

Vegetation cover of the coastal strip in the Neftchala district of Azerbaijan

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Abstract: The article discusses the vegetation cover of the Caspian coast and part of the Kura riverine strip bordering the sea (Neftchala district). Leading families (*Asteraceae*, *Poaceae*, *Chenopodiaceae*, *Fabaceae*) and characteristic species of this zone (*Aeluropus littoralis*, *Heliotropium sibiricum*, *Suaeda confusa*, *Suaeda altissima*, *Salicornia europea*, *Salsola tragus*, *Chenopodium album*, *Limonium meyeri*, *Tamarix meyeri*, *Carduus arabicus*, *Senecio vernalis*) have been identified. Communities (shrub, ephemeral, and secondarily saline annual saltwort riverine) have been determined, experiencing a large anthropogenic load. Factors influencing the state of vegetation are grazing and the use of the sandy coastal zone for a “spontaneous beach”. The main landscape communities of the coastal part of the region have been identified. These include shrub communities with the dominance of *Tamarix ramosissima*, annual saltwort with *Petrosimonia brachiata* and *Suaeda confusa*, shrub saltwort communities with *Halocnemum strobilaceum*, psammophyte-littoral with the dominance of *Heliotropium sibiricum*, *Cakile euxina*.

Keywords: *community, disturbance, dominant species, factors, landscape, riverine, transformation, types of vegetation*

INTRODUCTION

Nowadays, vegetation studies are fundamental to understand the structure and evolution of the landscape and are used as a basis for habitat monitoring [Musarella et al., 2020; Xystrakis et al., 2022]. Phytosociological method is the most useful tool to investigate vegetation structure and composition of species [Rivas Martínez 2005; Blasi et al., 2011; Cano Carmona et al., 2022]. Worldwide coastlines are characterized by typical flora

and vegetation, that act also as a natural protection of this environment [Das, 2022] and as a greenhouse gas sink [Rosentreter et al., 2023]. However, human activities affect the health of the coastal areas. Main causes of disturbance of coastal vegetation include construction of private houses, hotels, parking lots and tracks, trampling by visitors and vehicular traffic [Enríquez-de-Salamanca 2023].

Coastal ecosystems influenced by global climate aridization, cyclical transgression of the Caspian Sea and human activities are among the so-called “red” zones [Kostianoy, Kosarev 2005]. Pre-Caspian region is characterized by rich mineral resources, vegetation, etc. In this regard, it is the object of natural disasters, man-made, recreational and other human activities. In the 20th century, the main factor influencing the coastal ecosystems of Azerbaijan was increased grazing and oil production [Shakhsuvarov et al., 1993; Kahramanova, 2002;]. At present, these are climate change, recreation, construction of engineering facilities and intensive development of industrial infrastructure, in particular oil production [Ismailov et al., 2015].

The coastal strip of the Neftchala district is the least studied part of the Caspian Sea in Azerbaijan. Of particular interest is the section of the sea where one of the largest rivers of Transcaucasia, the Kura river, flows into. We have not found any literary sources concerning specific geobotanical descriptions of the vegetation cover in this part of the region. Taking into account this circumstance and the issues discussed above, the purpose of the present study was to monitor the coastal river and sea parts of the Neftchala district.

MATERIAL AND METHODS

Study area. The tasks of the study include registration of plant communities of the coastal strip and adjacent territories, assessment of the level of synantropization of plant communities and identification of the main directions of vegetation cover transformation. The object of the study was the vegetation cover of natural and differently disturbed coastal ecosystems, as well as riverine parts of the Kura river in contact with the coast. In our study, we considered the main parameters of

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vegetation cover transformation to be: the change in the species composition in disturbed and undisturbed areas and the nature of the location of plant communities in space and time.

Neftchala district is located in the southeastern part of the Republic of Azerbaijan, on the coast of the Caspian Sea. The territory of the district is a surface plain. On its territory there is a part of the Shirvan and Mughan plains belonging to the Kura-Araz lowland. (Fig 1). The absolute height of the district is 25-28 meters below sea level.

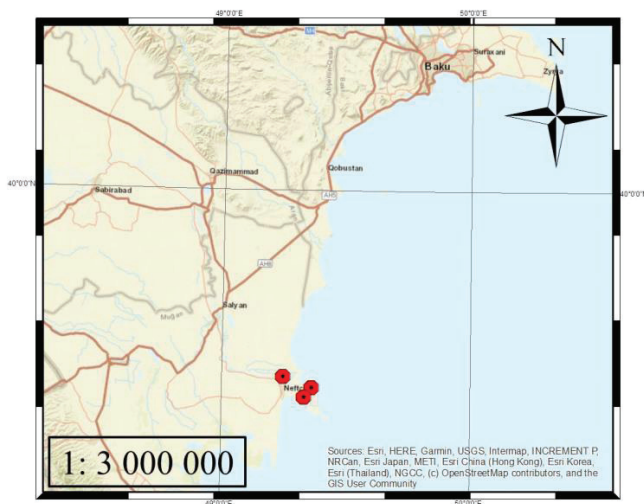


Figure 1. Studied coastal part of the Neftchala district.

The climate is dry subtropical. The Kura, the largest river of the republic, flows into the Caspian Sea in Neftchala district. The study was carried out in 2023 by methods generally accepted in geobotany [Korchagin A.A., Lavrenko, 1964]. The indicator of the degree of disturbance of phytocoenoses was estimated by the hemerobic group ratios [Jalas, 1955]. For this purpose, model plots of 100x100 m size were laid out, on which the study was carried out. Species recorded at the plots were distributed into groups: a. ahemerobe — species of natural communities, o. oligo ahemerobe — species of natural communities that tolerate weak anthropogenic influence, m. mesohemerobe — species of natural communities experiencing extensive anthropogenic influence, b. β -euhemerobe — species of communities that are far from natural and resistant to intensive exploitation, c. α -euhemerobe — weed representatives of natural and anthropogenic communities that endure regular and severe disturbances, p. polihemerobe — plants grown in cultivation and typical ruderal plants

that tolerate strong and frequent habitat disturbances; t. metahemerobe — species of completely degraded ecosystems and artificial communities. Next, the apophytization index was calculated, i.e., the ratio of the number of apophytes to the number of anthropophytic species in a particular community. During standard geobotanical descriptions, the abundance of species was recorded at the plots. The abundance was estimated according to the Braun-Blanquet scale [1932]: r-single individuals, + few individuals,

1. Average number, 1) projective cover (pc) <5% from the study area, 2) quite a number, pc 5-25%, 3) pc 25-50%, 4) pc 50-75%, 5) pc >75%. Plant names are presented according to the “Flora of Azerbaijan” (1952-1961), taking into account Plants of the World Online.

2. Plants were identified in accordance with “Flora of Azerbaijan” [1950-1961] taking into account World Flora Online.

RESULTS AND DISCUSSION

Currently, the key role in the formation of the vegetation cover of the study area belong to species such as *Aeluropus littoralis* (Gouan) Parl., *Tournifortia sibirica* L., *Bromus japonicus* Houtt., *Suaeda altissima* (L.) Pall., *Salicornia europaea* L., *Salsola tragus* L., *Chenopodium album* L., *Chenopodium hybridum* L., *Limonium meyeri* (Boiss.) O. Kuntze, *Tamarix meyeri* Boiss., *Cousinia microcephala* C.A.Mey. ex DC. registered with high abundance marks (3-4 points); in a less degree *Adonis aestivalis* L., *Tripolium pannonicum* (Jacq.) Dobrocz., *Amaranthus retroflexus* L., *Alopecurus myosuroides* Huds., *Psylliostachis spicatus* (Willd.) Nevsky, *Polypogon maritimus* Willd., *Juncus acutus* L., *Haloctenium strobilaceum* (Pall.) M. Bieb., *Salsola dendroides* Pall., (3-2 points). Of the listed 20 dominant species, nine species (40%) are representatives of the synanthropic flora. During the study period (April-June, 2023), 76 species from 19 families were recorded on the coast. Despite the apparent high diversity, four families are predominant: *Asteraceae* Gisece (11 species, 14.5%), *Poaceae* Barnhart (19 species, 25.0%), *Amaranyhaceae* Juss. (10 species, 11.8%), *Fabaceae* Juss. (8 species, 10.5%), the remaining families account for from 1 to 3-4 species (Fig. 2).

The study of the vegetation cover showed that riverine shrub (secondary and local communities marked), riverine annual saltwort (secondary saltwort), coastal desert shrub saltwort from *H. strobilaceum* (local), coastal shrub (local, transitional), coastal desert annual saltwort (local), coastal psammophyte-littoral (local),

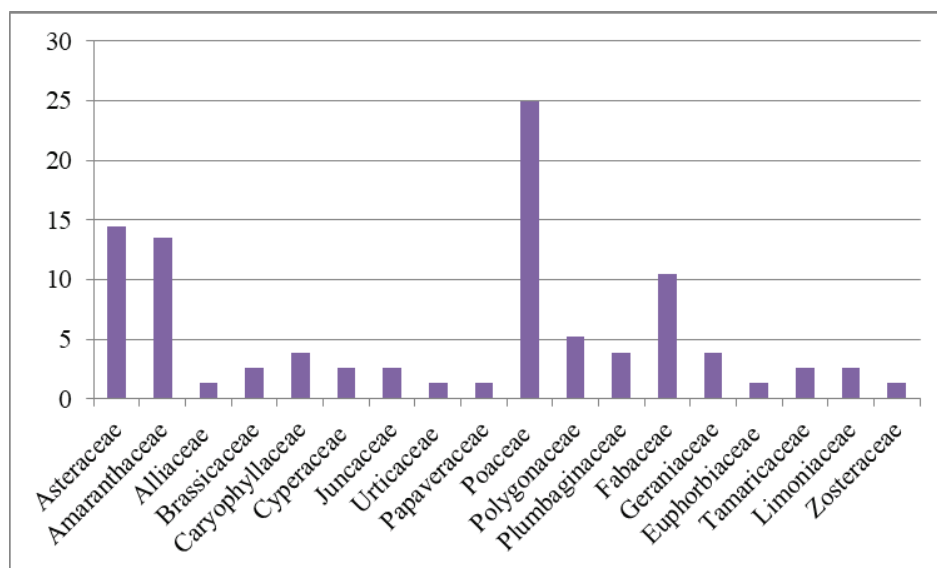


Figure 2. The ratio of families in the coastal flora of Neftchala district.

coastal ephemeral (local) vegetation are common for the coastal strip and the Kura river part adjacent to it (Tab. 1).

In the course of field studies, it was established that the distribution of the tamarisk formation in the area is

of zonal character. It is a “satellite plant” of the entire modern pre-Kura river strip of Azerbaijan and forms thickets with 95% projective cover. In the 90s, due to the lack of fuel for heating residential buildings, tugai tree forests were actively cut down everywhere by the

Table 1. Plant communities in the studied areas of Neftchala district.

Formations	Associations
Riverine shrub vegetation	
<i>Tamariceta meyeri</i> (zonal, secondary post-forest formation)	<i>Tamarix meyeri</i> + <i>Tamarix ramosissima</i> – <i>Herbosa</i>
<i>Rubeta sanguineus</i> (zonal local formation)	<i>Rubus sanguineus</i> - <i>Tamarix meyeri</i>
Riverside annual saltwort vegetation	
<i>Petrosimonea brachiatae</i> (formation of secondary salinity)	<i>Petrosimonia brachiata</i> + <i>Suaeda confusa</i>
Coastal desert shrubby saltwort vegetation	
<i>Halocnemeta strobilacei</i> (zonal local formation)	<i>Halocnemum strobilaceum</i> - <i>Ephemeretae</i>
Coastal shrub	
<i>Tamariceta ramosissima</i> (local range-narrowing transitional)	<i>Tamarix ramosissima</i> – <i>Herbosa</i>
Coastal desert annual saltwort	
<i>Suaeda confusa</i> (zonal local formation)	<i>Suaeda confusa</i> + <i>Salicornia europea</i>
Coastal psammophytic-littoral vegetation	
<i>Arguseta sibirici</i> (zonal local formation)	<i>Argusia sibirica</i> - <i>Aeluropus littoralis</i> <i>Argusia sibirica</i> + <i>Cakile euxina</i> <i>Suaeda confusa</i> + <i>Salicornia europea</i>
<i>Junceta acutus</i> (zonal local formation)	<i>Juncus acutus</i> - <i>Ephemeretae</i>
Coastal ephemeral vegetation	
<i>Ephemereta</i> (zonal formation typical of desert and semi-desert ecotopes)	<i>Ephemeretae</i>

local population. As a result, most of these forests were replaced by secondary shrub vegetation consisting of species of the genus *Tamarix* L. In Neftchala district, tamarisk formations stretch along the river network to the confluence of the Kura river into the sea. However, on sandstones they reduce their projective cover to 25% and occur fragmentarily directly in the coastal line. A wide distribution of saltwort shrub communities from *H. strobilaceum* was noted. The species *Juncus acutus* L. and *J. gerardi* Lois. are found directly on the coast and along small freshwater ponds, in wet areas throughout the area. The overflow of the Kura river in the 2000s and the subsequent decrease in its level over time in recent years have caused secondary salinization of the soil. As a result, annual saltwort communities penetrated into these areas from the coastal strip with the participation of *Petrosimonia brachiata* (Pall.) Bunge, *Salsola tragus* L., *Suaeda altissima* (L.) Pall. Also, plant groupings with the participation of ephemers were noted on the areas (*Bromus japonicus*, *Eremopurum orientale* Jaub. et Spach., *Lolium rigidum* Gaudin., *Capsella bursa pastoris* Medik., *Geranium molle* L., *Tragopogon graminifolius* DC. etc.). However, their species richness and forage quality should be recognized as insufficient, because these plant communities are dominated by weeds and poisonous plants (*Senecio vernalis* Waldst. et Kit., *A. aestivalis*, *Hordeum leporinum* Link etc.), which in turn penetrate the coastal zone. The coastal zone was also affected by the transgression of the Caspian Sea for many years, which led to a critical decline in the herbaceous representatives from the genera *Melilotus* (L.) Mill., *Medicago* L., *Trifolium* L.

Unsystematic grazing of cattle has led to the trampling of the soil, secondary salinization and contamination of phytocoenoses, and increased fishing in some places has led to the complete disappearance of the coastal vegetation. The latter is associated with the constant movement of fishing boats and vehicles along the coast (Fig. 3). Taking into account the ratio of hemerobic groups, the level of apophyte was determined, which is based on the percentage ratio of species of natural (apophytes) and disturbed (anthropophyte) communities. The higher the percentage of anthropophyte species, the greater the disturbance of the community (Fig. 4).

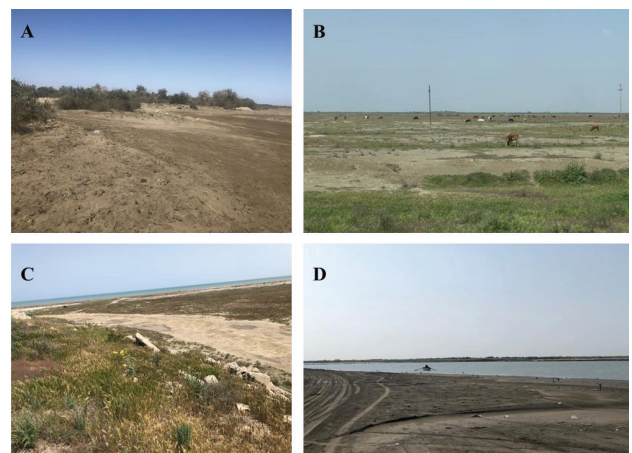


Figure 3. Some areas of the coastal part of Neftchala district: A. area covered with *Tamarix* species, B. area subjected to grazing, C. eroded area, D. area where the Kura flows into the Caspian Sea and sandy coastal zone.

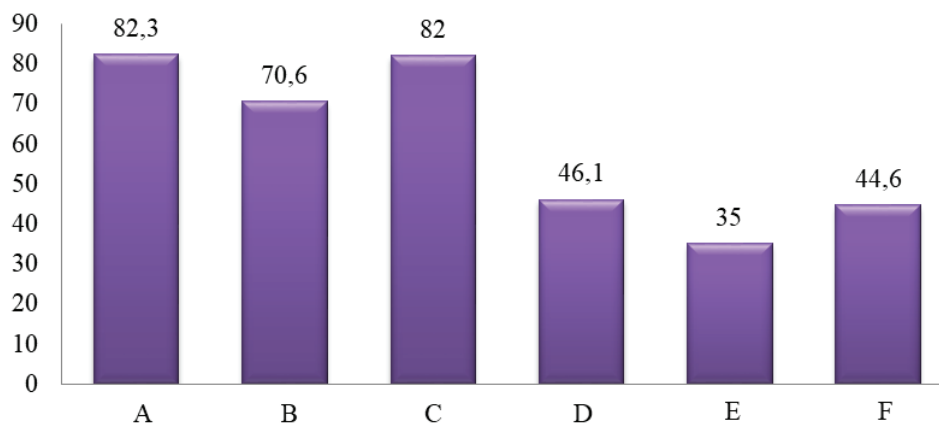


Figure 4. Indicators of disturbance of vegetation types in the coastal and pre-Kura zone: (X-axis vegetation types: A-riverside shrub; B-riverside annual saltwort; C-coastal desert shrub saltwort; D-coastal desert annual saltwort; E-coastal psammophyte-littoral; F-coastal ephemeral); On the Y axis - indicators of the degree of disturbance of vegetation in %.

The assessment showed that shrub, ephemeral, and secondarily saline annual saltwort communities are characterized by high anthropogenic rates, i.e. experiencing a large anthropogenic load.

CONCLUSIONS

In the coastal and adjacent Kura territories of the Neftchala district, nine plant communities are registered, of which two communities dominated by *T. ramosissima* and *P. brachiata* are secondary. *T. ramosissima* were formed as a result of deforestation of tugai forests, *P. brachiata* as a result of secondary salinization. Along with this, six native communities have been identified (blackberry, rush, annual seedweed, saltwort-meadow, coastal tamarisk), of which coastal tamarisk are currently narrowing their range. An assessment of the level of synanthropization of coastal vegetation showed that most communities are characterized by high contamination of ruderal-segetal species belonging to genera *Amaranthus* L., *Chenopodium* L., *Cousinia* Cass. It has been established that factors such as fishing and grazing create conditions for the emergence of strong desertification processes. At the same time, it is expected that the development of tourism, which began in the last two years on the coast, will have a negative impact on vegetation in the future.

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Azərbaycanda Neftçala rayonunun sahil zolağının bitki örtüyü

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Məqalədə Xəzər sahilinin bitki örtüyündən və Kür çayı zolağının dənizlə həmsərhəd olan hissəsindən bəhs edilir. Aparıcı fəsilələr (*Asteraceae*, *Poaceae*, *Chenopodiaceae*, *Fabaceae*) və bu ərazi üçün xarakterik növlər (*Aeluropus littoralis*, *Argusia sibirica*, *Suaeda altissima*, *Salicornia europea*, *Salsola tragos*, *Chenopodium album*, *Limonium meyeri*, *Tamarix meyeri*, *Cardus arabicus*, *Senecio vernalis*) müəyyən edilmişdir. Böyük antropogen yükə məruz qalan (kol, efemer və təkrar şoranlaşan çay kənarı birliklik duzlaşan birliklər) müəyyən edilmişdir. Bitki örtüyünün vəziyyətinə təsir edən amillərdən otarılma, balıqçılıq və qumlu sahil zonasının “çimərliklər” kimi istifadəsi aiddir. Bölgənin sahilyanı hissəsinin əsas landşaft birlikləri müəyyən edilmişdir. Bura *Tamarix ramosissima* növünün üstünlük təşkil etdiyi kol birlikləri, *Petrosimonia brachiata* və *Suaeda confusa* növlərinin üstünlük təşkil etdiyi illik şorangələr, *Halocnemum strobilaceum* kol şoranlıqları, *Heliotropium sibiricum*, *Cakile euxina* dominantlıq etdiyi psammofit-littoral ərazilər daxildir.

Açar sözlər: birlik, pozulma, dominant növlər, amillər, landşaft, çay boyu, transformasiya, bitkilik tipləri

Растительный покров приморской полосы Нефтчалинского района Азербайджана

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В статье рассматривается растительный покров побережья Каспия и часть куринской приречной полосы граничащей с морем. Определены ведущие семейства (*Asteraceae*, *Poaceae*, *Chenopodiaceae*, *Fabaceae*) и характерные виды этой зоны (*Aeluropus littoralis*, *Argusia sibirica*, *Suaeda altissima*, *Salicornia europea*, *Salsola tragos*, *Chenopodium album*, *Limonium meyeri*, *Tamarix meyeri*, *Cardus arabicus*, *Senecio vernalis*). Установлены сообщества (кустарниковые, эфемеровые и вторичнозасоленные однолетне-солянковые приречные) испытывающие большую антропогенную нагрузку. Факторами, влияющими на состояние растительности являются выпас, рыболовство и использование песчаной зоны побережья для «стихийных пляжей». Выявлены основные ландшафтные сообщества прибрежной части региона. К ним относятся кустарниковые сообщества с доминированием *Tamarix ramosissima*, однолетние солянки с *Petrosimonia brachiata* и *Suaeda confusa*, кустарниковые солянки с *Halocnemum strobilaceum*, псаммофитно-литоральные с доминированием *Heliotropium sibiricum*, *Cakile euxina*.

Ключевые слова: сообщество, нарушение, доминирующий вид, факторы, ландшафт, приречной, трансформация, типы растительности