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Research Article

Ecological Consequences of Anthropogenic Transformation of Modern Landscapes of the Lower Kura Depression

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Abstract

The article describes the development history, differentiation features, anthropogenic transformation and ecological features of modern landscapes of the Lower Kura depression. On the basis of large-scale mapping of landscape components in the research area, the role of a number of natural and anthropogenic factors in the formation and development of the modern landscapes of the area was analyzed, and the modern ecological results created by them were determined. For this purpose, the role of a number of landscape-forming azonal and anthropogenic factors in landscape differentiation was systematically analyzed and the modern ecological condition of geocomplexes was evaluated.

Keywords: Modern Landscapes; Anthropogenic Transformation; Landscape Dynamics; Ecological Problems, Lower Kura Basin

Introduction

The modern landscapes of the Lower Kura basin differ dramatically from other geocomplexes of our republic due to their structural-functional, differentiation, anthropogenic and ecological characteristics. The reason for this is the geological developmental characteristics of the natural landscapes of the area, the structural characteristics of the components that make up modern landscapes, and the diversity of the manifestation characteristics of anthropogenic impacts.

The analysis of modern geological-geomorphological, hydrogeological, hydrological features of the region reveals that the emergence, development and complexity of landscape differentiation depends on the influence of zonal and azonal factors specific to the region. The geological development of the terrain, the lithological characteristics of the rocks that make up the area, and the climatic conditions have a direct role in the formation of the contemporary landscapes of the area. The history of the development of the studied area relief has been reflected to one degree or another in the research conducted in different parts of the depression at disparate time intervals.

The purpose of the work and the current status of the issue

Although the Lower Kura depression as a large morphostructural area began to form in the Oligocene, the Quaternary stage of development played an vital role in the creation of individual relief lines and forms developed within it and in its modern manifestation.

Commencing with the conclusion of the Absheron century, crucial changes took place in the development of the relief of the depression. During this period, the area of the alluvial-proluvial plains was greatly expanded due to intensive tectonic uplift of the surrounding areas and sea regression against the background of the South Caspian Sea. As an outcome of the regression, the Kura depression was completely freed from the sea, denudation on the edges of the depression, continental accumulation processes intensified in the central part, and a broadening of the allüvial-proluvial plains.

During the Lower Baku epoch, the tectonic uplift movements diminished in the surrounding mountainous areas, and the transgression of the Caspian Sea took place due to the lowering of most

of the depression. The relief patterns and forms formed in the central part of the depression were buried under the marine, and alluvial-proluvial plains continued to form on the edges.

During the Lower and Middle Pleistocene, tectonic activities intensified and sea regression took place. The processes of uplift and denudation prevailed in the neighboring mountainous areas and on the sides of the depression, and subsidence and accumulation processes prevailed in the central part of the depression. Subsequently, the Lower Caspian transgression occured, and the sea entirely engulfing the Kur-Araz plain and reaches the Eldar desert in the west [13].

The activity of tectonic movements has intensified between the Lower and Upper Caspian. Mud volcanoes, which were taken shape formed by this period and reached a height of 300-400 m, were active in the watershed of the Langebiz, Kalamad, and Big Harem ridges. During the transition from the Middle Pleistocene to the Upper Pleistocene, there was an valuable change in the paleogeographical structure of the lower Kura basin due to the resurgence of tectonic movements and the cooling of the climate. The level of the Caspian Sea has dropped to 45 m and the area has been completely freed from the sea.

Amidst the intensification of tectonic activities, the Kura River flowed into the Caspian Sea through the Kyzylagac Bay. The rivers of the northeastern slope of the Lesser Caucasus flow into the Kura River in the Shirvan Plain. The ephemeral regression was superseded by the Upper Caspian transgression. At this time, the sea covered the more depressed axial part of the Kura depression [7].

Research methodology

The analysis of geological materials demonstrates that the tectonic movements had a differential character. Ujar, Gargali, Kizilagac depressions have been subjected to more subsidence. Concurrently, Duzdag and Godekboz ridges were utterly formed. The Girovdag-Babazanen anticlinal zone was uplifted and formed an island within the basin. In connection with the formation of the eastern part of the Khojashen-Goychay anticlinal uplift, the Kurdmashi synclinal trough was formed during this period.

At the end of the Upper Caspian, tectonic movements and fold formation processes intensified and the sea underwent a short-term profound regression. The area of denudasion-accumulation plains expanded and new marine terraces were formed on the edges of the depression. A little later, the regression of Alt Khvalin transpired. At that time, although the sea covered a vast region, it did not reach the borders of the Upper Caspian. Minor modifications in the terrain were observed. In connection with the intensification of exogenous relief-forming processes, the slopes of separate uplifts on the sides of the depression and in the surrounding areas have turned into bedlands.

At the onset of the Upper Khvalin, marine transgression took place under conditions of stabilization of tectonic movements, cooling of climate and increase of humidity. At this time, the sea covered the most rapidly subsiding part of the depression and did not go beyond "0" m horizontal. The coast line is accompanied in some places (in the plains of Mil, Mugan, Lankaran and uplifts in the depression) by abrasion steps and coastal ridges. Subsequently, the sea of Upper Khvalin retreated with certain intervals. Relatively much stoppage is observed at 10 m level [7,10].

Obtained results and their discussion

Following the Upper Khvalin, a short-term regression occurred and was soon (approximately 8 thousand years ago) replaced by the Yenikaspian transgression. At the sea's peak level, the eastern part of the Southeast Shirvan, Salyan, Mughan plains is covered by the sea. Generally, all the morphosculptures of the depression acquired their modern appearance in the New Caspian age. Throughout this period, the Kura and Araz rivers altered their beds several times within the Lower Kura depression, which played a certain role in the formation of the relief in the coastal zone [12,13].

As observed, the relief of the Kura depression was primarily formed in the Quaternary period, it was constantly complicated in terms of time and space, when the tectonic movements intensified between the stratigraphic units and within them, exogenous processes intensified, and new morphostructures and morphosculptures were created. From the analysis of the paleogeographical conditions of the Quaternary period, it is clear that the current natural complexes of the area underwent drastic changes during the historical periods, and the borders of the landscape increased and decreased multiple times as a result of the often observed contrasting fluctuations in the climate. Fluctuations in the level of the Caspian Sea played an significant role in the creation of these processes. Consequently, not only the horizontal structure of the landscapes, but also the vertical structure underwent complex changes.

The analysis of numerous literature source and fund materials illustrates that various genetic types of semi-deserts have developed in accordance with the specific geological and geomorphological characteristics of the studied area, hydrogeological, hydrologi-

cal conditions, natural drainage and the nature of the surrounding low mountains and high plains at the foot of the mountains. The analysis of the landscape structure of the region indicates that the Lower Kura depression is a unique independent semi-desert landscape province. Semi-desert complexes were formed in the marine, alluvial-marine, alluvial, alluvial-proluvial, deluvial-proluvial plains of the area and encompassing more than 70% of the geocomplexes in the Kura-Araz plain [4].

The absolute height of the regions where semi-desert landscapes are spread varies in a very large range. In the east of the region, the semi-deserts of the coastal plains begin at the shores of the Caspian Sea (-27.5 m), and in the south, they pass through the "0"-meter isohyps, the boundary between the semi-desert and droughty desert landscapes. In the west of the Mil Plain, in the Karabakh Plain, the border of the semi-deserts traverses an isohypse with an absolute height of 100 m [5,9].

The flat and smooth plains on which the semi-deserts develop are characterized by the surface slope of 0.50 and less, composed of easily erodible sea, river, and alluvial sediments of the Quaternary period. Gray, gray-meadow, gray-brown, light chestnut soils and their diverse saline and brackish types are spread here. The basis of the vegetation cover is wormwood-ephemeral, wormwood-saline, saltine groups and covers from 25-30% to 70-80% of the surface. Some salt marshes and marshes are totally devoid of vegetation [1,2].

In the eastern part, the semi-deserts of the sea plain start from the coastal zone of the Caspian Sea. In the south of the Mughan plain, the boundary between the semi-desert and dry-desert landscapes passes through a horizontal strip of approximately "0" m. In the western part of the Mil and Karabakh plains, the border rises 100 meters and crosses a height of 90-100 m. 65-75% of the species involved in the creation of the semi-deserts of the area are annual plants [9]. The yield per m2 in the semi-desert complexes varies between 0.5-1 kg in wet weight and 0.2-0.5 kg in dry weight [6].

In the area under study, dry-desert landscapes are located higher than semi-desert landscapes due to their absolute height, and their lower and upper borders are indented-protruding depending on the relief conditions, the inclination of the slopes and the location of deluvial-proluvial plumes [5]. The absolute height of these complexes, predominantly found on alluvial, alluvial-proluvial, deluvial-proluvial plains, is not higher than 100-200 m. Dry-desert landscapes cover an area of 15.8 million/km^2 in the studied area. This is 15.5% of the territory of the republic. In the dry steppe complex, mainly open chestnut soils have developed. Wormwood, wormwood-agot, oat, phrygana, and other plant groups are disseminate on these lands. Vegetation within the complex is relatively rich and covers 65-75% [4,9].

Intrazonal (hydromorphic) landscapes have been formed as a result of groundwater seeping to the surface in areas where semi-deserts have developed. Diverse types of hydromorphic landscapes have evolved in the study area, and they are mainly spread in the Kura-Araz plain. Here, hydromorphic landscapes are located in the relative depressions of the relief: in the Kurboyu akhmazals and chalas, in the Karasu contact depression, in the inter-conical depressions, in the Big and Small Aggol depressions in the Mil plain, in the heel part of the buried uplifts, in the Agchala and Mahmudchala depressions in the Mugan plain, in the depressions between the sand bars in the Salyan plain, flat, smooth and It was formed on sunken shores, on the shores of Kizilagac Bay and in the Kanık-Eyrichay valley. The hydromorphic landscapes that exist along the Kura and Araz rivers are created due to the accumulation of flood and filtration waters in the sunken areas of the surface, and in places far from the rivers, as a result of the depressions cutting off the groundwater level. The productivity of phytomass in these complexes is 8-10 times higher than the surrounding background landscapes [3,4,6].

The existing hydromorphic complexes in the area are regulated by the regime of Kura-Araz rivers. Their formation and changes in their morphogenetic characteristics are associated to the rise and fall of the Kura and Araz rivers. The floods that occurred in the Kura and Araz rivers in 2010 had a serious impact on the Kurboi landscapes. Clay-swamp, grass-swamp, salt-swamp, etc. of repetitive-derived type. the area of landscapes has increased.

Tugai forest landscapes are a unique intrazonal landscape type that stretches along the lowland rivers of our studied area in the form of a narrow, broken narrow band [8,11]. The differentiation of Tugai woods within the landscape depends on the morphogenetic type of the plains, the meso- and micro-forms of the relief, drainage characteristics, and the mechanical composition of the sediments that make up the surface of the plains. Sparse forests and thickets are usually formed in the flow cones of Shirvan rivers. In particular, small-area forests and forest-shrubs are formed in the inter-cone strips, which are the main forms of the meso-relief, at the top and crown parts of the cones, and at the relative bending boundaries located between them. The soil-vegetation cover is very poorly developed in the top and crown parts of the cones. Due to periodic strong floods and floods, the streams were flooded, the surface of

the river beds was broken by cutting, and in conclusion, the soil and ecological conditions of the forest cover deteriorated.

Until the 60s and 70s of the 20th century, these complexes were subjected to serious anthropogenic effect, their area decreased sharply, and now this forest complex has entirely disappeared in lower Kurboy. Currently, where these forests are spread, seliteb, seliteb-garden and various agro-landscapes have been created, and wormwood-ephemeral and wormwood semi-deserts remain in unused areas. At present, it remains in the left and right banks of the Kur, mainly between Yevlakh-Korpukend, and in small quantities between the villages of Zardab-Mammadli, Molakend-Khajali, and below Sabirabad in very small areas. Alluvial tugay, alluvial-meadow and chala-meadow soils have developed in the areas where tugay forests have developed [8,11].

Arid sparse forest and thickets complex developed on the southern slope of the Khojashen-Goychay ridge at an altitude of 300-600 m [11]. Turyanchay reserve was created for the protection of arid-sparse forest landscapes within the area and with a limited area.

The systematic analysis of the numerous materials, space images, geological, geomorphological and hydrogeological maps mentioned about the Lower Kura basin illustrates that the interaction of soil and surface water, the modern relief-forming processes of the area have a crucial impact on the landscape structure, the components that make them up, and by complicating the differentiation within the landscape, creates a foundation for the development of environmental problems. GIS analysis of satellite images shows that exogenous processes and modern anthropogenic influences are the fundamental natural factor determining the ecological conditions in the foothills and low mountain ridges of the area (Figure 1).

The features of the relief, the lithological features of the rocks that make up the area, created the basis for the dynamic development of a number of exogenous processes. Ravine networks, gobos and pseudokarsts are clearly visible here. The analysis of geological materials indicates that the rocks that make up the area are mainly characterized by their sensitivity to erosion processes. The development of horizontal fragmentation here has fundamentally affected the structure of the landscape and has led to the violation of the integrity of the soil-vegetation cover.

In the depression areas of the flat alluvial plains of the lower Kura depression, the fact that groundwater is close to the surface is

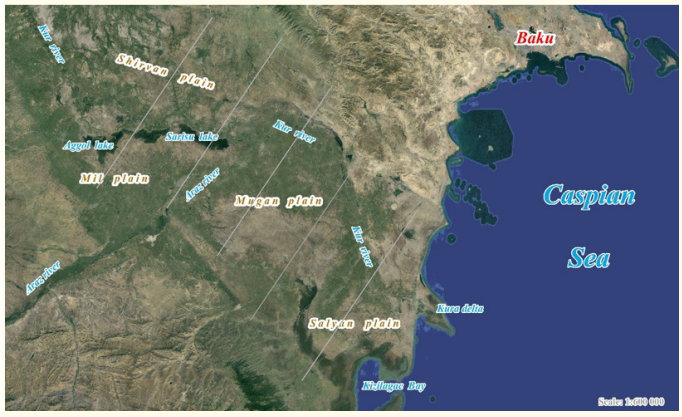

Figure 1: The Lower Kura depression satellite image (Landsat 7 ETM+).

the main cause for a number of ecological problems such as salinization, swamping, and has created the foundation for the development of landscape units composed of halophyte plant groups.

The modern natural landscapes of the region have been drastically transformations as a result of the centuries-old influences of people, and in their place, secondary landscapes and anthropogenic complexes have been formed. It was determined that the intensive alteration of natural landscapes in the area started from the period when agriculture appeared and was highly developed. The first agro-landscapes appeared in the 1st millennium BC. Thus, every modern natural anthropogenic complex was formed as a result of long natural-historical processes.

The formation of the contemporary settlement system of the population in the Lower Kura depression after the 50s of the 20th century was due to the use of oil-gas and hydropower resources, the creation of agricultural products processing enterprises, the development of agriculture and animal husbandry in recent years. The expansion of the settlement process has led to varying degrees of anthropogenic transformation of landscapes within the territory and the emergence and development of a number of environmental issues.

Settlement and various anthropogenic influences have led to diverse degrees of anthropogenic transformation of natural landscapes. The basis of modern anthropogenic loads in the area are irrigated agricultural fields, gardens and plantations, cities, seliteb complexes representing villages of different sizes, infrastructures with disparate functions - roads, canals, water reservoirs, ditches, pipelines, power lines, man-made ravines, bogs, artificial fragmen-

tation and so on. contane. Anthropogenicity of natural landscapes in these areas is more than 60% [3,4].

Violation of the norm of anthropogenic loading of landscapes and irrational utilization of natural resources are the primary causes of environmental issues. From this point of view, landscape improvement in the studied area is limited to the development of the main ecological problems - salinization, re-salinization, degradation of winter pastures, desertification, erosion processes, which we have identified taking into account the characteristics of the affect of natural and anthropogenic factors. It has been established that the manifestation of the mentioned environmental problems occurs mainly as a result of natural factors in the foothills of the area, and mainly anthropogenic factors in the plains and depressions. This process depends on the location characteristics of the population settlement and farms.

Conclusion

The Lower Kura depression is one of the important agricultural regions of the Republic of Azerbaijan. The modern natural landscapes of the region have been drastically transformations as a result of the centuries-old influences of people, and in their place, secondary landscapes and anthropogenic complexes have been formed. Settlement and various anthropogenic influences have led to diverse degrees of anthropogenic transformation of natural landscapes. Violation of the norm of anthropogenic loading of landscapes and irrational utilization of natural resources are the primary causes of environmental issues. Landscape improvement in the studied area is limited to the development of the main ecological problems - salinization, degradation of winter pastures, desertification, erosion processes, which we have identified taking into account the characteristics of the affect of natural and different anthropogenic factors.

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