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ECOGEOGRAPHICAL RISKS AND ANTHROPOGENIC TRANSFORMATION OF GEOSYSTEMS ON THE COASTAL PLAIN OF CASPIAN SEA

Aim: The main aim of the study is to research the regularities of the anthropogenic transformation and ecogeographical situation of the landscapes on the coastal plain of the Caspian Sea from Pirsaat river to Astara river.

The methodological basis of the article is determine dynamic of forests we prepared forests maps of investigation area. For this purpose we used the topo map of the area of 1987, and Google Earth imagines. Then we compared these years' materials, and analyzed conclusions.

Results: In the article we have represented results of our investigation materials on the branch of technogenic transformation of the landscapes based on modern methods, and relevant maps are prepared. We have analyzed landscape components, like relief, climate, vegetation cover and etc., dynamics of forests, precipitations and etc. We grouped the anthropogenic activities in the investigation area. Consequently we have determined risks and hazards in the landscapes on the coastal plain of Caspian Sea due to human effects.

Transformation characterizes of Salyan and Lankaran, South-eastern Shirvan plains due to anthropogenic effects have researched in the article. Dynamic analyzes of old and modern topo maps, satellite maps, survey with older people let determine transformation degrees and development levels of modern natural and natural-anthropogenic landscapes. Eco systems of the protected areas are compared with landscapes exposed to anthropogenic effects based on analogy method. NDVI, dynamics of technogenic landscapes, forest ecosystems maps allow to create anthropogenic transformation map of the investigation area. We divided investigation area into 5 parts due to transformation degrees: unchanged landscapes that retain their natural structure, poorly transformed landscapes, medium transformed landscapes, strongly transformed landscapes, natural-technogenic landscapes. Then risk and hazards are assessed. System of measures to overcome ecological risks and hazards have been prepared by us. We have determined that 24% of the investigation area (1585 km²) were ecologically protected landscapes. In 26% of the area (1705 km²), natural complexes are poor transformed. In 40% (2598 km²) of natural complexes are moderately transformed, and in 10% (680 km²) of natural landscapes are strongly transformed and belong to high-risk areas. Compiled maps and scientific results can be source in management of risks in the area and in the proper organization of insurance business.

Theoretical and practical significance. The results of the research can be used by the research and design institutes of the Ministry of Ecology and Natural Resources. 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.

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.

Keywords: coastal plain of Caspian Sea, technogenic transformation, anthropogenic activities, GIS, landscapes

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ЭКОГЕОГРАФИЧЕСКИЕ РИСКИ И ТРАНСФОРМАЦИЯ АНТРОПОГЕННЫХ ГЕОСИСТЕМ ПРИБРЕЖНЫХ РАВНИН КАСПИЙСКОГО МОРЯ

Цель: Основная цель исследования - изучение закономерностей антропогенной трансформации и экогеографической ситуации ландшафтов прибрежной равнины Каспийского моря от реки Пирсаат до реки Астара.

Методологической основой статьи является определение динамики лесов, составленные нами карты лесов исследуемой территории. Для этого мы использовали топографическую карту местности 1987 года и изображения Google Earth. Затем мы сравнили материалы этих лет и проанализировали выводы.

Результаты: В статье, представлены научные результаты техногенной трансформации ландшафтов на основе современных методов и составленные соответствующие карты. Нами выявлены особенности нескольких компонентов, а именно рельефа, климата, растительного покрова, динамика лесов, количество осадков и др. Проведено группирование антропогенной деятельности на территории исследований.

Исследован характер трансформации под воздействием антропогенных воздействий Сальянской, Ленкоранской равнин и Юго-Восточной Ширвани. Древние и современные топокарты, спутниковые снимки,

опросы пожилого населения позволили выявить степень трансформации и развития природных и природно-антропогенных ландшафтов. На основе метода аналогий проведено сравнение экосистем охранных территорий с ландшафтами, подвергающиеся антропогенному воздействию. NDVI, динамика техногенных ландшафтов, карты лесных экосистем позволили картирование антропогенных трансформаций исследуемого региона. По степени трансформации исследуемый регион поделен на 5 частей: неизменные ландшафты с сохраненной природной структурой; слабо измененные ландшафты; средне-измененные ландшафты; сильно измененные ландшафты; природно-техногенные ландшафты. Дана оценка рискам и опасностям. С нашей стороны предложены меры позволяющие устранить экологические риски и опасности.

Нами определено, что 24% (1585 км²) территории, с экологической точки зрения, охраняемые, 26% (1705 км²) слабо измененные природные комплексы. 40% (2598 км²) природных комплексов средне, 10% (680 км²) сильно изменены и относятся к территориям повышенного риска. Составленные карты и научные результаты могут быть использованы при управлении и страховании рисков на исследуемой территории.

Научная новизна: Полученные научные результаты позволят сохранить экологическое разнообразие ландшафтов равнины Каспийского моря и оптимизировать природно-ресурсный потенциал ландшафтов.

Ключевые слова: прибрежная равнина Каспийского моря, техногенная трансформация, антропогенная деятельность, ГИС, ландшафты

Purpose. The main purpose of the study is to research the regularities of the anthropogenic transformation and ecogeographical situation of the landscapes on the coastal plain of the Caspian Sea from Pirsaat river to Astarra river.

Introduction. In the context of global climate change, the rapidly growing human demand against the background of intensification of droughts in some regions leads to an increase in the anthropogenic burden on natural landscapes. This creates anthropogenic transformations with different modifications. Scientifically-proven transformations, ultimately, create a variety of risks and hazards to people's life. After the 30th years of the XX century total area of marshes and saline increased more than 7 times in the investigation area, which created risks and hazards to the productivity of planting and pasture lands.

Research area. The study area covers the South-eastern Shirvan, Salyan and Lankaran plains located in the coast of the Caspian Sea with a total area of 6568 square kilometers which is equal to 7,6% of the territory of Azerbaijan

Research methods. To determine dynamic of forests we prepared forests maps of investigation area. For this purpose we used the topo map of the area of 1987, and Google Earth imagines. Then we compared these years' materials, and analyzed conclusions.

To determine dynamics some seliteb-urban complexes in the coastal plain of the Caspian Sea during 1980-2020 years, we vectorized areas of settlements and compared those materials.

To determine modern conditions of land use on the coastal plain of Caspian Sea, we prepared relevant maps of the area.

The methodological basis of the work is the author's field research in the South-Eastern Shirvan, Salyan and Lankaran plains in 2010-2018. During the field research, the structural genetics and features of the landscapes, as well as the characteristics of anthropogenic transformations were studied and landscape mapping was carried out with the help of semi-stationary and route methods. The instrument processing used the decoding of numerous space images of 2014-2016 flights in the field, as well as computer technology, which is an integral part of GIS technology in the cameral options. The ecological assessment of the risks posed to the life activities of the population by natural and man-made hazards specific to the study area was compiled by a complex systematic approach and large-scale synthetic maps were obtained. Against the background of global and regional climate change, the dynamics of humid conditions in the study area were analyzed by cartographic methods of existing observation materials.

Analyzes and discussions. Anthropogenic landscapes are systems that are regulated, controlled carries out economic, technical and social functions by humans [1, 3, 4, 5, 6]. A number of researchers combine the complexes formed in the anthropogenic transformation of natural landscapes into 3 major groups. Anthropogenic modifications; natural anthropogenic landscapes; anthropogenic landscapes. These landscape groups differ from each other in the degree of anthropogenic change [1, 5, 6]. Anthropogenic transformation of landscapes in Azerbaijan have been studied by different researchers in different aspects.

Y.A. Garibov (2013) has conducted the modern structural and functional features of natural-anthropogenic landscapes in the Kur-Araz lowland, and has divided them into five groups according to the degree of anthropogenicization [2].

M.J. Ismayilov, S.M. Zeynalova, and L.A. Ismayilova compared landscape maps compiled as a result of field research in 2017 with ArcGIS software and calculated transformation indices of local

landscapes with a landscape map that could be formed in the conditions of natural climatic humidification in Lankaran natural region [1].

Here we have tried to study the transformation of natural landscapes on the basis of the ratio of protected and unprotected areas, types of anthropogenic activities, the study of the dynamics of components that can play an indicator role. The relative clarification of protected and unprotected areas provides an overview of the transformation of territorial landscapes and ecological balance.

The area of specially protected areas in the research area is 2.5 times higher than the national average and accounts for 24% of the total area. However, anthropogenic transformations of different directions and degrees have occurred in the coastal plains of the Caspian Sea. The structural and genetic features of anthropogenic transformations depend primarily on the degree of penetration of human economic activity into the natural landscape.

Anthropogenic activities have led to the emergence of transformations in natural landscapes that differ from each other in structural, genetic and functional features. Sometimes these transformations cause fundamental changes in the landscape. Wetland-meadow and semi-desert landscapes contaminated with oil and iodine-bromine mineral waters, covering 5.6% of the Salyan plain, have become a dead zone deprived of soil and vegetation. Therefore, it is important for landscapes to take into account environmental norms when using their natural resource potential.

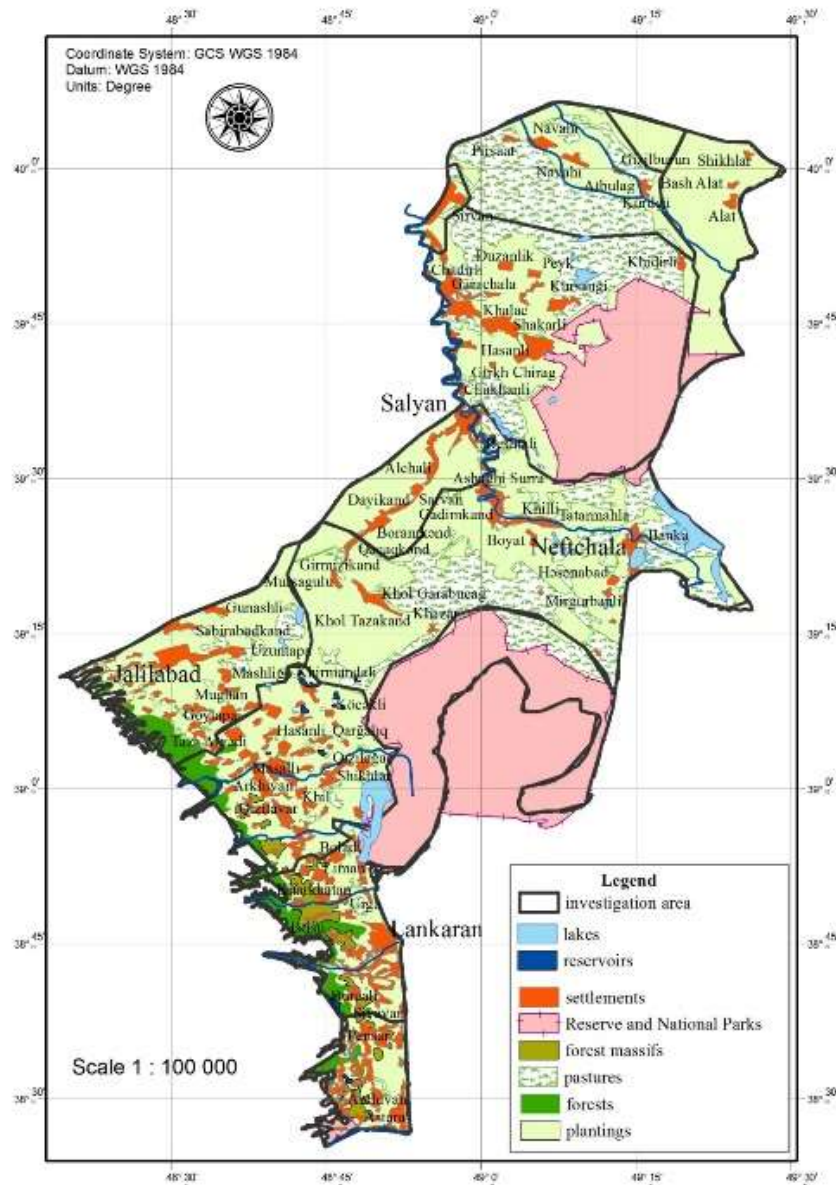


Figure 1. Modern conditions of land use on the coastal plain of Caspian Sea

Use and transformation of landscapes. In order to clarify the structural and functional features of anthropogenic transformations in the study area, a large-scale (1: 100,000) map of landscape use was compiled. Based on the large-scale landscape use map it was determined that planting areas cover 2,472 km² (37.6% of the survey area), pasture complexes cover 1 47 km² (22% of the surveyed area), settlements cover 585 km² (9% of the research area), roads cover 12 km² (0.2% of the research area), protected areas cover 1 585 km² (24% of the research area), forest and forest massifs cover 325 km² (5% of the survey area) (Figure 1).

As figure shows, the area of urban settlements has grown almost more than 50% (Figure 2). Urban expansion is being observed in Lankaran, Jalilabad and Neftchala. The reason for this is the creation of large industrial parks in recent years.

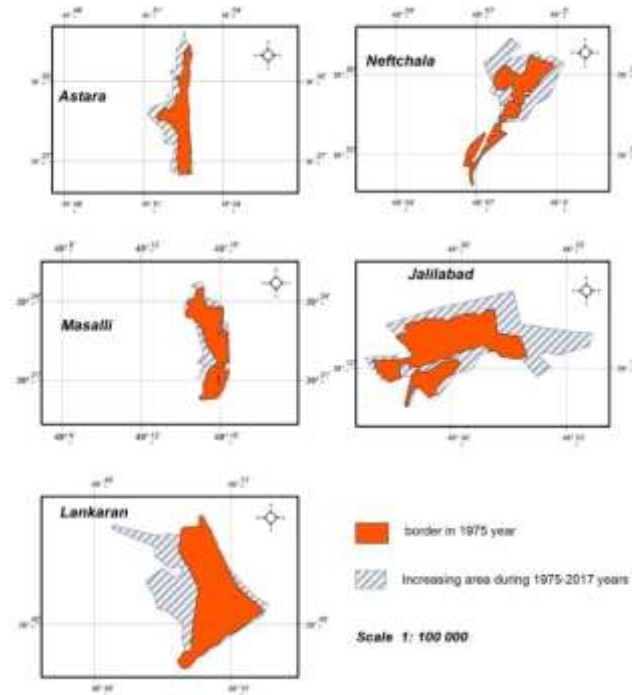


Figure 2. Dynamics of field structure of some seliteb-urban complexes in the coastal plain of the Caspian Sea during 1980-2020 years

The number of people living here has also grown rapidly (Table 1)

Table 1. Development dynamics of seliteb-urban complexes in 1980-2020

Names of towns	Area (km ²)		Increasing area during 1980-2020 years	
	In 1980	In 2020	km ²	%
Lankaran	7,5	12	4,5	60
Astara	6,5	9,9	3,4	52
Jalilabad	11,6	20	8,4	72
Nephtchala	8,8	10,5	1,7	19
Salyan	8,4	16	7,6	90
Masalli	7,6	10,3	1,7	36

Transformation of forest ecosystems. Forest landscapes in the studied area are mainly spread in Lankaran lowland. Until the early twentieth century, this forest covered almost the entire plain. The forests of the Lankaran lowland, characterized by the richness of relict and endemic fauna and flora, as well as high productivity, have been destroyed by the Karchovka method since the 1930s and used for tea plantations, citrus orchards, vegetable crops, etc. has been transformed. With the deforestation, the semi-desert and steppe landscapes of the Salyan plain have shifted up to 25-30 km towards the Lankaran lowland.

This has increased the trend of desertification in the Caspian coastal plains. In order to follow the transformations that have taken place in the forest landscapes of the Caspian coastal lowlands in recent years, maps have been compiled based on space images from 1987 and 2017 (Fig. 3).

Comparison of maps revealed that in 1987 the forest areas covered 621 km² (9.5% of the survey area). As a result of the forest demolition, 75 km² of these forests (1.2% of the research area) were replaced with forest massifs in 2017. The forest areas decreased by 325 km² (48%) over the last 30 years. At present, these forests are found on the steep mountain slopes adjacent to the plain and partly in the Hirkan National Park (Figure 4).

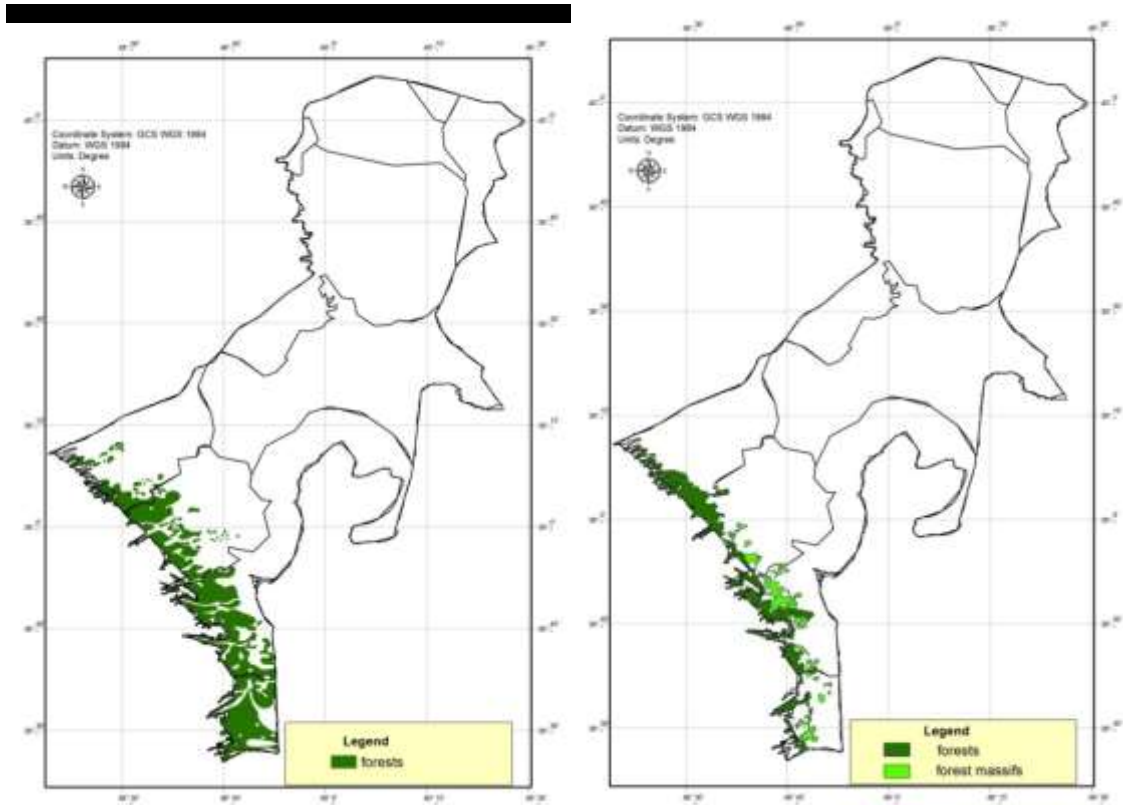


Figure 3. Change of forest areas in the coastal plain of Caspian Sea in 1987 (a) and 2017 (b)

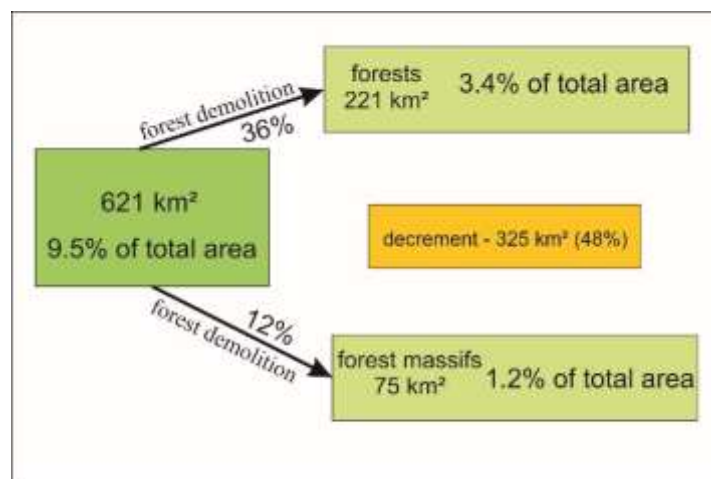


Figure 4. Dynamics of forests in the coastal plain of Caspian sea in 1987-2017

Transformations and risks. Grouping map of landscapes according to the degree of transformation on the coastal plain of Caspian Sea has been prepared due to modern methods after complex analysis of anthropogenic landscapes on the coastal plain of Caspian Sea (Figure 5). Current state of use of natural landscapes in the research area and assessment of anthropogenic transformations based on the eco-

geographical situation of natural complexes and the degree of impact of natural and man-made risks on human economic activity, zoning was carried out and a map with appropriate content was compiled. As can be seen from the analysis of the map, it has divided into 10 regions according to anthropogenic transformations and eco-geographical situation:

- 1) Ecologically protected area;
- 2) basically transformed urban landscapes formed on the site of plain forests
- 3) fundamentally transformed seliteb complexes
- 4) shrub landscape modified to garden-plantation landscape
- 5) strongly altered meadow, shrub landscape
- 6) poorly altered forest and post-forest shrub landscape
- 7) medium and strongly altered arid and semi arid shrubs
- 8) weakly altered hydromorph, swamps. Semi-deserts and shrubs
- 9) strongly altered semi-desert
- 10) weakly altered semi-desert

The map analysis shows that landscapes with a total area of 1585 km² are preserved in national parks and nature preserves, and anthropogenic transformation of landscapes is not observed in these areas. In some parts of Salyan and Southeastern Shirvan plains (1 890 km²), landscapes have been subjected to anthropogenic transformation. Anthropogenic transformation rate of landscapes in Kura river basin (1 140 km²) area is medium, on the coastal area of Caspian Sea and Pirsatchay basin (740 km²) it is strongly. The landscapes of the Lankaran plain (1 213 km²) have been subjected to the strongest transformation.

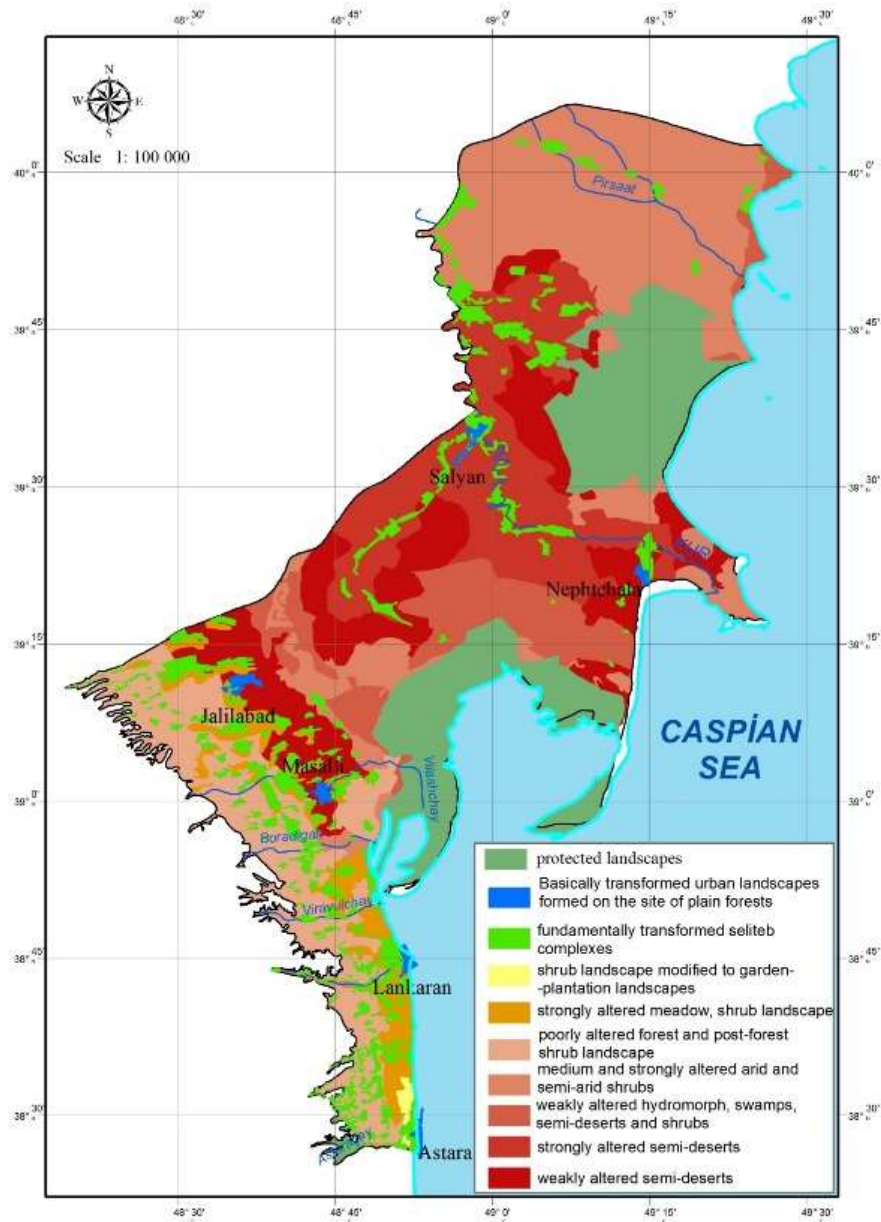


Figure 5. Grouping of landscapes according to the degree of transformation on the coastal plain of Caspian Sea

After all we prepared risk and hazards map of the landscapes of coastal plain of Caspian sea (Figure 6).

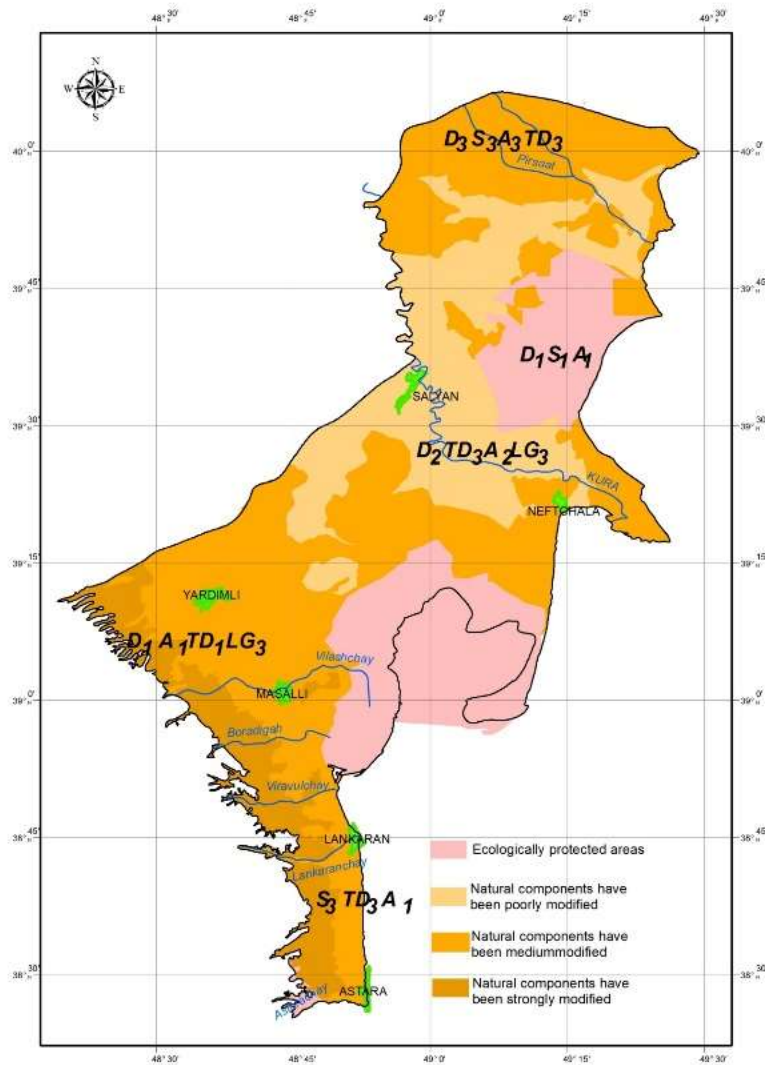


Figure 6. Eco geographical regions of coastal plain of Caspian Sea, Risks and hazards

risk and hazards: Desertification-D, Salinization –S, Marsh area –M, Aridity-A, Technogenic Disturbance –TD, Loss of Natural Genephond –LG, risk and hazard indexes: 1-Poor, 2-medium, 3-strong

Conclusion: It was determined that 24% of the study area (1585 km²) were ecologically protected landscapes. In 26% of the area (1705 km²), natural complexes are less transformed and less risky. In 40% (2598 km²) natural complexes are moderately transformed and moderate risk, and in 10% (680 km²) natural landscapes are strongly transformed and high-risk areas. Compiled maps and scientific results can be source in the management of risks in the area and in the proper organization of insurance business.

Shirvan and Gizilagaj parks as a whole and a small part of Hirkan National Park belong to the ecologically protected areas and are the main source of biodiversity and ecological balance. Areas with poorly altered natural components are on the banks of the Kura River, moderately altered areas are the Salyan Plain, Pirsatchay basin, and strongly altered areas are relatively high altitudes in the Lankaran lowlands.

References

1. Ismayilov M.J. Identification of the structural and functional features of modern landscapes of contact zones for the purpose of spatial planning // Actual problems of landscape planning. Moscow, 2011. p. 138-142
2. Garibov Y.A. Optimization of natural landscapes of the Azerbaijan Republic. Baku: AzTU, 2012, 216 p.
3. Mammadov G.Sh. Soil resources of Azerbaijan. Baku: Elm, 2002. 131 p.
4. Mammadov R.M., Ismayilov M.J. Estimation of natural-resource potential of landscapes of Azerbaijan and their rational use // Herald of the Azerbaijan Geographical Society. 2013. Vol. XVIII, p. 10-15
5. Nicolaev V.A. Cultural landscape - geocological system // Heralds Moscow State University. Series 5, Geography. 2000. № 6. p. 3–8.
6. Nizovtsev V.A. Toward the theory of anthropogenic landscape genesis. Geography and natural resources. 2010, № 2. p. 95-100.

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