

EXPLORATION OF SALINED AREAS IN THE MUGHAN PLAIN ON THE BASIS OF SPACE PICTURES

Aim: the main aim of the study is exploration of salined areas in the mughan plain on the basis of space pictures.

Methodology: The article is based on a study of saline areas in the Mugan plain. The study was conducted to compare the results of satellite imagery analysis with the actual situation in the area. As a result of the research, various cartographic maps of the area were compiled and evaluated.

Results: The history of the formation of the plain provides a necessary opportunity to explain the accumulation of salts in one way or another in the soils of the area. The western gulf of the Caspian Sea, which existed before the fourth period, as a result of its transgression and regression, was undoubtedly a major factor in the salinization of the territory. Analysis of geological materials shows that the saline sediments in the mountain systems covering the plains of the republic are eroded by external and internal factors and brought to the less inclined areas of the area under the influence of surface and underground currents. Surface water refers mainly to water flowing from mountain slopes. In this case, both the amount and chemical composition of the imported salts, of course, depends, above all, on the salinity of the eroded rocks and their chemical composition, which in turn is closely linked to the geological history of the area.

In low-slope areas, deluvial currents flowing to this part of the slopes increase the density of the solution by dissolving the salts found in the areas they pass through as they move along the surface. On the other hand, the density of streams moving inland from the upper parts of the slopes also increases here. In both cases, the deluvial currents flow to the ground in the less inclined part of the field, reducing their flow velocity. Finally, the solution soaked in the soil evaporates again in high-temperature climates, causing varying degrees of salinity, depending on the amount of salts it contains

Scientific novelty: The obtained scientific results will enable the protection of the ecological diversity of landscapes on the plain of the Caspian Sea and optimize natural resource potential of landscapes.

Key words: agrolandscape, ecosystem, salinization, remote sensing, analysis of satellite images, NDVI, LST.

Introduction: The article is based on a study of saline areas in the Mugan plain. The study was conducted to compare the results of satellite imagery analysis with the actual situation in the area. As a result of the research, various cartographic maps of the area were compiled and evaluated.

The Mugan plain has a unique morphostructure, covering a very large area between the Araz and Kura rivers. Along with the withdrawal of the Caspian Sea in the second half of the main fourth period (southern part) and at the end (remaining territory), it was formed as a result of the Araz and Kura rivers advancing their deltas and common accumulative shores to the east [9].

The morphology of the Mugan plain has become much more complicated as a result of frequent changes in the bed of the Araz river, as well as the Kura. The main forms of relief consist of ancient and old riverbeds, dams and ravines along the bed, inter-dam pits and depressions, ancient delta plains, and in the south the Bulgarian tributary and inclined deluvial-proluvial plains. Special mention should be made of large canals, irrigation networks and collectors located in the area. The north-eastern part of the plain is of alluvial-delta origin and is characterized by poorly fragmented hilly relief. The south-western part of the plain is older and was formed as a result of the accumulation of the Araz river. In the north-western part of it is alluvial-delta origin [13].

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Research area: The study area covers the Mugan plain of Azerbaijan.

Discussion. The formation of the plain continued in the historical period with the outflow of the Araz and Kura rivers during spring floods. Traces of the ancient valleys of the Kura and Araz rivers and their tributaries have been preserved in the modern relief in the form of numerous ravines, ridges.

The south-west is older than the north-east of the Mugan plain and was formed as a result of the accumulation of the Araz. Its north-western part is of alluvial-delta origin, and the process of river accumulation has long stopped here.

Marine accumulation played an important role in the formation of the south-eastern part of the plain in the Upper Khval and the New Caspian period. Analysis of the elevation map of the study area revealed that the heights of the study area fluctuate between -41 m and 100 m (Figure 1.1.). The surface of the plain is smooth and not fragmented, only in some places it is complicated by depressions (Mahmudchala, Agchala and etc.) with a smooth and shallow bottom. Previously, these areas were covered with lakes in shallow sea conditions [13].

In the north-western part of the Mugan Plain, in the submeridional direction, there is the Haji Elchi salinity with an area of about 320 km². Its formation is due to the fact that in this part of the plain the delta of the Bolgarchay penetrates more into Mugan.

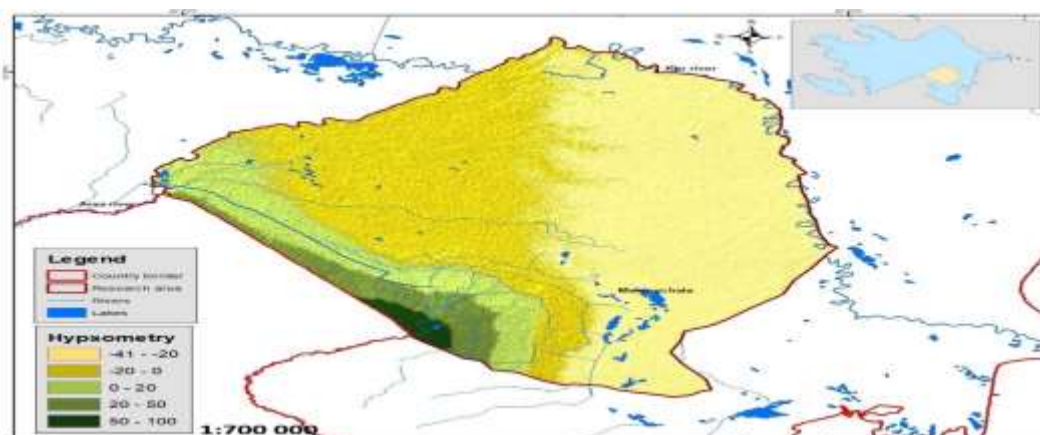


Figure 1.1. Distribution of the Mugan plain by absolute heights

In modern times, shallow lakes that dry up in summer are formed in place of salt marshes in winter and spring. Deflationary processes take place in their depressions. To the south-west, the saline depression is surrounded by a narrow (1.5-2 km) marine accumulative plain. Absorbed saline materials accumulate on the surface of this plain and create a small hilly relief. In the south-east, around the confluence of the Bolgarchay, this plain expands to 8 km. It then extends in a southerly direction along a 0 m coastline line, accompanied by a large coastal dam [14].

Under modern anthropogenic stress, the ecosystem and its main component, the soil cover, undergoes sharp changes and loses its ability to produce. As a result of these changes, the ecosystem is adversely affected and soils begin to degrade. Currently, this problem is most pronounced in arid and semiarid bioclimates in most parts of the world.

Desertification processes are even more dangerous for densely populated and more intensively used lands. Agro landscapes cover 48% of the country's territory [1]. Therefore, preventing desertification degradation in countries like ours is a very serious problem. In order to develop measures to combat desertification of desert lands, it is important to first assess and map these areas from a safety point of view. Because it is very difficult to prevent and repair the damage that caused the damage to the site. In this regard, the assessment of the salinization of the area has great scientific and practical value and relevance.

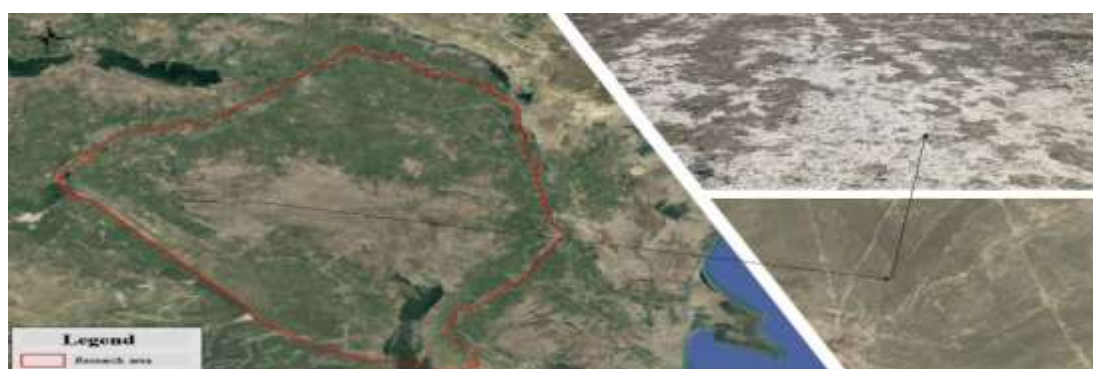


Figure 1.2. Adaptation of Haji Elchi saline depression of Mugan plain to the actual image of the satellite image

Many researchers around the world have rated the degradation of saline soils according to their development. N.G. Kharin (1985) used space imagery to compile a map of the degradation of saline soils in Turkmenistan. According to the intensity of the process of degradation of deserted lands, it is divided into 4 classes - weak, moderate, severe and very severe. N.G. Kharin first of all pointed out the degradation of vegetation as the main reason.

Summarizing the above, we went to the area to study the salinity in the Mugan plain. As we approached the coordinates of the Haji Elchi saline depression based on the Google Satellite image, we witnessed that the area was almost devoid of vegetation (Figure 1.2.). After getting acquainted with the views of N.G. Kharin and a number of researchers, we decided to continue the study of the salinized areas of the Mugan plain through satellite imagery.

Thus, to determine the ecological condition of the landscapes of the Mugan plain, we have compiled a vegetation (NDVI) map of the area (Figure 1.3).

NDVI is an assessment of plant reflections in nature that give plants a high reflection value in the near infrared band (NIR, near infrared) and a weak reflection value in the visible red band (R). Therefore, NDVI is a measure of the abundance of chlorophyll in plants. In this case, the map was compiled using the satellite image Landsat 8 dated 11.09.2021 [11] and the following formula:

$$NDVI = \frac{(NIR-RED)}{(NIR+RED)}$$

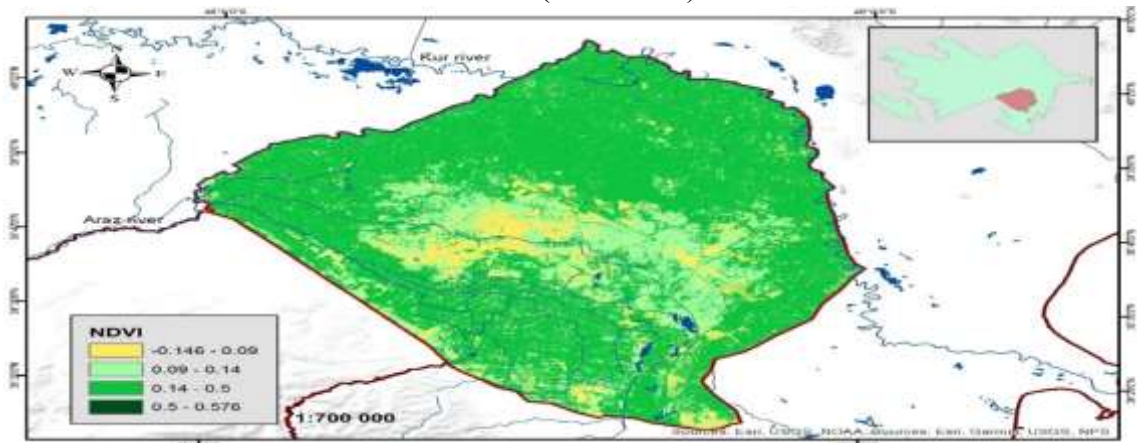


Figure 1.3. NDVI of Mugan plain landscapes

As a result of the process, the NDVI in the study area was estimated to be between 0.576 and -0.146, with areas between 0.4-1 having rich vegetation, areas with 0.2-0.3 vegetation but not very rich, 0.1 to lowlands are areas with water or rocks (Figure 1.4).

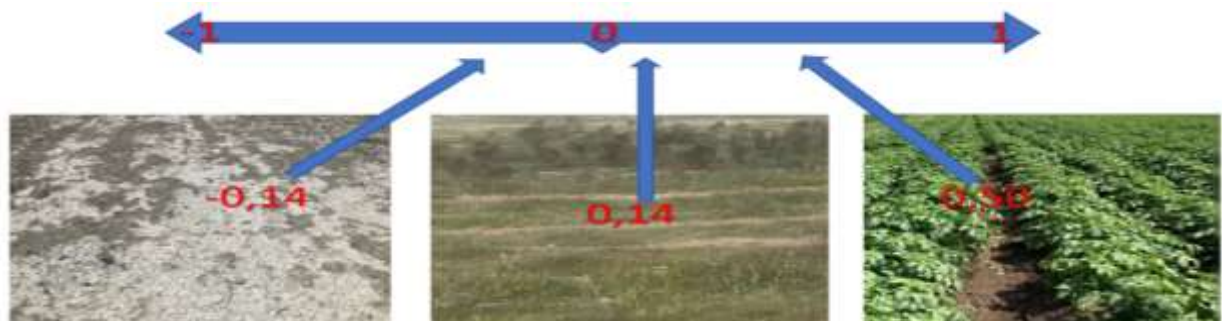


Figure 1.4. Equivalence of NDVI values in plants

Based on the analysis of the NDVI indicator map of the Mugan plain landscapes (Figure 1.3) and Table 1.1, it was determined that 70% of the Mugan plain, ie 3482.40 km², has a medium density vegetation. Areas with low vegetation cover and no vegetation at all make up 20.68% and 9.04% of the existing area, respectively. We are witnessing that these areas are observed in the territory of Haji Elchi saline depression.

Areas with weak vegetation (Figure 1.5) cover 1024.79 km² of the study area, which is saline areas. The main plants of these areas are blackberry, wormwood and ephemeral plants. According to V.A. Kovda (1944), blackberries accumulate up to 20-30% of salt in their stems from the environment in which their root system spreads. B.A. Keller (1929) shows that wormwood contains up to 10-15% ash content. This shows once again that the influence of plants on the accumulation of saline in deluvially saline soils is very large. At the same time, the influence of wild plants in the area is great.

In the fight against drought, the plants that grow in the conditions we have described have to extend their roots to the deeper layers of the soil so that they can receive the necessary amount of moisture for themselves. Here, the deep layers of soil and subsoil are relatively salty, but also highly saline. Therefore, plants that feed on the moisture of this place receive a certain amount of salt along with the moisture. As a result, these salts are lifted along with the moisture to the surface of the plant through the roots, and after the plants perish or while they are still alive, they are washed away by such rainwater and re-transferred to the soil. Thus, it causes a certain accumulation of salts in the top layer of the soil.

Table 1.1
NDVI of Mugan plain landscapes

Soil surface	NDVI	Area (km ²)	According to the total area (%)
Vegetation-deprived areas	-0.146-0.090	447.83	9.04
Areas with weak vegetation	0.09-0.140	1024.79	20.68
Areas covered with medium vegetation	0.14-0.500	3482.40	70.27
Areas with dense vegetation	0.500-0.576	0.40	0.01
Total		4955.42	100



Figure 1.5. Plant samples from saline areas

Taking into account all the above, there is a need to compile a map of the distribution of salts in the Mugan plain. To do this, we compiled a map of the distribution of plains (NDSI) in the Mugan plain using the following formula in the ArcGis program, using the space image Landsat 8 dated 11.09.2021 (Figure 1.6) [12].

$$NDSI = \frac{(Bant3 - Bant6)}{(Bant3 + Bant6)}$$

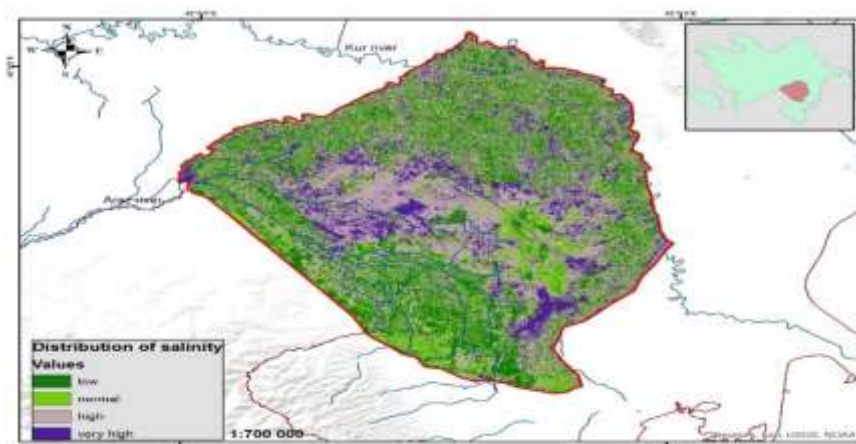


Figure 1.6. Distribution of salinity over the land cover in the Mugan plain

As can be seen from the map of salinity distribution in the Mugan plain, the areas with high salt distribution in the study area are found to be saline areas.

The history of the formation of the plain provides a necessary opportunity to explain the accumulation of salts in one way or another in the soils of the area. The western gulf of the Caspian Sea, which existed before the fourth period, as a result of its transgression and regression, was undoubtedly a major factor in the salinization of the territory. Analysis of geological materials shows that the saline sediments in the mountain systems covering the plains of the republic are eroded by external and internal factors and brought to the less inclined areas of the area under the influence of surface and underground currents. Surface water refers mainly to water flowing from mountain slopes. In this case, both the amount and chemical composition of the imported salts, of course, depends, above all, on the salinity of the eroded rocks and their chemical composition, which in turn is closely linked to the geological history of the area.

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Taking all this into account, based on the spatial image of the Mugan plain Landsat 8 dated 11.09.2021 and the NDVI map, we have compiled a map-scheme of temperature distribution on the ground surface (Figure 1.7) based on the following algorithmic steps [8].

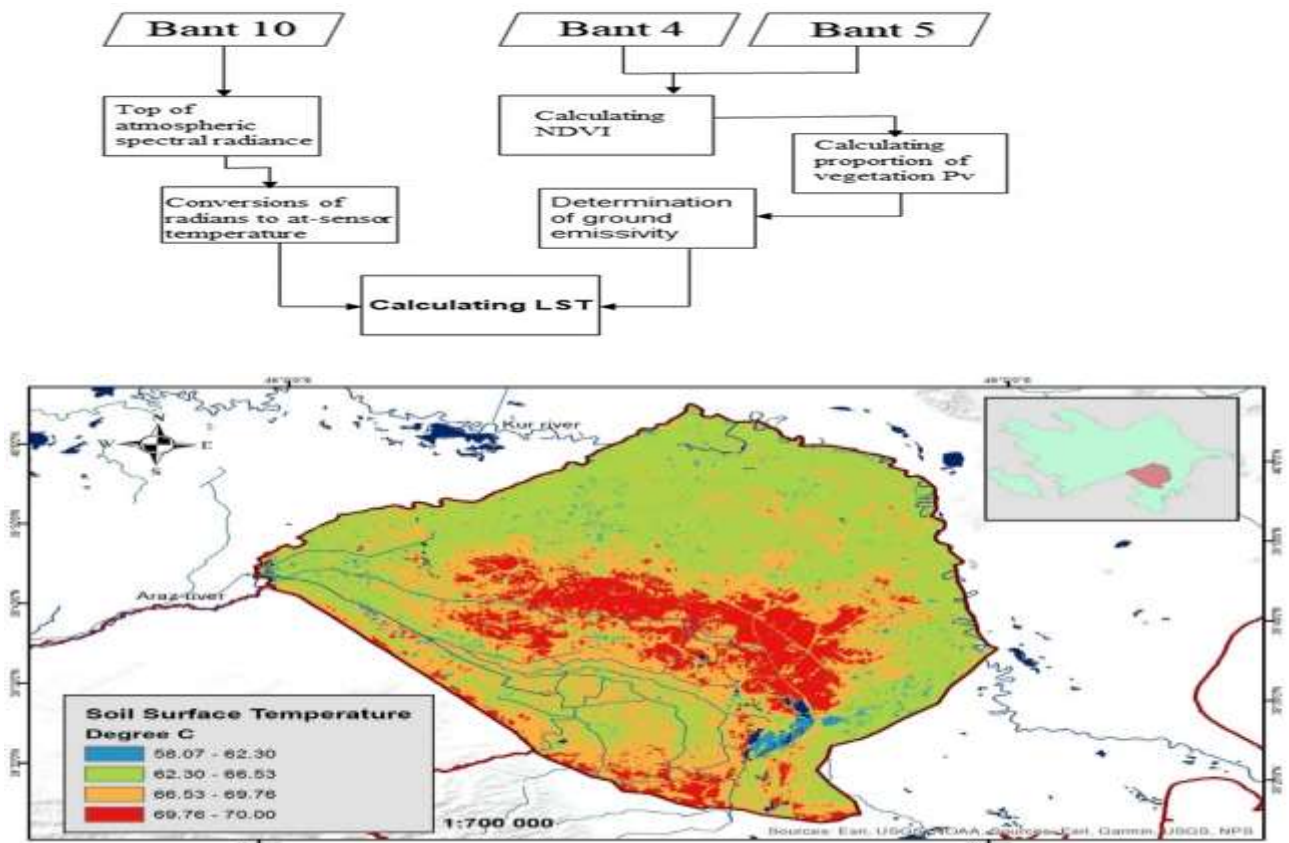


Figure 1.7. Soil temperature distribution in the Mugan plain

As can be seen from the map of soil temperature distribution in the Mugan plain, the highest temperatures in the study area occur in the area of Haji Elchi salinity.

Also, the consequences of the development of salinization are different due to various reasons. Ecologically, it manifests itself in vegetation, fauna, climate and hydrological conditions. Economically, it is primarily influenced by agro-landscapes. As a result of erosion, soil fertility decreases, vegetation in pastures becomes sparse and degraded.

Conclusion. Thus, salinization is an ecological process that manifests itself on a global scale, resulting in a decrease in the biological productivity of landscapes, including land cover, over time. This process leads to the intensive degradation of the Earth's arid, subarid and partially subhumid ecosystems,

as well as land cover. Salinization within the Mugan Plain is manifested in the violation of agro-ecological balance, loss of biological diversity, soil degradation.

References

1. Abduev.M.R. Deluvially saline soils of the plains of Azerbaijan. Baku, 2003, 99 pages.
2. Geography of the Republic of Azerbaijan. Physical geography I volume. Baku-2015. 530 p.
3. Babayev M.P. Gurbanov E.A. Study of desertification-soil degradation. Baku, 2008, 47 pages.
4. Garibov Y.A. Optimization of natural landscapes of the Republic of Azerbaijan. Baku, AzTU printing house, 2012, 216 pages.
5. Mammadov G.Sh. Khalilov M.Y., Mammadova S.Z. Agroecology. Baku, 2010, 551 pages.
6. Shirinov.N.Sh. Constructive geography of the Republic of Azerbaijan. Baku, 1996, Volume I, 260 pages.
7. Yagubov G.Sh. Research of technologically disturbed lands of the Republic of Azerbaijan, genetic features and ways of their reclamation. Baku, 2003, 2203 pages.
8. N.Taymus. Finding the emissivity values of Çukurova region by using Noaa-avhrr satellite data. Adana, 2009, 78 pages.
9. Мусеєв М.А. Ландшафты Азербайджанской Республики. Баку, БГУ, 2013, 137
10. Ширинов Н.Ш. Редактор(ы): Антонов Б.А. Новейшая тектоника и развитие рельефа Кура-Араксинской депрессии. Издание: Элм, Баку, 1975 г., 193 стр.
11. https://www.usgs.gov/core-science-systems/nli/landsat/landsat-normalized-difference-vegetation-index?qt-science_support_page_related_con=0#qt-science_support_page_related_con
12. <https://www.youtube.com/watch?v=QeuDmSJ18Ic>
13. <http://ru.wikipedia.org/wiki>
14. https://www.wikiwand.com/az/Az%C9%99rbaycan_%C9%99razisinin_fiziki-co%C4%9Frafii_rayonla%C5%9Fd%C4%B1r%C4%B1lmas%C4%B1

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