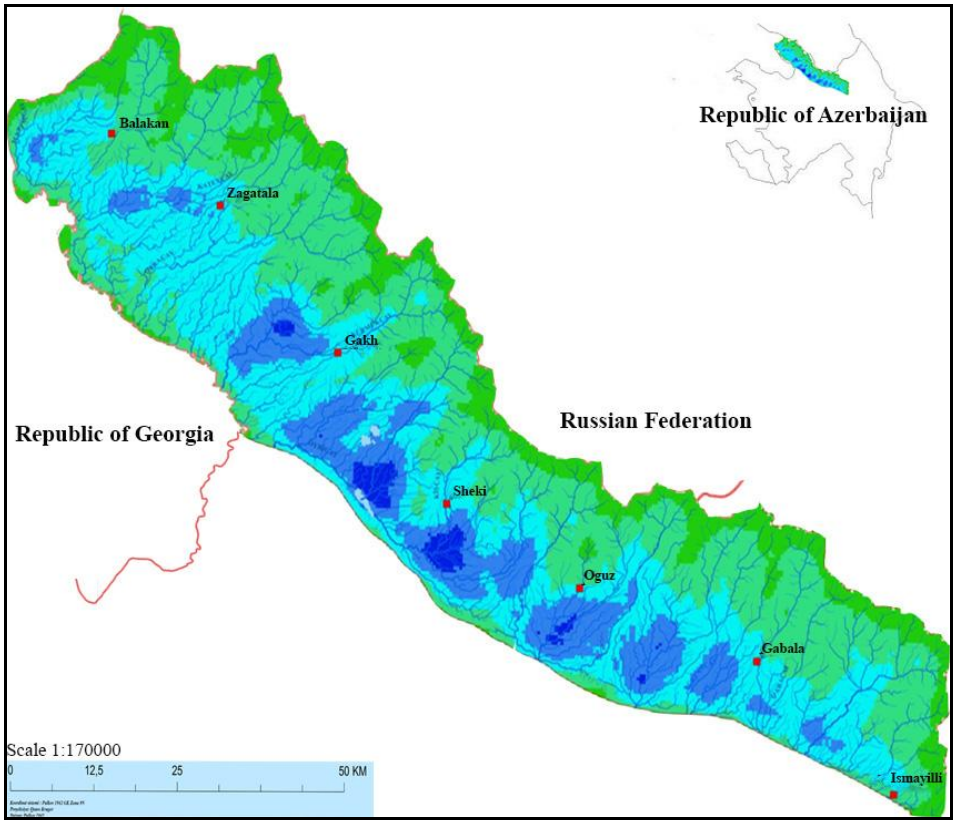

Figure. 1. Map of river network density on the southern slope of the Greater Caucasus and surrounding plains.

Source: compiled by the author.

Analysis of the river network density and hypsometric step map (Figure 1) of the southern slope of the Greater Caucasus, compiled on the basis of ArcGIS software, shows that the vertical sequence of natural landscapes and vertical structural types alternate with the corresponding sequence of hypsometric steps.

2. RESULTS AND THEİR DİSCUSSİON

As in all mountainous regions of the republic, forest landscapes are formed in relatively moist river valleys, while steppes, forest-steppes, and forest-shrubs are formed mainly on the site of former forests of secondary origin at absolute heights up to 500 m [4]. Forest-steppe, oak-hornbeam, hornbeam and beech forests are mainly formed at the altitudes of 500–1 500 m, high mountain forests and forest-meadows of post-forest anthropogenic origin — at 1 500–2 000 m altitude, subalpine and alpine meadows — at 2 000–3 000 m altitude, and subnival and nival complexes are formed higher areas [5].

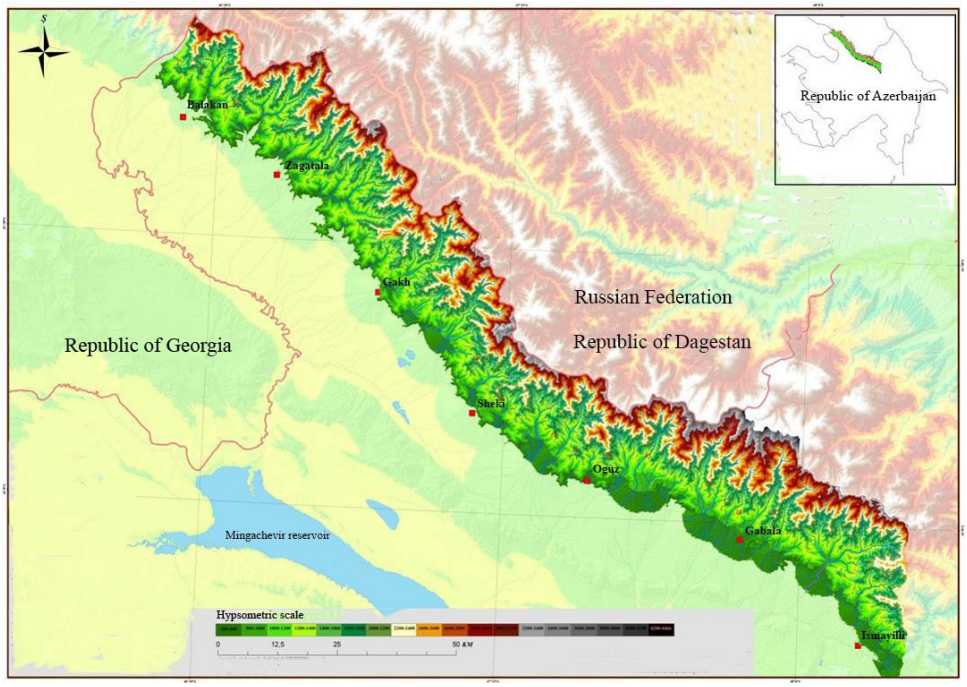

Figure. 2. Hypsometric map of the southern slope of the Greater Caucasus.
Source: compiled by the author.

Although the activity of exodynamic processes, environmental stress, floods, and landslides increase as altitude increases, the anthropogenic pressure decreases significantly [7]. No matter how much the population, the area of settlements, and the sphere of influence decreases, the danger of extreme and catastrophic processes increases. A comparison of geomorphological, flood, and landslide maps with hypsometric map data shows that (Figure 2) about 70% of floodplains are formed in the middle mountains, and the rest — in the highlands. The vast majority of landslides occur in the lowlands (65%) and the middle mountains (about 30%).

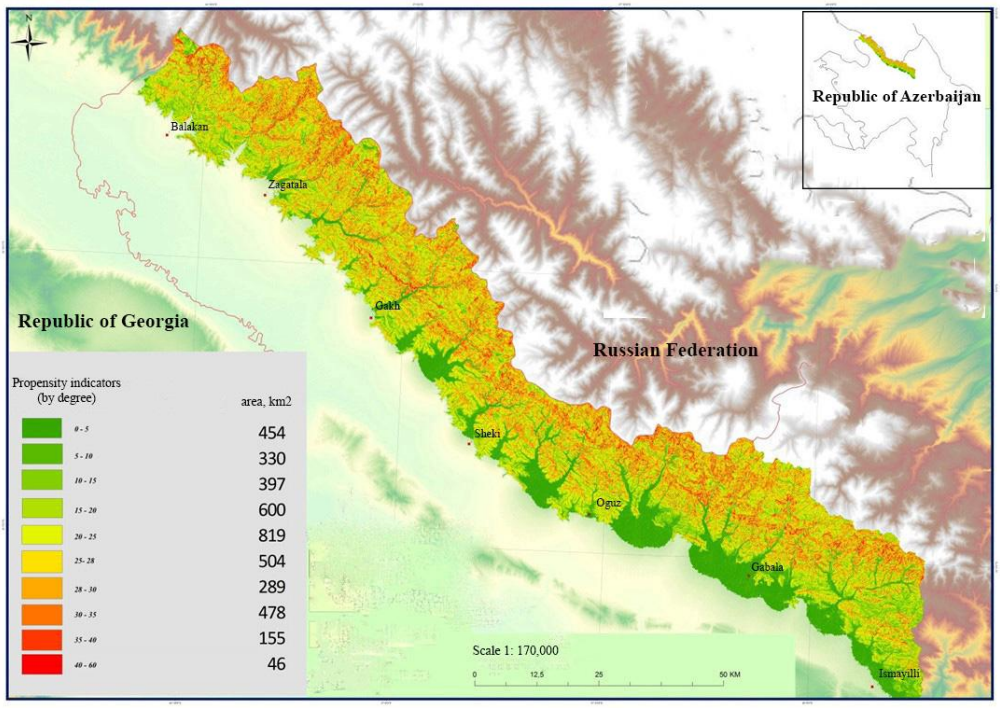

Figure. 3. Slope map of the southern slope of the Greater Caucasus.
Source: compiled by the author.

The developed slope map (Figure 3) plays an important role in the detection of ecologically high-stress areas. As a rule, active gravitational processes, especially avalanches, prevail in areas with high slope (40–45° and over). The soil surface and fragile and unstable rocks are washed away. The boundaries of landscape units are violated [12]. Stable and resilient units of forests and meadows are formed due to increased moisture storage and storage capacity in areas with a slope of 15–20° and less. At the same time, there is a potential for the origination of landslides in areas with such a slope.

There are more real opportunities for the development of this process especially in Aghsuchay, Girdimanchay, Akhokhchay, and other basins. As the inclination decreases, the risk of landslide degradation, erosion, and landslides decreases accordingly [3]. More stable landscapes are formed, completely reclaimed, almost no landslides are observed in the areas with a slope of 0–5° (454 km^2). Areas with a slope of 5–10° are very suitable for the formation of both agro-landscapes, orchards and sedentary landscapes [5]. Erosion, landslides, and other negative processes, occurring in these regions, do not cause very serious complications.

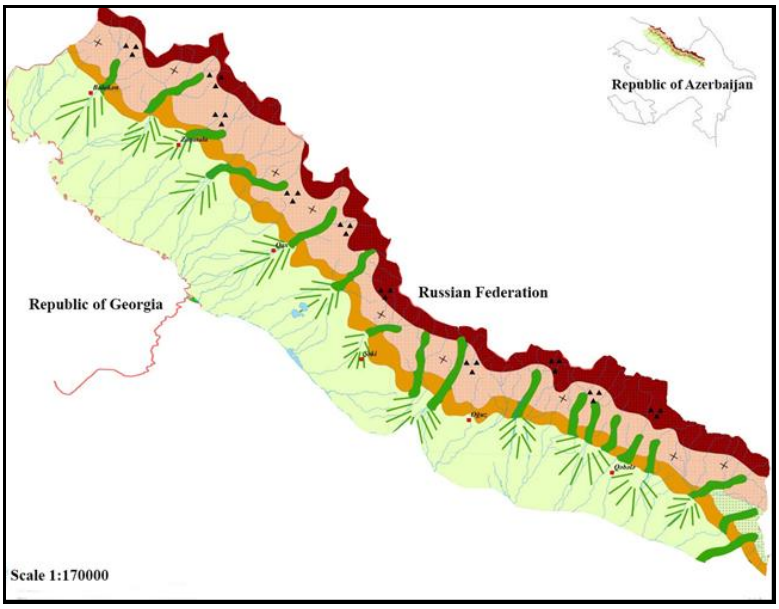

Figure. 4. Geomorphological map of the southern slope and surrounding plains of the Greater Caucasus [13].

The map legend

1. *Highly mountainous sharply fragmented watersheds, rocky outcrops and subnival partially nival glacial relief.*
2. *Sharp and moderately fragmented denudation and erosion-denudation slopes, mountain ridges and intermountain depressions of medium and partial high altitude.*
3. *Weak and moderately fragmented denudation, erosion-denudation mountain slopes and low slopes of low mountains.*
4. *Accumulative, accumulative-erosion and arid-denudation relief forms of flat and sloping plains, foothill valleys.*
5. *Accumulating river cones.*

The ArcGIS-based vegetation map (Figure 5) allows determining the formation of both vertical and local differences of landscapes. The analysis of landscape changes in different types of mountain-forest landscapes depending on the vegetation shows that several local types of mountain-forest landscapes appear in a small space at the same absolute height. In the Demiraparanchay basin, at 800–1 000 m altitude, in the expositions with azimuth views of 0°, 45° and 315°, there is a complete beech forest landscape due to the accumulation of moisture; in the expositions with 90°, 125° and 180° azimuth views, there are beech-hornbeam, partially hornbeam and oak mixed forests; and on the slopes of 180° and 225° azimuth, there are mainly oak and oak-hornbeam forests. In the Kishchay, Ayrichay, and Katekhchay basins, oak forests have a great advantage on the slopes with azimuth views of 180°, 125° and 135° at absolute heights of 1 000–1 500 m. However, the northern and adjacent slopes with the highest concentration of moisture are represented by beech forests throughout the region. This feature can also be applied to meadow

landscapes. The height of grass cover on the northern slopes is much higher than on the southern slopes.

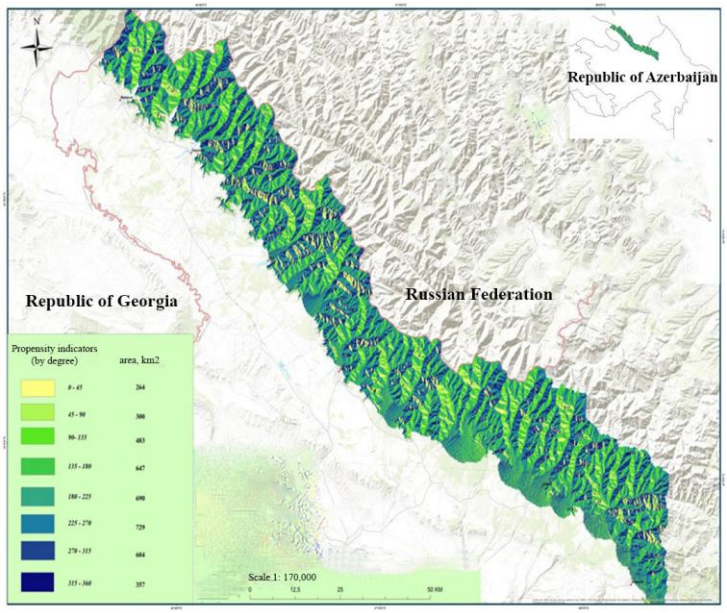

Figure 5. Vegetation map of the southern slope of the Greater Caucasus.
Source: compiled by the author.

RESULTS

Analysis of landscapes, formed on slopes with different vegetation cover, shows that the activity of exodynamic processes is closely related to the degradation and destruction of landscapes, the formation of floods and landslides, and the vegetation cover of slopes. Thus, excessive accumulation of moisture on the exposed slopes of the north (0°), north-west (315°), and north-east (45°) further increases the risk of landslides. In particular, as a result of the research in the Girdimanchay River basin, it was determined that about 70% of landslides occur on the north-eastern slopes. On the slopes with a southern view, their productivity is higher due to the fact that they receive more insolation and radiation.

As a result of the analysis of exogeomorphological factors in the studied region, it was determined that as the slope steepness and fragmentation increase, the anthropogenic transformation of landscapes weakens, but the degradation increases, the division of landscapes into small individual units on mountain slopes accelerates, and morphogenetic complexes are formed in connection with numerous ecogeomorphological and exodynamic processes. These features are characteristic of the southern and southeastern slopes of the Girdimanchay and Aghsuchay basins, of all the exposed slopes of the Damiraparan and Vendam rivers at absolute heights of 800–2 000 meters. The southern, southeastern, and southwestern exposure slopes of the region are characterised by high-yielding pistachio, hornbeam, oak forest, forest-shrub and secondary-type forest-shrub,

forest-meadow, and small-area steppe landscapes. These complexes are formed in most areas, especially in the Dashagil, Turyanchay, Kishchay, Kurmukchay, Zagatalachay, Ukhakhchay, Balakanchay water basins at absolute heights of 500–1 500 m, especially on the weakly divided middle and low slopes.

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ЭКОГЕОМОРФОЛОГИЧЕСКИЙ АНАЛИЗ АНТРОПОГЕННОЙ ТРАНСФОРМАЦИИ СОВРЕМЕННЫХ ЛАНДШАФТОВ ГАНИХ-АЙРИЧАЙСКОЙ ДОЛИНЫ С ОКРУЖАЮЩИМИ ГОРНЫМИ ОТКЛОНАМИ АЗЕРБАЙДЖАНСКОЙ РЕСПУБЛИКИ

Алиева Р. А.

Бакинский Государственный Университет, Баку, Республика Азербайджан
E-mail: ramila-eliyeva@mail.ru

В статье анализируются изменения антропогенной трансформации современных природных ландшафтов южного склона Большого Кавказа и прилегающих к нему равнин под влиянием экогеоморфологических факторов. Анализ современных ландшафтов исследуемой территории показывает, что активизация

экзодинамических процессов, деградация ландшафтов, образование селей и оползней во многом зависит от высоты хребтов, а также от обнаженности и крутизны склонов. Таким образом, более 70% оползней сосредоточены на южных и юго-восточных склонах гор в бассейнах Гирдиманчай и Агсучай. Южные склоны Большого Кавказа, а также юго-западные и юго-восточные склоны получают наибольшее количество инсоляции и солнечной радиации. В связи с этим наиболее плодородные лесостепные и лесные ландшафты формируются на 500–1 500 метров абсолютных высот пологих и слабо изрезанных склонов.

В сильно деградированных лесных ландшафтах средних гор (Курмук, Дашагил, Балаканчай, Айричай и др.), где преобладают поймы рек, максимальное количество осадков выпадает в основном на южных и юго-восточных склонах, а большая часть оползней приходится на формируется в низинах и предгорьях.

В результате анализа морфометрических карт установлено, что степные, лесостепные и лесокустарниковые комплексы формируются в основном на абсолютных высотах до 500 м в регионе; лесостепные, дубово-грабовые и буковые леса - на высотах 500–1 500 м; высокогорные леса и антропогенные лесные луга — на высотах 1 500–2 000 м; субальпийские, альпийские луга — на высотах 2 000–3 000 м; субнивальные и нивальные комплексы — на больших высотах.

Карта наклона играет важную роль в выявлении областей высокого экологического стресса в изучаемом регионе. На участках с уклоном 40–45 градусов и более происходит размывание поверхности почвы и неустойчивых пород, усиление активных гравитационных процессов. Устойчивые, устойчивые лесные и луговые ландшафты формируются на участках с уклоном 15–20 градусов и менее. В зависимости от смены ландшафта в горных и равнинных ландшафтах формируются разные типы кварталов.

Ключевые слова: ландшафт, трансформация, дифференциация, антропогенные факторы, экогеоморфология, природные комплексы, экзодинамика, оползни.

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