

## INFLUENCE OF RELIEF ON ANTHROPOGENICIZATION OF NATURAL LANDSCAPES (on the example of Lankaran natural region of Azerbaijan)

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**Abstract.** The paper is devoted to analysis of the process of reduction of precipitation in the territory of Lankaran natural region, which is characterized by geological, geomorphological, climatic and vegetation complexity. It is shown that the relief factor has a greater impact on the studied region than other mountain systems of the Republic of Azerbaijan. The differences caused by the regional complex effects of relief create differences in the location of people in those landscapes, causing them to be exposed to different levels of anthropogenic impacts on the landscape.

**Keywords:** *Agrolandscape, agro-irrigation, transformation, anthropogenic complex, ecological problem, differentiation.*

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### 1. Introduction

The main features of the relief and orography of the Talysh Mountain System, geographical location, inversion of natural terrain complexes due to the barrier effect of the ridges, the structure of sediments and rocks involved in the geological structure, other endogenous and exogenous factors have caused considerable diversity of environmental conditions. The main features of the relief and orography of the natural region are the alternation of all-Caucasian parallel ridges and mountain depressions, the dynamics of morphostructures, the geographical position of the region is close to the Caspian Sea, the Iranian plateau can be directly affected by dry-continental climate. As a result of the complex influence of the above-mentioned factors, the directions of transformation have been formed in the landscapes of Lankaran region for a long historical period (Ismayilova, 2015; Khalilov, 2020).

In landscapes, the main factor that creates vertical differentiation is relief. There are assessments from various aspects in this direction. Examples of these aspects are landscape asymmetry and landscape inversion. In the Lankaran natural region, the absolute height of the territory is in accordance with the structure observed in the whole territory of the Republic. However, the absolute height of the total area of Lankaran natural region does not exceed 2,500 m.

Absolute lack of height did not reduce the number of landscape types compared to other mountain systems of the country. Because the barrier effect of mountain slopes in the Talish Mountains also has an important landscape-creating role. Moist currents entering the area from the east via the Caspian Sea are prevented by the Talish Mountains. For this reason, the annual rainfall on the south-eastern slopes of the Talish Mountains is 1600-1800 mm/cm<sup>2</sup>, which is higher than the national average. Humid, humid landscapes of the famous Hirkan type are formed here. The forest landscape in the region is observed

from the foothills of the Burovar and Peshtasar ranges to an absolute height of about 200-400 m to 1500-1600 m. Analysis of vertical differentiation shows that, unlike other mountainous areas of the country, moist subalpine meadows do not appear in the areas above the absolute height of 1600 m, which has a similar absolute height. Also, if the semi-desert landscape type is formed in the foothills of the Greater Caucasus mountain system, in the Talish mountain system this landscape type is found in the upper parts - in the foothills as a result of severe arid climatic conditions created by hot and dry tropical air masses. These include semi-desert xerophytic shrubs in the highlands, and mountain meadows (Garibov & Ismayilova, 2015; 2009; Ismayilova, 2015; Garibov, 2011).

Morphogenetic differences of the landscapes formed in the high areas of Lankaran natural region cause various anomalies in the area. These anomalies include landscape inversion, intrazonality and so on. Meadow-forest, forest-shrub, etc. are found in the areas of rocky-gravelly, sandy-stony, sandy-clayey rocks of the rivers of the Lankaran lowland, where the lithological composition of the rocks is characterized by high filtration capacity landscape complexes predominate. From the lowland part of the region to the middle mountainous areas, volcanic sediments and changes in metamorphic rocks are observed in natural terrain complexes. Due to the high filtration capacity of the mentioned rocks, forest landscape and forest-shrub landscape complexes have been developed in the areas of the Talish Mountains with an absolute height of 1500-1600 m. Although wormwood, ephemeral, saline areas are observed in the Caspian coastal parts of Lankaran natural region, especially in the form of very small steppes in the sand dunes, it cannot be considered as a background of a semi-desert landscape complex spread over a wide area. A reed-and-chilly swampy landscape complex has developed on the Sari Peninsula, which is considered to be one of the ancient deltas of the Kura River, and in the inter-tribal depressions of the ancient river valleys, located on the border between the Lankaran natural province and the Kura basin. Both these areas and the areas of freshwater springs covered with forests along the Caspian coast of the Lankaran natural region are examples of intrazonal landscape complexes spread in the region (Museibov, 2013; Garibov, 2011).

In general, this region is one of the most developed and densely populated regions of the republic, as the availability of favorable relief conditions creates a favorable environment for human life and economic activity in the region. The area is characterized by anthropogenic impact, anthropogenic deformation of ecosystems and the extensive development of anthropogenic landscapes, especially agro-landscapes (Garibov & Ismayilova, 2009; Khalilov, 2020).

Comparison of quantitative indicators of the vertical distribution map of Lankaran natural region (Figure 1) and the population density map of Lankaran natural region (Figure 2), which I compiled on the basis of GIS (ArcGIS software) to study the dependence of the location of the population on the relief of hypsometric indicators and the degree of vertical fragmentation in Lankaran natural region. Based on the analysis, it is clear that 21.6% of the population living in the mountainous parts of the natural region live in the areas with a vertical fragmentation of up to 100 m / sq. km and a total area of about 627 km<sup>2</sup> at an altitude of 200-650 meters. There are a total of 62 rural settlements in this hypsometric range, which corresponds to the arid landscape of the lowlands. The population density is 52.5 people / km<sup>2</sup>. The total area of crops in this landscape zone is 128 km<sup>2</sup>, the total area of pastures and hayfields is 52 km<sup>2</sup>, the total area of settlements is 22.9 km<sup>2</sup>, and the total area of roads is 40.7 km<sup>2</sup> (Guliyeva, 2019; Museibov, 2013; Garibov, 2011).

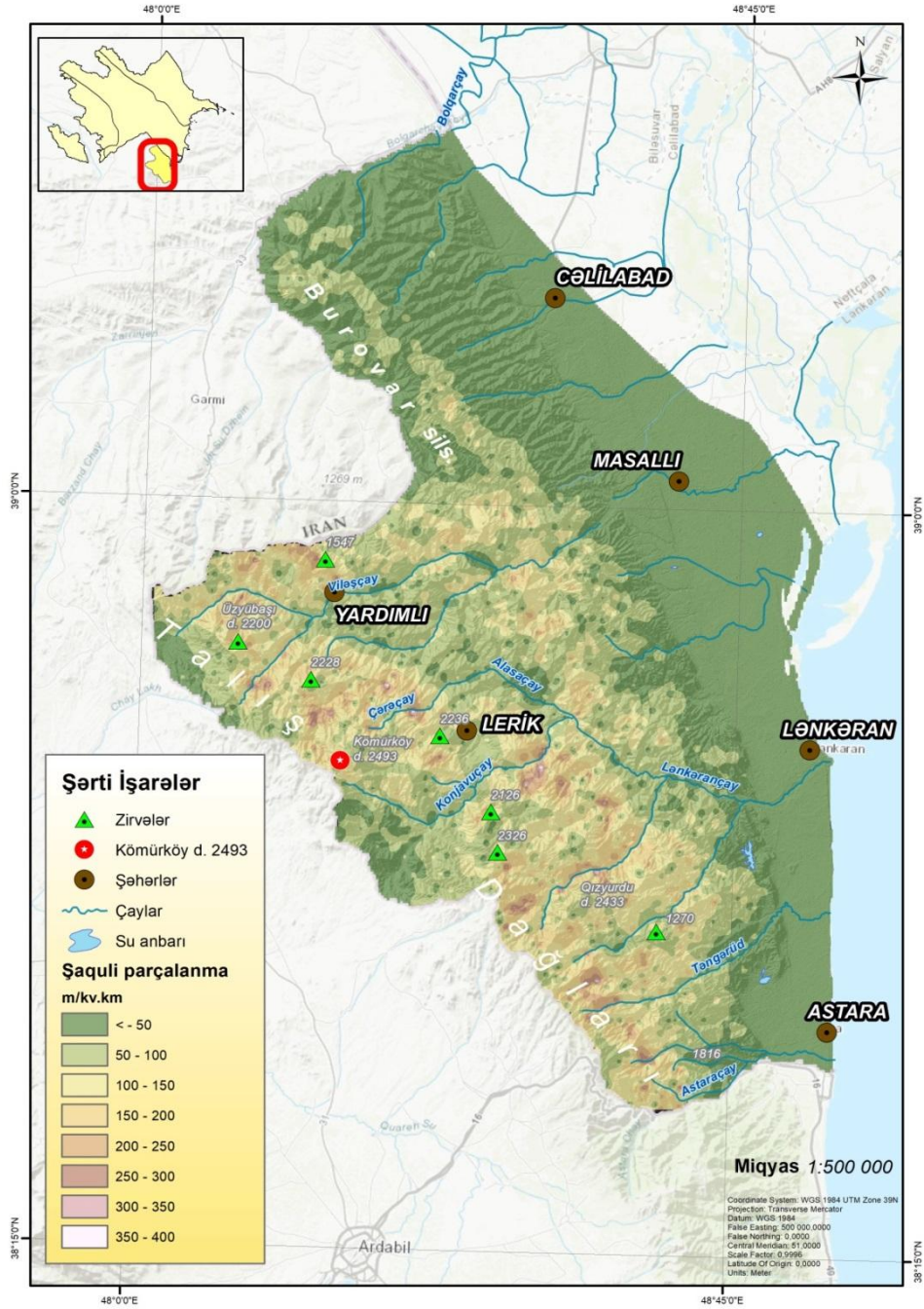
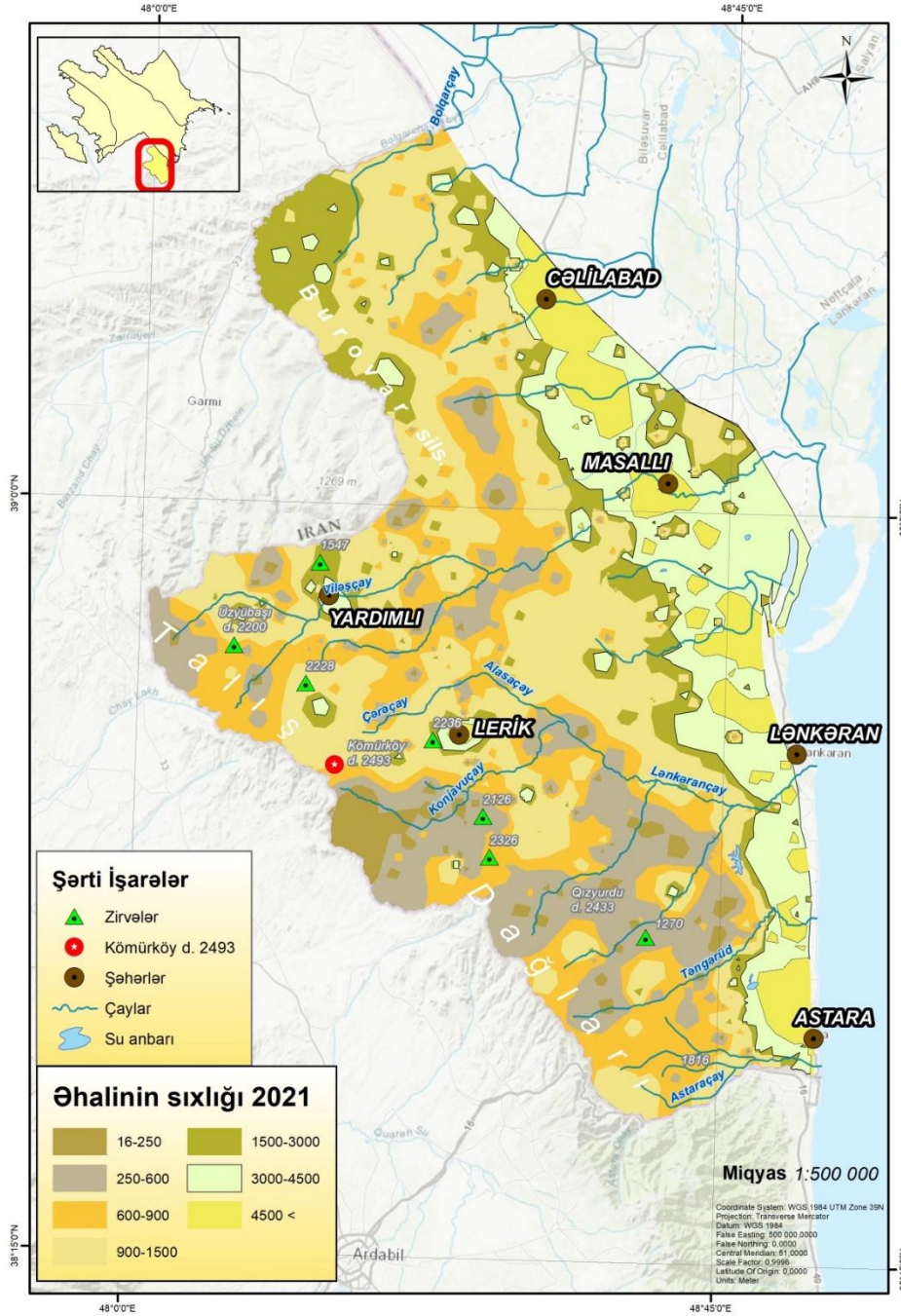


Figure 1. Map of vertical division of Lankaran natural region  
(Compiled by: S.M. Salayev)



**Figure 2.** Population density map in Lankaran natural region.  
(Compiled by: S.M. Salayev)

The degree of vertical fragmentation is observed in the range of 150-200 m/km<sup>2</sup> and the total area is about 836 km<sup>2</sup>. The average density is 93.6 people / km<sup>2</sup>. There are 168 rural settlements and one city (Yardimli), one urban district in this strip. It should be noted that the amount of precipitation in the north of Lankaran region is gradually decreasing. The driest period in these areas, typical of the subtropical climate, is summer.

The number of sunny hours in the area is more than 2,200 hours. As in the broad-leaved forest landscape of the severely fragmented middle mountain range, forest biogeocenoses in the described landscape type have been subjected to human economic activity. As in other areas, vegetation and soil cover in this landscape have changed as a result of human activities. In particular, the anthropogenic impact on the Hirkan forest complex not only destroys vegetation, but also has a significant impact on the water regime of important rivers in the region (Guliyeva, 2019; Museibov, 2013; Ismayilova, 2015; Garibov, 2011).

19.6% of the population living in the Talysh mountainous part of the natural region in the areas with a vertical fragmentation range of 200-250 m / km<sup>2</sup> and a total area of about 1416 km<sup>2</sup>, corresponding to the broad-leaved forest landscape of the middle mountains and altitude 1200-1700 meters lives in. There are 58 rural settlements and one city (Lerik) in this zone with an average density of 21 people/km<sup>2</sup>. This zone is characterized by the fragmentation of the relief, which is sharply exposed to tectonic-erosion processes. The slope of the surface is 5°-30°. The climate here is humid and warm, the average annual temperature is 10°C on average and the amount of precipitation is 1200 mm on average. The annual amount of solar radiation is 135-140 kcal/cm<sup>2</sup>. Unlike the meadow-steppe landscape, this landscape is well supplied with moisture. As a result, there are favorable conditions for dense vegetation.

Vegetation in this zone is mainly represented by broad-leaved oak, hornbeam and beech forests. Deforestation in the area of the broad-leaved forest landscape of the sharply fragmented middle mountains observed in some areas of Lankaran province in this zone also leads to the formation of a meadow-shrub landscape in the areas “free” from forests. These forests, located in the middle mountains of Talysh, are of great soil-protective and water-regulating importance, and due to their degradation, they do not allow the formation of water flow by retaining some of the rainwater during atmospheric precipitation. Thus, the destruction of the forest floor affects the regime of large rivers in the region, such as Lankaranchay, Astarachay, Vileshchay, Tengerudchay, Bolgarchay, which leads to some unexpected changes in all areas where rivers flow. This is reflected in the violation of the economic plans of the people who regulate their economic activities according to these rivers. The total area of crops in this landscape zone is 76 km<sup>2</sup>, the total area of pastures and hayfields is 30 km<sup>2</sup>, the total area of settlements is 96.7 km<sup>2</sup>, and the total area of roads is 17.3 km<sup>2</sup> (Garibov & Ismayilova, 2008; Guliyeva, 2019; Ismayilova, 2015).

7.7% of the population living in the Talysh mountainous part of the natural region in the areas with a vertical fragmentation range of 250-400 m/km<sup>2</sup> and a total area of about 683 km<sup>2</sup>, corresponding to the xerophytic steppe landscape of the middle mountains and at an altitude of more than 1700 meters - i live. There are 42 rural settlements in this strip with an average density of 26 people / km<sup>2</sup>. In Lankaran region this type of landscape is widespread on the south-western slope of the middle mountain range and the height of the area fluctuates between 1500-2000 m. Climatic indicators of this landscape type are as follows: annual amount of solar radiation is 135 kcal / cm<sup>2</sup>, average annual temperature is 10 ° C, average annual precipitation is 250 mm. Lack of precipitation leads to a lack of moisture. The period of snow cover is about three months. The density of the river network is very low. This is due to the lack of favorable conditions for the normal flow of the river. The production potential of these lands is not great. It is often used as a summer pasture. In recent years, the increase in livestock and uncontrolled grazing has naturally led to the acceleration of erosion processes here. Although the condition of the soil is low, the application of mountain farming, contour and reclamation

measures, anti-erosion agro-technical and phytomeliorative measures in this zone can help to restore and increase fertility. The total area of crops in this landscape zone is 71 km<sup>2</sup>, the total area of pastures and hayfields is 80 km<sup>2</sup>, the total area of settlements is 236.2 km<sup>2</sup>, and the total area of roads is 10.6 km<sup>2</sup> (Garibov & Ismayilova, 2015; Guliyeva, 2019; Museibov, 2013).

In the areas above the absolute height of 2000 meters, the lands where the meadow-steppe landscape is spread, such as hayfields, summer pastures, as well as in some areas of the region, cereals, legumes, etc. Planting of plants is carried out. Ecologists and botanists of the last century noted that in order to maintain ecological stability and balance in natural pastures, it is impossible to graze more than two head of cattle per hectare. Otherwise, the ground cover may be damaged. However, we see that on average, at least 7-8 head of cattle per hectare are grazed by the local population engaged in cattle breeding during the daily economic activities in the mentioned areas. There are cases of intensive grazing of animals in accordance with the rules. In addition, this type of activity, which is more productive during the mentioned sowing works, raises problems such as increasing the intensity of soil erosion in plowed sloping areas (Garibov & Ismayilova, 2015; Mammadova, 2005; Khalilov, 2020).

### 3. Conclusion

As a result the following suggestions are offered to prevent the problems mentioned above at various levels and caused by anthropogenic impacts or to minimize the amount of damage:

- Systematic study of natural landscapes of Lankaran region, ensuring the definition of norms and average limits of anthropogenic loading in each landscape type;
- Placement of the population in accordance with the demographic landscape overload in the region, even at absolute heights, with the exact implementation of state programs on socio-economic development of the regions to optimize anthropogenic impacts.

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