REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertation submitted for the academic degree of Doctor of Sciences

FLORA, VEGETATION OF THE CASPIAN COAST AND THEIR EFFECTIVE USE (IN THE AREA OF THE REPUBLIC OF AZERBAIJAN)

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INTRODUCTION

Relevance and degree of development of the topic. The diversity and richness of the plant ecosystem of the Caspian Sea coastal area of Azerbaijan is related to the variety of natural conditions of the area, as well as its formation under the influence of distant floristic regions. There is a great need to conduct floristic, as well as ecological and geobotanical studies of wild flora and natural vegetation related to the biodiversity of the territory[1]. In this regard, studies in phytocenosis, which is part of the biocenosis, are of great importance in modern times. Without analyzing the flora of the Caspian Sea coastal area, studying the species composition and structure of vegetation by formation and association, it is impossible to classify phytocenoses, draw up an ecological-geobotanical map, calculate the productivity and forage quality of winter pastures and village-adjacent grazing areas, as well as develop recommendations for the protection and efficient use of phytodiversity based on ecological assessment.

Conducting relevant research in the coastal zone of the Caspian Sea, which is subject to anthropogenic impact, is of great importance from a theoretical and practical point of view. Therefore, research of natural phytocenoses is necessary in botany and ecology for development of complex measures (simplificated and fundamental) towards environmental protection, and proper use and improvement of pastures and grazing areas in accordance with geobotanical indicators. For the realization of the actual problem mentioned earlier in our country, "State Program on effective use of summer and winter pastures and hayfields and prevention of desertification in the Republic of Azerbaijan"[2] , as well as Action Plan for the implementation of the "State Program for 2016-2020 on the

[1] Azərbaycan Respublikasında bioloji müxtəlifliyin qorunmasına və davamlı istifadəsinə dair 2017–2020-ci illər üçün Milli Strategiya// Azərbaycan Respublikası Prezidentinin 2016-cı il 3 oktyabr tarixli Sərəncamı ilə təsdiq edilmişdir. -Bakı: Qanun. -2016. https://president.az/az/articles/view/21261

[2] Azərbaycan Respublikasında yay-qış otlaqlarının, biçənəklərin səmərəli istifadə olunması və səhralaşmanın qarşısının alınmasına dair Dövlət Proqramı //Azərbaycan Respublikası Prezidentinin 2004-cü il 22 may tarixli sərəncamı ilə təsdiq edilmişdir. -Bakı: Qanun. -2004. https://e-qanun.az/framework/5994

development of the real estate cadastre system, increasing the efficiency of land use and its protection in the Republic of Azerbaijan" envisages conducting geobotanical research for the improvement and efficient use of forage areas[3].

Thus, works on the study of the vegetation cover of the Caspian Sea coastal area can be found in the research papers of some authors[4, 5, 6]. However, these studies covered specific areas and did not fully reflect the plant diversity of the Caspian coast as a whole. In order to implement the "Problem of efficient use and protection of the plant world on biological grounds", it was considered important to carry out research based on scientific research in the flora and vegetation of the Caspian coast with progressive methods.

The object and subject of the research. The object of the research was the flora and vegetation cover of the Caspian coast. The subject of the research was conducting floristic and geobotanical research in Samur-Yalama, Absheron, Shirvan, Hirkan National Parks and Gizilaghaj State Reserve, located within six botanical-geographical regions (Samur-Shabran lowland, Caspian coast lowland, Absheron, Gobustan, Lankaran-Mugan and Lankaran lowlands) on the Caspian coast at an altitude of 28.0 to 200 meters above sea level and assessing productivity and determining load of natural forage areas in Siyazan, Neftchala and Astara regions in autumn, winter and spring seasons in 2016-2020.

The purposes and objectives of the study. The main purpose of

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[3] Azərbaycan Respublikasında daşınmaz əmlakın kadastr sisteminin inkişafı, torpaqdan istifadənin və onun mühafizəsinin səmərəliliyinin artırılmasına dair 2016- 2020-ci illər üçün Dövlət Proqramı" //-Bakı: Azərbaycan" qəzeti, -17 iyul, -2016. - s. 2-4.

[4] Шахсуваров, Р.Т. Псаммофитная растительность прибрежной полосы Каспийского моря (Самур-Дивичинская аллювиально-морская низменность): / Автореферат дисс. канд. биологических наук. /-Баку, 1994. –33 с.

[5] Гахраманова, М.Х. Псаммофитно литоральная флор Апшеронского полуострова в связи с трансгрессией Каспийского моря: / Автореферат канд. биологических наук. / -Баку, 2002. - 25 с.

[6] Ağaquliyev, İ.M, Vahabova, L.T. Şirvan Milli Parkın dənizsahili-qumsal bitkiliyinin fitosenoloji-floristik xüsusiyyətləri və qorunması // Xəzər dənizi və ətraf regionların ekosistemləri, -Bakı: Azərbaycan Coğrafiya Cəmiyyəti, -2010. XV cild, - s.153-157.

the research is to compile a taxonomic conspectus of the flora diversity of the Caspian coast (within the borders of Azerbaijan), to provide an analysis of taxa (division, class, family, genus, species) according to the new nomenclature, to prepare their biomorphological, ecological, botanical-geographical classification, to reveal the reasons for the de- cline of species with protection status, as well as to map the current state of natural vegetation by examining its ecological-geobotanical parameters. In addition, the purpose includes issues such as productivity of natural pastures and grazings, as well as the implementation of practical measures for their improvement.

The following objectives have been set for their implementation:

– Prepare a conspectus of the wild flora of the Caspian coast of the Republic of Azerbaijan, analyze them by taxa (division, class, family, genus, species) according to the latest nomenclature, and develop a biomorphological, ecological, botanical-geographical classification;

– To determine rare and endangered species of the Caspian coast flora with protection status (included in the "Red Book" of the Republic of Azerbaijan), including endemic and relict species by geobotanical regions;

– To investigate the ecological-geobotanical parameters of the natural vegetation of the research area, to analyze the vegetation to the level of formation and association;

– Compile the "Ecological-geobotanical map of the natural vegetation cover of the coastal zone of the Caspian Sea in the territory of the Republic of Azerbaijan" according to the modern classification,

– To carry out the productivity, forage quality, capacity and ecological assessment of the winter pastures in the area;

– To reveal the effects that cause the degradation in the vegetation cover of the Caspian coast, especially the process of salinization, as well as to determine the ways of protection, efficient use and improvement of phytodiversity exposed to these effects and develop measures and recommendations on scientific basis.

Research methods. Within the territory of the Republic of

Azerbaijan, field research was carried out by route and stationary methods in six botanical and geographical regions of the Caspian coast. Floristic, bioecological, geographical areological and geobotanical analysis of the flora and vegetation of the area, determination of forage productivity, assessment of pastures were performed with modern methods, and endemic and plants with protection status were also determined.

Geobotanical studies in the wild flora and natural vegetation cover formed in different relief, soil-ecological conditions of the region were carried out in the preparative, field and cameral stages.

Main provisions submitted to the defence. As a result of the conducted research, the following conceptual approaches were obtained and presented in the form of provisions:

– The floristic and geobotanical study of the Caspian coastal areas in Azerbaijan determines the decisive role of the influence of sea waters in the formation of vegetation types characterized by the dominance of edificators in the flora and phytocenosis of those areas.

– Groundwater plays a decisive role in the formation of various life forms of plants and vegetation types in the coastal areas of the Caspian Sea.

– According to the regularity of the distribution of plants on the altitude zones in the botanical-geographical regions as they rise above sea level in the coastal areas, mesophytic ecological feature is replaced by xerophytic.

– There is a correlative relationship between the ebb and flow of sea level and the types of vegetation formed in coastal areas. The ebb and flow of water creates a basis for changes of vegetation types and flora biodiversity.

– In coastal areas, there is a interrelationship between the formation of flora, vegetation cover and range types and sea waters.

– Natural regularities among the “plant sea” were discovered in the determination and development of the genesis of the Caspian coastal flora.

Scientific novelty of the research. As a result of field-geobotanical studies and cameral-floristic researches conducted in the Caspian Sea coastal area of Azerbaijan, a conspectus of the flora was

determined.

In the wild flora of the area, 1054 species of plants belonging to 124 families and 506 genera were studied: 40 mosses, 16 fern-like, 5 horsetail, 1 gymnosperm, 992 angiosperm; 758 species of dicotyledon and 234 species of monocotyledons. The total number of species recorded in the flora of the Caspian coast is 23.42% of the flora of Azerbaijan (on 4557 species).

Based on the conspectus of the flora, its taxonomic, biomorphological, ecological, geographical, areological, endemicity, as well as rare and endangered species included in the "Red Book" of the Republic of Azerbaijan were analyzed.

The dominance of plant groupings and phytoecological principles (for the compilation of map) were taken into account as the main criteria for the preparation of classification of phytocenoses based on the systematization of geobotanical descriptions recorded during our multi-year field researches on the vegetation cover of the area as well as the preparation of schemes on the vegetation types.

New distribution areas of 6 types, 25 formation classes, 125 formation groups, 179 associations, and 21 species of plants were clarified in the phytocenoses of the Caspian Sea coastal area (including the vegetation of Samur-Yalama, Absheron, Shirvan, Gizilaghaj and Hirkan National Parks).

"Geobotanical map of the natural vegetation cover of the Caspian Sea coastal zone in the territory of Azerbaijan" on a scale of 1:200,000, separate corresponding maps of the territory (conditionally northern, central and southern parts) based on this map, "New distribution ranges of species in the botanical-geographical regions of plants in the flora of the Caspian coast", "Map of the botanical-geographical zoning of the Caspian coast in the territory of the Republic of Azerbaijan" on a scale of 1:600,000 were compiled using modern computer software (GIS).

69 species listed in the "Red Book of the Republic of Azerbaijan"in the flora of the Caspian coast have been identified as rare and endangered.

In the flora of the Caspian coast in the territory of Azerbaijan, new distribution areas of 21 species of plants on botanical-

geographical regions are shown on the same-name map compiled by us. In this regard, these species were recorded in geobotanical descriptions and herbariums of plants were collected within the following botanical and geographical regions:

1. Samur-Shabran lowland – *Calligonum polygonoides* L., *Euphorbia iberica* Boiss., *Astragalus falcatus* Lam.

2. Absheron – *Suaeda heterophylla* (Kar.et Kir) Bunge., *Salsola nitraria* Pall., *Gypsophila szovitsii* Fisch. et. C.A.Mey.ex Fenzl., *Erysimum caspicum* N.Busch.

3. Gobustan – *Atriplex laciniata* L., *Scrophylaria divaricata* Ledeb.

4. Lankaran-Mughan – *Vicia ervilia* (L) Willd., *Galium articulata* (L) Ehrend., *Triglochin maritimum* L., *Crypsis alopecuroides* (Pall.et Mitt) Schard., *Tamarix meyeri* Boiss.

5. Lankaran lowland – *Poa masenderana* Freyn & Sint., *Arabis mollis* Stev., *Trigonella cancellata* Desf., *Symphytum peregrinum* Ledeb., *Nonnea decurrens* (C.A.Mey) G.Don.fil., *Campanula odontosepala* Boiss., *Centaurea hyrcanica* Bornm.

The productivity of the wormwood (*Artemisieta*), petrosimonia *(Petrosimonieta)*, saltwort-wormwood *(Salsoletum-Artemisiosum)* and Christ's thorn - elder - dogtooth (*Paliuruseta-Sambucusetum-Cynodonosum*) formations found in the semi-desert, desert and hollow-meadow vegetation distributed in the winter pastures of the Neftchala district on the Caspian coast, in the village-adjacent grazing areas of the Siyazan and Astara districts was determined, the forage quality was investigated, and the pasture capacity and ecological assessment were determined.

Based on the results of conducted research (in 2016-2020) and studies, recommendations were made on the measures to protect the flora and vegetation specific to the biodiversity of the National Parks located in the area of the studied Caspian coast, and to effectively use and improve the phytodiversity of pasture-grazing areas.

Theoretical and practical significance of research. According to the studies and researches, the first flora conspectus of the area prepared for the protection of the wild flora of the Caspian coast created the basis for the compilation of the “Geobotanical map of the

natural vegetation cover of the Caspian Sea" based on the ecological-geobotanical classification for the effective use and improvement of phytodiversity. Results of the research work can be used in the ecological-phytocenological study of other botanical-geographic regions of the republic, in the reissue of the books "Flora of Azerbaijan", "Determinants of Plants", "Map of vegetation cover of Azerbaijan", "Green", also in the preparation of the "General scheme of natural forage areas of Azerbaijan" and "Botanical-geographical zoning map of the Republic of Azerbaijan".

The Ministry of Ecology and Natural Resources of the Republic of Azerbaijan can benefit from information on the flora and vegetation of Samur-Yalama, Absheron, Shirvan, Gizilaghaj and Hirkan National Parks located on the Caspian coast in Azerbaijan, as well as recommendations on the protection of biological diversity.

It is considered appropriate for the Ministry of Agriculture of the Republic of Azerbaijan to take advantage of the measures related to the productivity, forage quality, capacity, efficient use and improvement of the semi-desert, desert and hollow-meadow phytocenoses formed on the Caspian Sea coastal area.

"Geobotanical map of the natural vegetation cover of the Caspian Sea coastal zone in the territory of Azerbaijan" and the indicators on the productivity of natural forage areas and forage quality can be used by the State Service for Property Issues under the Ministry of Economy of the Republic of Azerbaijan for economic and ecological assessment in the land cadastre.

Approbation and application. Important scientific results obtained on the basis of research and studies were presented at the scientific and practical conferences, congresses and conventions at the republican and international level, and the following materials were published in accordance with the plan and program of the dissertation topic: The 3rd International Symposium on Euroasian biodiversity (Minsk, Belarus, SEAB-2017); Innovations in Biology and Agriculture to Solve Global Challenges. Dedicated to the 90th Anniversary of Academician Jalal A.Aliyev (Bakı, 2018); Ministry of Education and Science of the Russian Federation. Ecology of the urban environment: History, modernity and prospects (Astrakhan,

2018); III International Scientific Conference of Young Researchers (Baku, 2019); Actual problems of modern natural and economic sciences. International Scientific Conference (Ganja, 2019); Abstracts of the Conference of Young Scientists and Researchers on "Innovation and Traditions in Modern Botany" devoted to the 130th anniversary of academician A.A.Grossheim (Baku, 2019); Behavioral theories and practice of Russian science, a collection of scientific articles based on the results of the international scientific and practical conference (St. Petersburg, 2021); International scientific conference "Current problems of modern natural and economic sciences" dedicated to the 99th anniversary of the birth of National Leader Heydar Aliyev (Ganja 2022); I International conference "Protection of biodiversity of Eurasia: contemporary problems, solutions and perspectives" with the joint cooperation of Andijan State University of the Republic of Uzbekistan, Ege University of the Republic of Turkey and Baku State University of the Republic of Azerbaijan (Andijan, 2023);; International scientific conference "Current problems of modern natural and economic sciences" dedicated to the 100th anniversary of the birth of National Leader Heydar Aliyev (Ganja, 2023); The International Scientific-Practical Conference on "Modern Approaches in the Study of the Plant Kingdom" dedicated to "Year of Heydar Aliyev" by the Institute of Botany of the Ministry of Science and Education of the Republic of Azerbaijan (Baku, 2023); Republican scientific conference "Actual problems of biology in the context of sustainable development" dedicated to the 100th anniversary of National Leader Heydar Aliyev. Baku State University, Ministry of Science and Education of the Republic of Azerbaijan (Baku, 2023); The international conference on "Heydar Aliyev and the nature of Azerbaijan" dedicated to the 100th anniversary of the birth of the National Leader, Heydar Aliyev, organized by the division of Biological and Medical Sciences of the Azerbaijan National Academy of Sciences (Baku, 2023) and etc, including reported at the seminars and meetings of the Institute of Botany, MSE RA.

On the topic of the dissertation, 41 works, 14 theses, 27 scientific articles were published, which are presented in the literature list of

the dissertation.

The name of the institution where the dissertation work was performed. Dissertation work was carried out in the Department of Systematics and Phylogeny of Higher Plants of the Institute of Botany, MSE RA.

The structure and scope of the dissertation. The dissertation consists of an introduction, 7 chapters, 22 paragraphs, 19 clauses, result, recommendations for production and a list of literature with 310 titles. There are (including appendices) 28 pictures, 7 schemes and 68 tables. The research work consists of an introduction with 15127 characters, Chapter I – 23002 characters, Chapter II – 12591 characters, Chapter III – 41509 characters, Chapter IV – 49476 characters, Chapter V – 220040 characters, Chapter VI – 40993 characters, Chapter VII – 38384 characters, result – 4697 characters, recommendations for production – 1980 characters, list of references, with a total of 323 pages and total volume of the work (with the exception of figures, tables, graphics, appendices and list of references) 447799 characters. Conspectus of the flora of the Caspian Sea coastal area (1054 species), analysis of botanical-geographical elements by species, large-scale geobotanical maps (with the legend), vegetation classification scheme, map of botanical-geographical zoning, geobotanical descriptions, map on the distribution of new species, tables and diagrams on climate parameters, productivity, forage quality, capacity and ecological assessment as well as distribution diagram of formation classes specific to the types of natural vegetation cover, and tables, photographs and color diagrams are presented in the appendix to the dissertation.

MAIN CONTENT OF THE DISERTATION

CHAPTER I. THE HISTORY OF THE STUDY OF FLORA AND VEGETATION OF THE CASPIAN COAST (LITERATURE SUMMARY)

The flora of the Caspian Sea coastal area (hereinafter referred to as the Caspian coast) on the territory of the Republic of Azerbaijan has been of interest to travelers, naturalists, geographers, botanists

and other researchers from foreign countries, including Germany and Russia, for many years.

The study of the wild flora and natural vegetation formed in different soil and climate conditions on the Caspian coast of Azerbaijan was first started in the 17th century. Description of the flora and vegetation of the Caspian coast on literature summary been conventionally divided into five periods (stages) according to historical chronological and administrative principles and analyzed. The results of scientific research conducted in various directions have been widely interpreted.

CHAPTER II. METHODS, OBJECTS AND MATERIAL OF RESEARCH

2.1. Research methods. The flora and vegetation of the Caspian coast of the Republic of Azerbaijan was studied by floristic and geobotanical methods.

Geobotanical studies in the wild flora and natural vegetation cover formed in different relief, soil-ecological conditions of the region were carried out in the preparative, field and cameral stages.

Field research works were carried out by semi-stationary and stationary methods on routes based on large-scale topographical and land management plans of coastal administrative regions on state land registry (1:50,000 scale). The species composition and structure of the formations according to the classification (as the main criterion, the largest classification unit was taken type, and the smallest unit - association) of forest, shrub, semi-desert, desert, hollow-meadow and water-swamp types of phytocenoses spread here are recorded separately in geobotanical descriptions.

For the study of the vegetation cover in the natural forage areas (winter meadows and village-adjacent grazings) of the administrative districts located in the region, “Field geobotany”[7], “Methodology for certification of natural forage lands”[8] , “Methodical instruction on

[7] Полевая геоботаника: [В 5 т.] / Под ред. Е.А. Лавренко, А.А. Корчагина, - Москва; Ленинград: АН СССР. – т. 3 - 1964. – 287 с.

[8] Методика паспортизации природных кормовых угодий/ Под. ред. колл., - Москва: ВНИИК. -1967. –127 с.

geobotanical research of natural forage areas of Azerbaijan"[9], "Guide regarding large-scale geobotanical studies of natural forage areas of the Republic of Azerbaijan"dan[10] were used.

In the investigation of the botanical-geographical elements of the species, range classes vere given according to A.A. Grossheim[11], and types according to A.I.Tolmachev[12], R.V.Kamelin[13] and N.N.Portnier[14]. Life forms of plants were given according to C.Raunkier[15] and I.Serebyakov[16] , ecological groups aacording to B.Bikov[17]. The productivity wad determined in the semi-desert, desert and hollow-meadow vegetation widespread in Siyazan, Neftchala and Astara districts with the mowing and model method based on the methods by I.M.Ponyatovski[18], I.V.Larinin[19]. The scientific works such as "Flora of Azerbaijan"[20], G.F.Akhundov[21],

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A.M.Asgarov[22], V.J.Hajiyev, S.H.Musayev, V.M.Alizade[23] and others were used in the investigation of flora by endemic and subendemic species. Rare and endangered plants are identified according to the "Red Book"[24] of the Republic of Azerbaijan.

2.2. Objects of research. The objects of the research were the flora and vegetation cover of the Caspian coast. The relevant objects cover the boundaries of six botanical-geographical regions (Samur-Shabran lowland, Caspian coast lowland, Absheron, Gobustan, Lankaran-Mugan and Lankaran lowlands) on the territory of Azerbaijan.

2.3. Research material. Researches and studies on the flora and vegetation of the Caspian Sea coastal area and their diversity have been started since 2009 as well as the flora and vegetation of the Samur-Shabran lowland have also been studied[25]. In this regard, since 2016, more than 500 registrations on field geobotanical descriptions have been made in the territory of the Caspian coast, as well as more than 2000 herbarium material have been collected.

Based on the results of the research, an ecological-geobotanical map of the vegetation cover of the area was drawn up based on large-scale land management plans[26, 27, 28] (Figure 1).

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[27] Qurbanov, E.M., Hüseynova, H.Z. Xəzər sahilinin orta hissəsinin ekoloji- geo-botaniki xəritəsi [Xəritə] / Azərbaycan Respublikası əqli mülkiyyət agentliyi. Əsərin qeydiyyatı haqqında şəhadətnamə. №11146. -Bakı: -2019. - 1 v.

[28] Qurbanov, E.M., Hüseynova, H.Z. Xəzər sahilinin cənub hissəsinin ekoloji-geo-botaniki xəritəsi [Xəritə] / Azərbaycan Respublikası əqli mülkiyyət agentliyi. Əsərin qeydiyyatı haqqında şəha¬dətnamə. № 14/C-11058-20. -Bakı: -2020.-1 v.

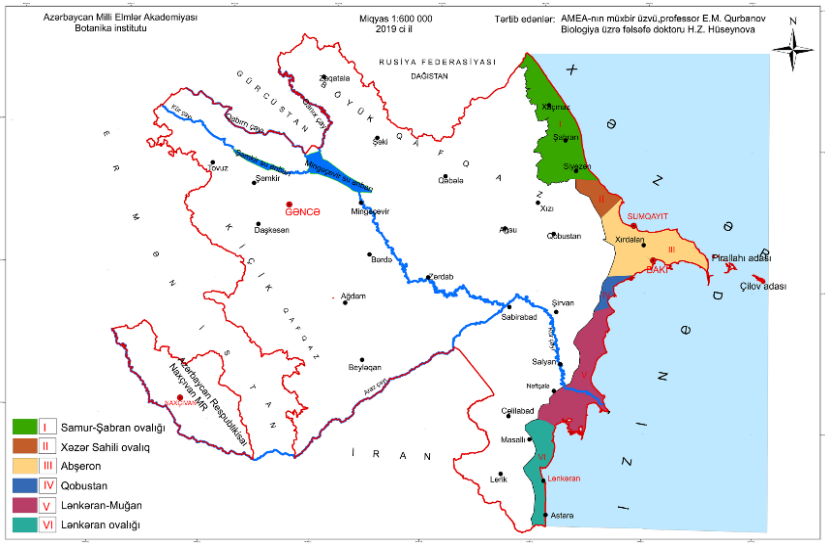


Figure 1. Map of the botanical-geographical zoning of the Caspian Sea coast in the territory of the Republic of Azerbaijan

CHAPTER III. FLORA OF THE CASPIAN COAST AND ITS ANALYSIS

The adherence of the Republic of Azerbaijan to International Conventions created the basis for the study of the flora of the Caspian Sea coast and its analysis on a scientific basis.

It is important to develop the "legend" based on the modern classification, which is the main criterion in the compilation of the ecological-geobotanical map (1:50000, 1:10000 and 1:600000 scale) of the territory of the Caspian coast of Azerbaijan (Samur-Shabran lowland in the north, Absheron, Gobustan in the middle part, Lankaran-Mugan and Lankaran lowlands in the south, as well as all botanical-geographical (geobotanical) regions). In this regard, the conspectus of the flora and the analysis of taxa specific to its parameters, as well as of relevant indicators - life forms, ecological groups, geographical elements, endemics, subendemics, rare, endangered or threatened plants, and examination of herbaria are important. Based on this, herbarium specimens were collected from the research objects during field research (in 2011-2018) and handed over to the Institute of Botany of the Ministry of Science and

Education of the Republic of Azerbaijan, as well as other copies of herbaria are stored in the Department of Botany and Plant Physiology, Faculty of Biology, Baku State University.

3.1. Analysis of the Caspian Sea coastal area. According to the conducted studies and researches, the area flora was analyzed in terms of taxonomy, biomorphology, geography, ecology and endemicity and the "Conspectus of the flora of the Caspian coast" was developed. In the Conspectus, Latin and Azerbaijani names of taxa (division, family, genus and species) belonging to the wild flora of the Caspian coast are given according to "Flora Azerbaijan"[29], A.M. Askarov[30], "World Flora Online"[31].

3.2. Taxonomic analysis of flora. Based on the analysis of the flora of the Caspian Sea coast area by taxa, 1054 plant species belonging to 5 divisions, 2 classes, 124 families and 506 genera were determined for the flora of the area. In the flora of area, 40 species of mosses, 16 species of fern- like, 5 species of horsetail, 1 species of gymnosperm və 992 species of angiosperm were recorded (table 1).

Table 1. Taxonomic structure of Caspian coastal flora

	Groups of plants (divisions and classes)	Distribution by taxa					
		Families		Genera		Species	
		Total number	In % by number	Total number	In % by number	Total number	In % by number
1	*Bryophyta*	16	12,9	29	5,7	40	3,8
2	*Polypodiophyta*	9	7,2	14	2,7	17	1,6
3	*Equisetophyta Equisetopsida*	1	0,8	1	0,2	5	0,5
4	*Gymnospermae*)	1	0,8	1	0,2	1	0,1
5	*Angiospermae*	97	78,2	461	91,1	992	94,1
6	a) *Monocotyledon*	23	17,8	107	21,1	234	22,2
7	b) D*icotyledon*	74	60,4	354	70,0	758	71,9
	Total:	124	100,0	506	100,0	1054	100,0

Of these, 22.2% are monocotyledons (234 species) and 71.9% (758 species) are dicotyledonous. Based on the analysis of the

[29] Флора Азербайджана/ Баку: Изд-во АН Азерб.ССР. -т. I-VIII. -1950-1961.

[30] Əsgərov A.M. Azərbaycanın bitki aləmi (Ali bitkilər-Embriophyta) //-Bakı: "Teass-press".- 2016, 444 s.

[31] https://www.worldfloraonline.org/

structure of taxa, it was found that the 1054 plant species studied in the flora of the Caspian Sea coastal area make up 23.1% of the flora of Azerbaijan (4557 species) and 16.6% of the flora of the Caucasus (6350 species) (table 2).

A comparison of taxa and life forms of plants or biomorphs in the flora of the Caspian coast with the flora of the northeastern regions of Azerbaijan was made (table 3).

Table 2. Comparative analysis of the taxa in the flora of the Caspian Sea coastal area with the flora of Azerbaijan

Taxa and life forms	In the flora of Azerbaijan		In the flora of the Caspian coast	
	number	By %	number	By %
Families	159	100	124	77,9
Genera	1117	100	506	45,2
Species	4557	100	1054	23,1
Trees	119	100	23	19,3
Shrubs, semi-shrubs, subshrubs, semi-ubshrubs	316	100	75	23,7
Grasses	4122	100	956	23,1

Table 3. Comparison of taxa and biomorphs in the flora of the Caspian coast with the flora of the northeastern regions of Azerbaijan [Shukurov E.S.-2003]

Taxa and life forms	In the flora of the north-eastern regions of Azerbaijan	In the flora of the Caspian coast
	number	number
Families	106	124
Genera	656	506
Species	1819	1054
Trees	71	23
Shrubs, semi-shrubs, subshrubs, semi-subshrubs	139	75
Grasses (perennial, biennial, annual)	1609	956

The comparison of taxa and life forms of plants, or biomorphs in the flora of the territory with the flora of the northeastern regions of Azerbaijan shows that 77.1% of the genera and 57.9% of the species in the flora of the Caspian coast are also represented in northeastern regions.

In particular, as Table No. 3 shows, this corresponds to 32.4% for trees, 54.0% for shrubs, semishrubs, subshrubs, semi- subshrubs and 59.4% for herbs in the flora of the north-eastern regions of Azerbaijan.

3.3. The main indicators of the flora. 3.3.1. Biomorphological analysis of flora. In the flora of the Caspian coast, the indicators of the life forms of the plants recorded are different (Figure 2). So, in the flora of the area, herbaceous plants are more common than trees and shrubs.

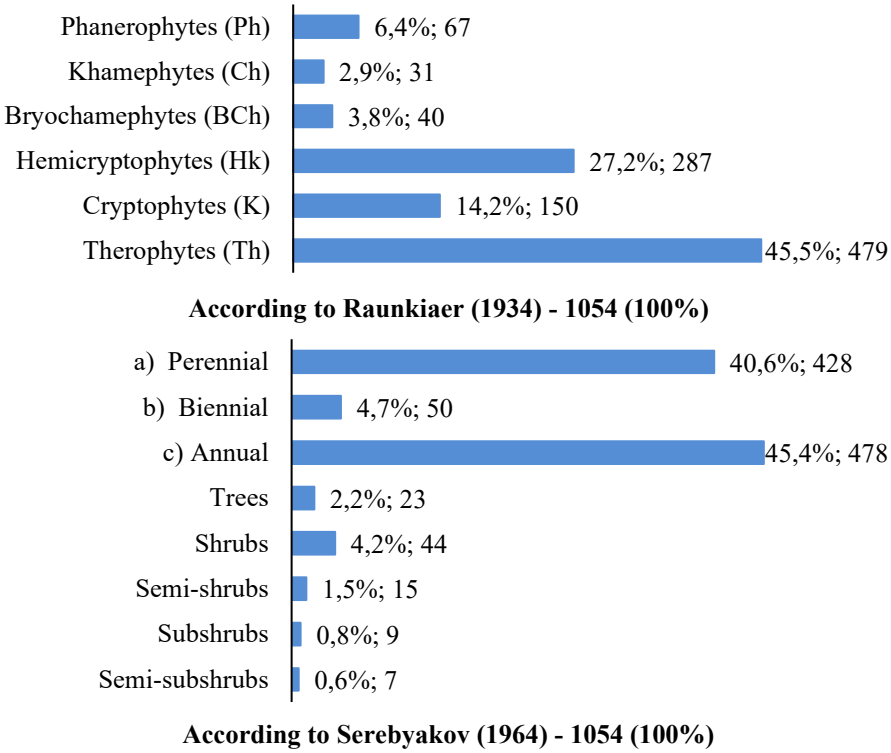


Figure 2. Biomorphological classification of plant species found in the flora of the Caspian Sea coastal area

As shown in Figure 2, the biomorphological analysis of the flora of the Caspian coast revealed that therophytes are more represented by 479 species (45.5%), hemicryptophytes by 287 species (27.2%),

cryptophytes by 150 species (14.2%), phanerophytes by 67 species (6.4%), briochamephytes by 40 species (3.8%), chamephytes by 31 species (2.9%) in the composition of area flora.

According to Serebryakov (1964), 956 species of grasses (428 perennial grasses, 50 - biennials and 478 - annuals) are recorded in the floristic composition of the area. Including, perennial grasses account for 40.6%, biennial grasses - 4.7% and annual grasses - 45.5%.

The species formed in semi-desert, desert, hollow-meadow and swamp phytocenoses in the area also differ from each other. Halophytes and psammophytes are widespread in desert vegetation.

3.4. Ecological analysis of flora. The analysis of the flora of the Caspian coast by ecological groups was examined taking into account the relationship of plants to water, humidity and the granulometric composition of the soils where they spread. The flora of the area belongs to 6 ecological groups. From the analysis of the relevant ecological groups, it is known that in the flora of the Caspian coast, xerophytes by ecological groups are represented by 199 (18.9%) species, xerohalophytes by 4 (0,4%), halophytes by 53 (5,0%), haloxerophytes by 10 (0,9%), halomesophytes by 5 (0,5%), halopsammophytes by 20 (1,9%), psammophytes by 101 (9,6%), psammoxerophytes by 78 (7,4%), psammoxeromesophytes by 20 (1,9%), psammohalophytes by 6 (0,6%), psammomesophytes by 28 (2.7%), psammomesoxerophytes by 2 (0.2%) and psammohydro-mesophytes by 7 (0,7%) species. In addition, the ecological types spread in the vegetation of the area: mesophytes (total 429 species, 40,7%, including, according to the composition mesophytes were recorded with 151 species (14.3%), mesoxerophytes - 197 species (18.7%), mesopsammophytes - 10 species (0.9%), mesoxero-psammophytes 39 species (3.7%), mesohalophytes- 4 species (0.4%), mesohydrophytes 28 species (2.6%)), hydrophytes - 73 species (6.9%), hydromesophytes - 15 species (1.4%) and hydroxeropsammophytes - 4 species (0.4%).

3.5. Analysis of botanical-geographic elements of flora. The study of the botanical-geographical or phytogeographical elements of the wild flora of the Caspian coast in the territory of the Republic of

Azerbaijan on methodological grounds is of great importance.

Elements of the Ancient Mediterranean range type in the flora of the Caspian coast dominate with 474 (45.0%) species. After that, according to the number of species, the boreal is represented by 349 species, desert by 82, Ancient (Tertiary) by 47, Caucasus by 36, adventive by 27, steppe by 13, undetermined by 15 and cosmopolitan by 10.

3.6. Analysis of species of flora with protection status. One of the problems of environmental protection and ecological monitoring in modern times is the protection of flora, as well as its efficient use[32].

Analysis of flora endemicity. From the comparison shown in Table 4, it can be seen the distribution of 240 endemics in the flora of Azerbaijan was determined by G.F.Akhundov, 181 endemics by A.M.Askerov, 200 species according to International Caucasus Endemic Plants**,** the "Red Book" of the Republic of Azerbaijan (table 4-5). According to the comparison of literature sources, it was specified that the amount of relevant endemics is represented by 28 (11.7%), 7 (3.9%) and 61 (30.5%) species.

Table 4. Comparison of endemic species in the flora of the Caspian coast with endemic species in the flora of Azerbaijan

Range of endemics	G.F.Akhundov		Flora of the Caspian coast		A.M.Askerov		Flora of the Caspian coast		International Caucasus Endemic Plants, the "Red Book" of the Republic of Azerbaijan		Flora of the Caspian coast	
Azerbaijan range	number	By %	number	By %	number	By %	number	By %	number	By %	number	By %
	240	100	28	11,7	181	100	7	3,9	200	100	38	30,5

[32] Qurbanov, E.M., Hüseynova, H.Z. Abşeron Millı Parkı ərazisində biomüxtəlifliyinin mühafizəsi // AR ETN Botanika İnstitutu "Heydər Əliyev İli"Nə Həsr Edilmiş "Bitki Aləminin Öyrənilməsində Müasir Yanaşmalar" Mövzusunda Beynəlxalq Elmi-Praktiki konfrans, -Bakı: -22-24 İyun, -2023. -s. 50-51.

Table 5. Endemic plants of the Caucasian range represented in the flora of the Caspian coast

№	Families	Genera		Species	
		Number	By %	Number	By %
1.	*Asteraceae* Giseke	10	28,6	12	27,9
2.	*Fabaceae* Juss.	4	11,4	5	11,6
3.	*Scrophulariaceae* Juss.	3	8,6	3	7,0
4.	*Brassicaceae* Burnett	3	8,6	3	7,0
5.	*Boraginaceae* Juss.	2	5,7	4	9,3
6.	*Chenopodiaceae* Vent.	2	5,7	3	7,0
Total: 6 families		24	68,6	30	69,8
10 families with 2-1 species		11	31,4	13	30,2
Total: 16 families		35	100	43	100

As Table 5 reflects, according to the number in the flora of the area, *Asteraceae* consists of 10 genera, *Fabaceae* - 4 genera, *Scrophulariaceae* and *Brassicaceae* both - 3 genera, *Boraginaceae* and *Chenopodiaceae* both - 2 genera, and remaining 10 families - 11 genera and 2-1 species. In the composition of the flora, *Asteraceae* participates with 12 species, *Fabaceae* with 5 species, *Scrophulariaceae* and *Brassicaceae* with 3 species each, *Boraginaceae* with 4 species and *Chenopodiaceae* with 3 species, *Iridaceae, Salicaceae, Polygonaceae* and etc. families with 2-1 species each.

Out of 460 endangered species in the “Red Book”, 69 species are represented in the flora of the Caspian coast (Fig. 3).

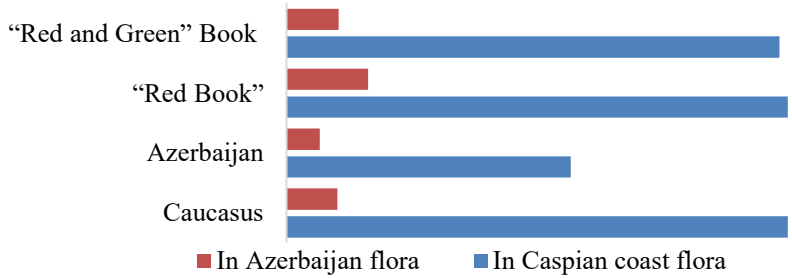


Figure 3. Comparison of endemics of Caucasian and Azerbaijan range in the flora of Caspian Sea coastal area and species included in the “Red Book”, “Red and Green” books of the Republic of Azerbaijan

3.7. Analysis of rare and endangered species included in the "Red Book of the Republic of Azerbaijan". The categories of rare and endangered species spread in the area were developed, as well as 69 species (rare and endangered) plants were identified in the flora as a result of the study (Appendix 2). Plants with protection status for Caspian coastal flora (out of these plants, 12 (17.3%) -CR, 22 (31.8%) - EN, 17 (24.6%) -VU, 4 (5.79%) -LC, 2 (2.89%)- DD, 12 (17.3%) -NT) belong to the national assessment list according to IUCN categories and criteria.

Of the trees distributed in the study area - *Quercus castaneifolia* C.A.Mey., *Parrotia persica* C.A.Mey., *Pyrus hyrcana* Fed., *P.salicifolia* Hablitz, *Gleditsia caspia* Desf.; shrubs - *Anabasis brachiata* Fisch. & C.A.Mey. ex Kar. & Kir., *Calligonum bakuense* Litv., *Vitis sylvestris* C.C.Gmel., *Punica granatum* L. and *Hedera pastuchovii* Woronow were classified as rare and endangered plants and very rare distribution of *Calligonum bakuense* Litv., *Astragalus bakuensis* Bunge, *Ferula persica* Willd., *Centaurea hyrcanica* Bornm. and other species was observed in the psammophytic desert phytocenoses of the Caspian coast.

In connection with the development of tourism, the construction of a large number of recreations on the shores of the Caspian Sea, as well as the expansion of quarries here, have led to the narrowing and digression of the range of rare and endangered plants in the flora. Therefore, the implementation of measures for the protection and monitoring of biodiversity is purposeful.

3.8. Analysis of plants included in the "Red" and "Green" books of Flora. Out of the 4200 species in the flora of Azerbaijan, one out of every ten species is currently under threat of extinction. Among them, 547 species are rare or endangered, of which 17 are higher spores, 5 - gymnosperms and 394 - flowering plants (table 6).

3.9. Analysis of flora by taxa according to the "Conspectus of Caucasian Flora". The indicators on the taxa or categories of the flora of the Caspian coast were determined according to the "Conspectus of the Flora of the Caucasus" and it was found that 243 species of plants united in 32 families and 150 genera are found in the flora of the area.

Table 6. The taxon composition of the plants distributed in the flora of the Caspian coast and listed in the "Red and Green Books of Azerbaijan".

№	Families	Genera		Species	
		Number	By %	Number	By %
1	*Poaceae* Barnhart.	7	17,5	7	15,9
2	*Fabaceae* Lindl.	5	12,5	5	11,4
3	*Cyperaceae* Juss.	3	7,5	4	9,2
4	*Asteraceae* Giseke	3	7,5	3	6,9
5	*Polygonaceae* Juss.	2	5,0	2	4,5
6	*Rosaceae* Juss.	2	5,0	2	4,5
7	*İridaceae* Juss.	1	2,5	2	4,5
8	*Chenopodiaceae* Vent.	1	2,5	2	4,5
9	*Apiaceae* Juss.	1	2,5	2	4,5
Total: 9 families		25	62,5	29	65,9
15 families are represented by 1 genus and 1 species		15	37,5	15	34,1
Total: 24 families		40	100,0	44	100,0

CHAPTER IV. NEW DISTRIBUTION AREAS OF PLANTS IN THE FLORA OF THE CASPIAN COAST AND ANALYSIS OF ENDEMICS ON BOTANICAL-GEOGRAPHICAL REGIONS

4.1. Analysis of new distribution areas of plants. As a result of the research, the new distribution area of 21 species belonging to 14 families and 21 genera was determined in the flora of the Caspian coast. Based on the new distribution areas of plants, *Fabaceae,* and *Chenopodiaceae* dominate with 3 genera each (14.3%) in the flora of area. The families *Boraginaceae, Poaceae* and *Brassicaceae* are represented by 2 species each (9.6%), and the other 9 families are represented by one genus and one species.

The number of species in the identified new distribution areas are as follows: mainly, Lankaran lowland - 7 species (33.3%), Samur-Shabran lowland - 3 species (14.2 %), Lankaran-Mughan lowland - 5 species (24 %), Absheron - 4 species (19 %), Gobustan botanical-geographic region - 2 species (9.6%). These species were recorded in formations as well as associations on forest, shrubs, semi-desert, desert, hollow-meadow and swamp vegetation types in the natural

phytocenoses of the Caspian coast[33].

4.2. Analysis of endemics by botanical-geographic regions. According to the numbet of endemics with Azerbaijan range distributed in the botanical-geographical regions of the Caspian coast, Samur-Shabran and Caspian coastal lowland are represented by 18 species (18, 4 %) (each), Absheron by 27 species (27,6 %), Gobustan 19 species (19, 4%), Lankaran-Mughan by 2 species (2,0%), Lankaran lowland by 12 species (12,2 %) and other botanical-geographic regions by 2 species (table 7).

Table 7. Indicators (spectrum) of the distribution of endemic plants determined in the vegetation of the Caspian coast by botanical- geographical regions

№	Botanical-geographic regions	Caucasian endemics		Azerbaijan endemics	
		Number	By %	Number	By %
1.	Samur-Shabran lowland	12	15.4	18	18.4
2.	Caspian coastal lowland	14	18.0	18	18.4
3.	Absheron	14	18.0	27	27.6
4.	Gobustan	16	20.5	19	19.4
5.	Lankaran-Mughan	3	3.8	2	2.0
6.	Lankaran lowland	15	19.2	12	12.2
7.	Other botanical-geographic regions	4	5.1	2	2.0
	Total:	78	100.0	98	100.0

CHAPTER V. NATURAL VEGETATION OF THE CASPIAN COAST, ITS CLASSIFICATION, MAPPING AND PHYTOCENOLOGICAL CHARACTERISTICS

5.1. Ecological-geobotanical classification and map of vegetation. The natural vegetation of the Caspian coast is divided into 6 zones according to the climate, topography and soils of the area. The natural vegetation of the area in these zones consists of 6 types – forest, shrub, semi-desert, saltwort desert, seashore (side) psammophyte desert, hollow-meadow and swamp types, 25 formation classes, 125 formation groups and 179 associations. In

[33] Hüseynova, H.Z. Xəzər sahilinin şimal hissəsində Botaniki-coğrafi rayonlar ərazisində bəzi növlərin yeni yayılma arealları (Azərbaycan Respublikası ərazisində) // Bakı Üniversiteti "Xəbərlər" Təbiət elmləri seriyası, Bakı Universiteti. – 2020. №1, – s. 19-25.

accordance with the geobotanical classification units, the distribution structure was developed based on the species composition of the mentioned vegetations (by formations and associations) (table 8).

Table 8. Spectrum of vegetation of the Caspian coast by geobotanical classification units

Types	Forest	Shrub	Semi-desert	Desert		Hollow-meadow	Swamp	Total
				Brackish	Sandy			
Formation class	2	2	4	5	3	4	5	25
Formation group	15	7	7	39	23	16	18	125
Associations	17	13	15	48	30	31	25	179

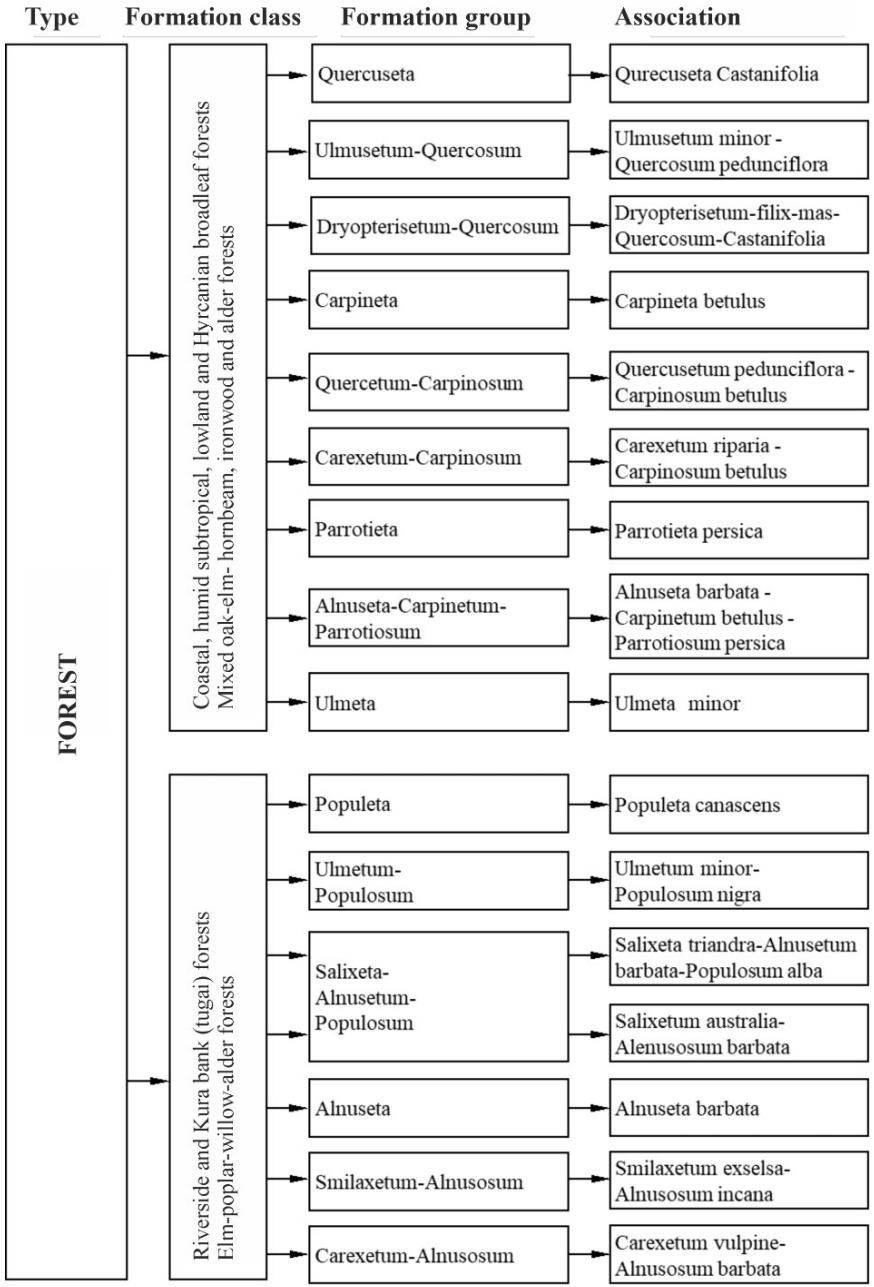
5.2. Phytocenological features of vegetation. The natural vegetation of the Caspian coast was classified and analyzed by zones as follows.

I. Vegetation of the forest zone formed on meadow-brown, irrigated meadow-brown, forest-yellow, alluvial meadow-forest and irrigated alluvial-meadow soils:

Forest vegetation. According to our research, it was found that out of 1054 species, 23 species (2.2%) of trees and 44 species (4.2%) of shrubs were distributed in the flora of the Caspian coast. In the forest- type vegetation formed on the Caspian coast, 15 formations and 17 association groups belonging to 2 formation classes were recorded (classification scheme 1).

Few forests extend along the banks of rivers (Kur, Lankaranchay, Astarachay (south of the Caspian coast), and Tugay forests are found on the banks of rivers. Pedunculate oak *(Quercus longipes Stev.)* and European hornbeam (*Carpinus betulus* L.) form the basis of seaside forests in the studied area and create elm-oak *(Ulmusetum- Quercosum),* hornbeam *(Carpineta),* oak-hornbeam *(Quercetum- Carpinosum)* and sedge-hornbeam *(Carexetum-Carpinosum)* wood (in Samur-Yalama National Park) separately and also in a mixed form. Chestnut-leaved oak *(Quercus castaneifolia),* Persian ironwood (*Parrotia persica*), elm *(Ulmus suberosa* Moench*)* and etc. trees were recorded in "spot" in these forests.

II. Vegetation of the forest and mixed shrub zone, common in floodplain-meadow-forest, meadow-gray and gray soils:



Classification scheme 1. Forest vegetation classification scheme

Shrub vegetation. Two (2) formation classes, 7 formation groups and 13 associations belong to the shrub type of vegetation on the coast of the Caspian Sea (classification scheme 2).

Phytocenoses belonging to this type of vegetation were recorded at an altitude of 28 to 200 meters above sea level on the coast of the Caspian Sea, including on the banks of rivers in the Samur-Shabran lowland, on the banks of Kur river, mainly in floodplain meadow-forest, meadow-gray and gray soils.

It was determined that shrub plants such as French tamarisk (*Tamarix ramosissima* Ledeb.) and Caspian oleaster (*Elaeagnus caspica* (Sosn.) Grossh.) are distributed in a wide area along the rivers flowing from the Samur-Shabran lowland and in the lower part of the Kura river.

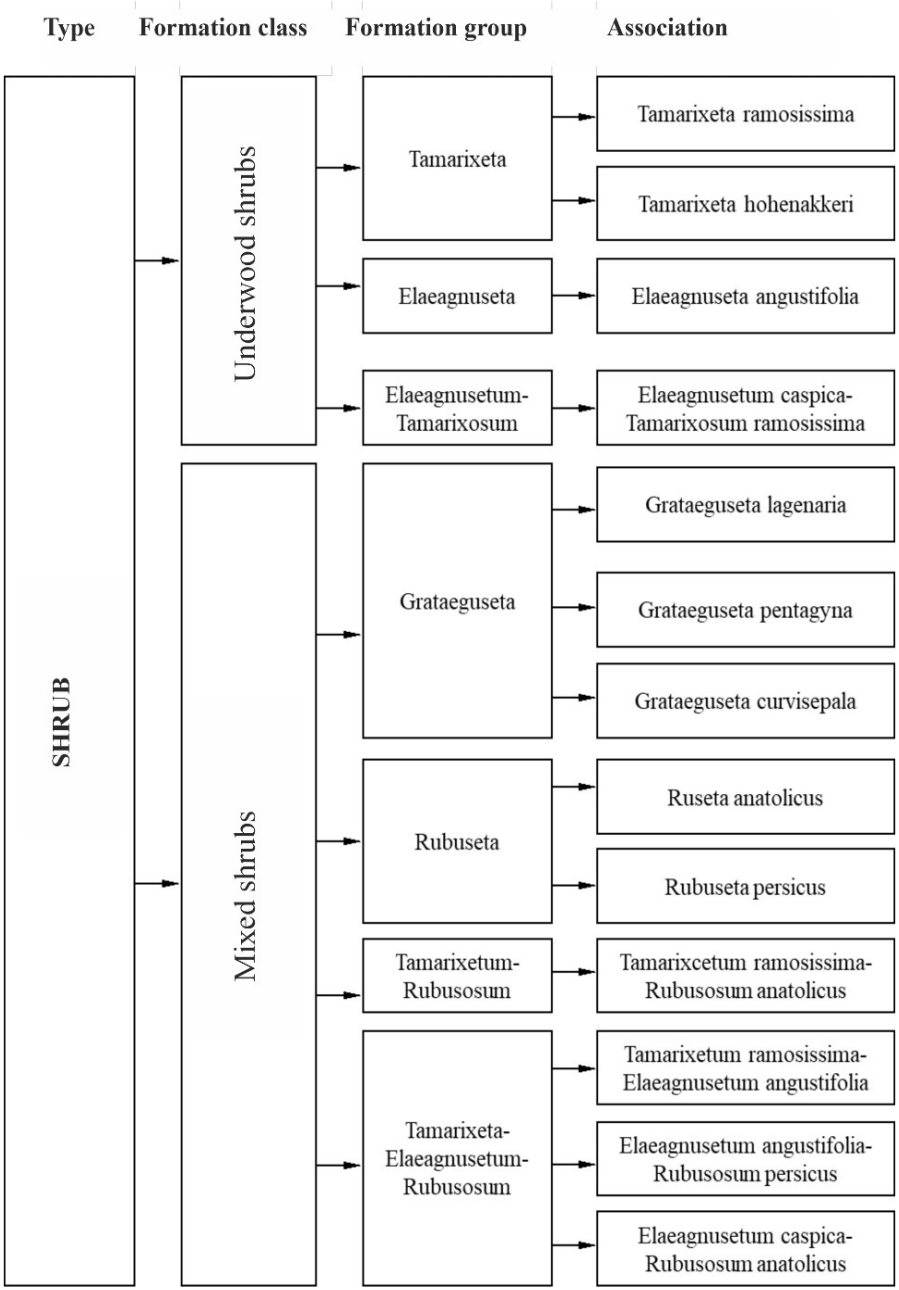
III. Vegetation of the dry subtropical and semi-desert zone, distributed on gray, gray-meadow and gray-brown soils:

Semi-desert vegetation. Semi-desert is one of the main landscape types of the earth, forming transition strips between steppe and desert vegetation. A seasonal rhythm is obvious in the development of semi-desert vegetation: the plants that spread here develop intensively in the spring (after the first rain), the vegetation stops in the summer, and the growth resumes in the fall. The vegetation period lasts 8-9 months. As can be seen from the "Classification of the vegetation cover of the Caspian coast", the semi-desert vegetation type in the vegetation cover of the area is represented by 4 formation classes, 7 formation groups and 15 associations (classification scheme 3).

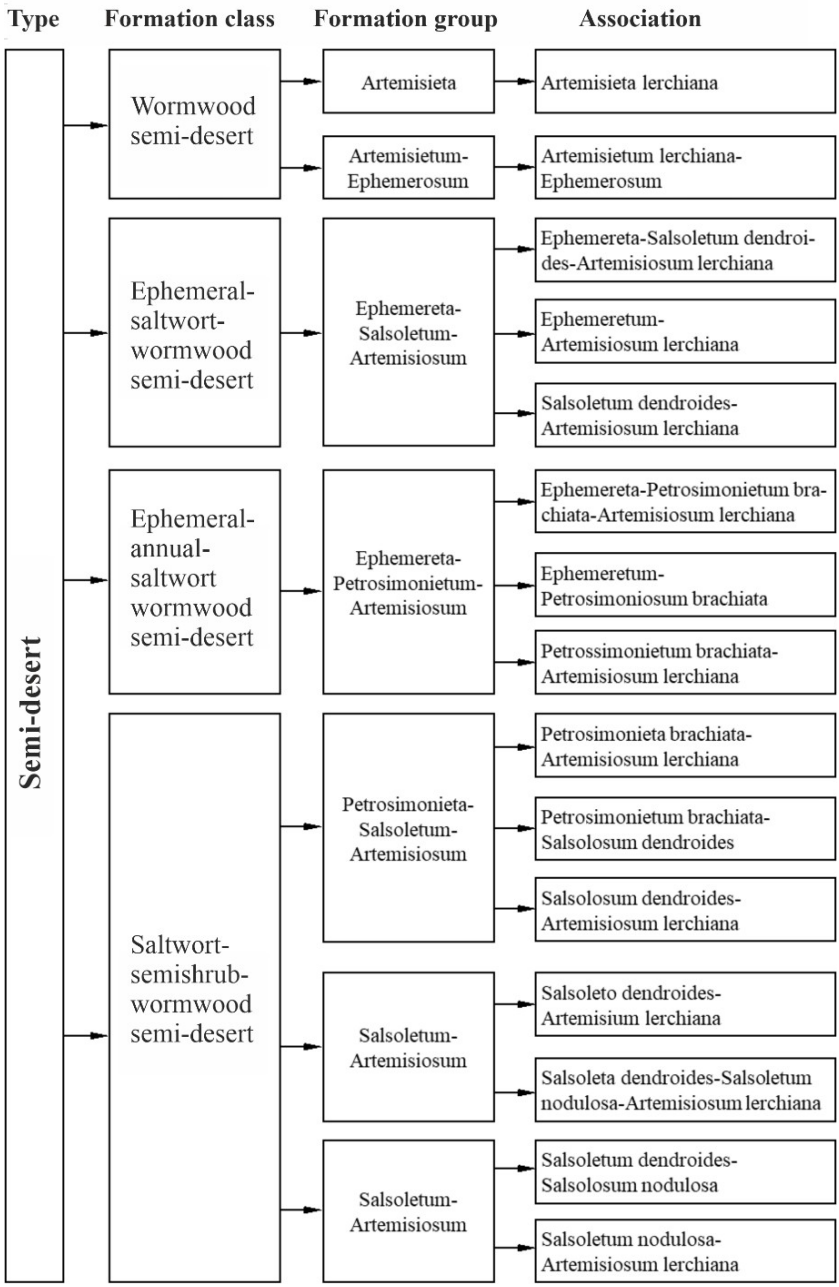
IV. Vegetation of saltwort and seaside psammophyte desert zone distributed in saline, brackish, meadow-gray, gray-brown, sand and sandy soils:

Desert vegetation. The study of the relief, climate, soil cover and phytocenological features of the research area made it possible to provide modern classification of saltwort (halophytic) and seaside sandy or psammophytic desert vegetation. Desert vegetation is formed in the form of strips in a wide and narrow range on the North Caspian coast - in the territory of Shabran, Siyazan and Khizi districts[34].

[34] Gurbanov, E.M., Huseynova, H.Z. Bioecological characteristics and importance of feed in xerophyts in the memorial desert plant of the Caspian coast // Аграрный научный журнал, -2021. №10, -p. 84-90.



Classification scheme 2. Shrub vegetation classification scheme



Classification scheme 3. Semi-desert vegetation classification scheme

Five (5) formation classes, 39 formations and 48 association groups were identified in the desert-type vegetation of the Caspian coast (classification scheme 4). The main elements of these coenoses are *Halostachys belangeriana* (Moq.) Botsch., *Salsola dendroides* Pall., *Suaeda microphylla* Pall., *Kalidium caspicum* (L.) Ung.-Sternb., *Artemisia lercheana* Weber and etc. saltwort desert plants.

Seaside sandy (*psammophyte*) desert vegetation. In the classification of sandy or psammophyte desert vegetation of the northern, middle and southern Caspian coast in the territory of Azerbaijan, 3 formation classes, 23 formations and 30 association groups were accepted as the main geobotanical or phytocenological classification units (classification scheme 5).

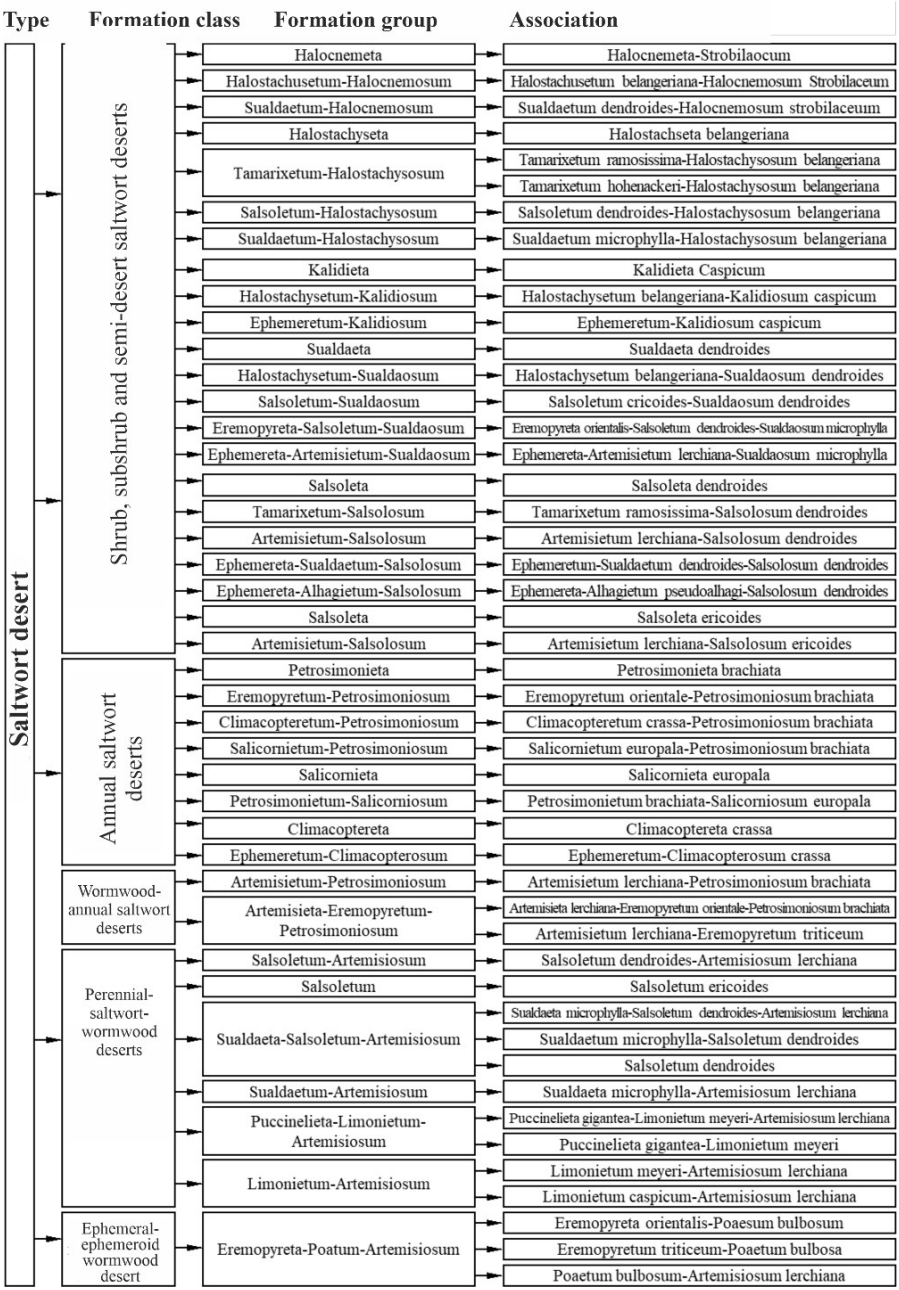
Out of 1054 species distributed in vegetation cover along the Caspian coast, 101 species (9.6%) belong to psammophytes. In the composition of these coenoses *Argusia sogdiana* (Bunge) Czer., *Suaeda confusa* Iljin, *Convolvulus persicus* L., *Lolium rigidum* Gaudin, *Artemisia scoparia* Waldst. et Kit., *Atriplex fominii* Iljin and other species are dominant and subdominant, or main elements as edificator.

I. Intrazonal vegetation developed on floodplain meadow-forest, light gray-meadow, meadow-brown, carbonate alluvial-meadow-gray soils:

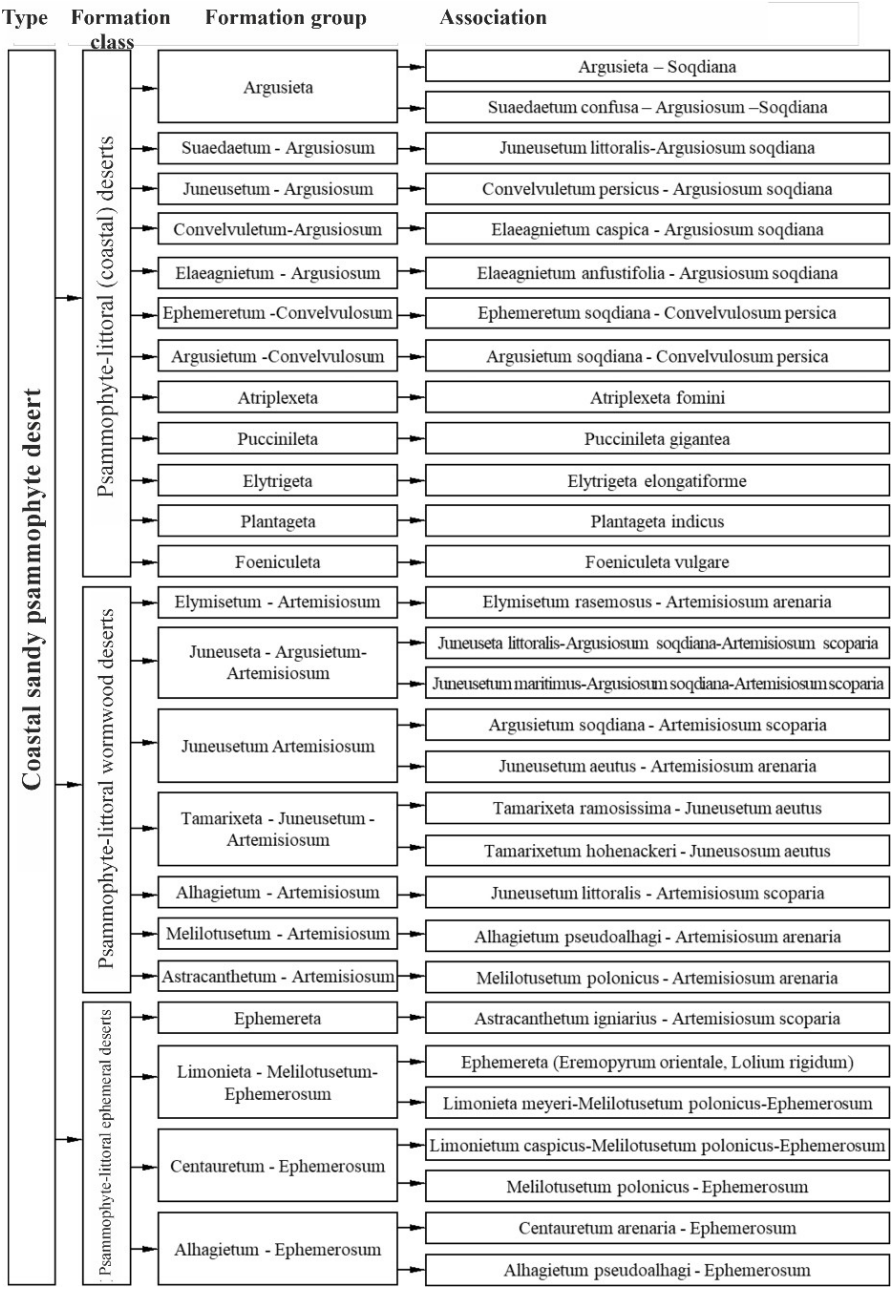
Hollow-meadow vegetation. The hollow-meadow phytocenoses spread on the Caspian coast are rich in the species composition of saltwort and psammophyte desert vegetation, including, mesophytic perennials are dominant due to the abundance in the hollow-meadow.

Hollow-meadow desert vegetation is characterized by a high projective cover or density, as well as hollow-meadow vegetation is intrazonal in a wide area along the Caspian coast.

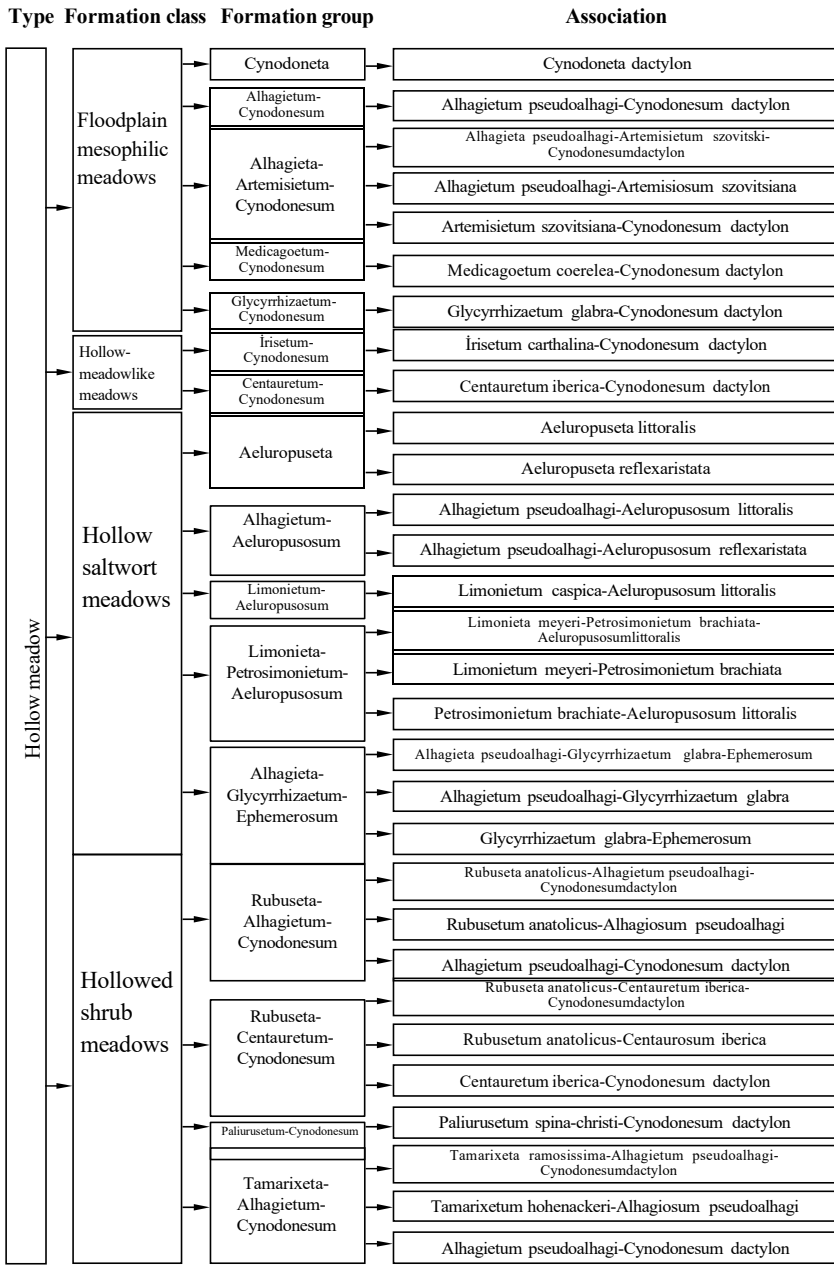
Four (4) formation classes, 16 formation groups and 31 associations were identified in the hollow-meadow vegetation formed on the Caspian coast (on the soils mentioned in the classification scheme) in the territory of Azerbaijan (classification scheme 6). In this vegetation, *Cynodon dactylon* (L.) Pers., *Alhagi pseudalhagi* (M.Bieb.) Desv. ex Shap., *Glycyrrhiza glabra* L.; *Medicago coerulea* Less. ex Nyman and etc. mesophyte species together form mixed coenoses.



Classification scheme 4. Desert vegetation classification scheme



Classification scheme 5. Seaside sandy psammophyte desert



Classification scheme 6. Classification scheme of hollow-meadow vegetation

II. Intrazonal vegetation distributed on irrigated alluvial-meadow and meadow-swamp and swamp soils:

Swamp vegetation. Swamp vegetation in the territory of the republic includes areas with excessive moisture, as well as swamp phytocenoses are found in standing water, brackish lagoons, lakes, water holes, and floodplain lands and and has intrazonality.

As a result of our researches, 2 formation classes, 7 formation groups and 9 associations were identified in the swamp vegetation cover in the Samur-Shabran lowland. The main elements of these coenoses includes *Phragmites australis* (Cav.) Trin. ex Steud., *Lemna minor* L., *Sparganium microcarpum* (Neuman) Raunk., *Arundo donax* L., *Cyperus longus* L., *Typha angustifolia* L., *Bolboschoenus macrostachys* (Willd.) Grossh. and etc. species.

During the research, the formation of new swamps was observed due to the flooding of the adjacent territory as a result of the rise and transgression of the Caspian Sea, and the remains of tugai forests were noticed in the lower reaches of the Kura River.

VI CHAPTER. PRODUCTIVITY, FORAGE QUALITY, CAPACITY AND ECOLOGICAL ASSESSMENT OF VEGETATION OF NATURAL FORAGE AREAS OF THE CASPIAN SEA COASTAL ZONE

In order to ensure the food security of the population in Azerbaijan, it is important to develop scientific and practical bases for the protection of the vegetation of natural forage areas, the effective use and improvement of biodiversity, including phytodiversity and the prevention of the degradation process. From this point of view, the productivity dynamics of semi-desert, desert and hollow-meadow phytocenoses, which are valuable forage sources for livestock in the Caspian coast area, their forage quality, grazing rate and vegetation cover spread in the growing environment and parameters of the ecological assessment of soils were investigated.

In order to analyze the productivity of winter pastures and village- adjacent grazings in the Caspian coastal area of our country, as well as the dynamics or variability of productivity according to formations, the last three-year data of Salyan-Neftchala, Khachmaz-Siyazan and Lankaran-Astara meteorological stations were referred

to. Forecasts of average monthly and annual air temperature and precipitation changes for the years 2016-2018 were taken as a basis.

6.1. Productivity, forage quality and capacity of winter pastures. In order to analyze the dynamics of the productivity of natural winter pastures on the Caspian coast, the climatic indicators of the Salyan-Neftchala administrative district were used[35].

Productivity, forage quality and capacity of *Artemisieta* formation. The vegetation cover of the formation is typical of the semi-desert type; productivity was determined in the winter pasture area of the Neftchala district located in the southern part of the Caspian coast (shown in contour No. 23).

Productivity of *Artemisieta* phytocenosis in autumn of 2016 was determined as follows: in wet mass 7,8 cent/ha (39.6%), in winter 6,0 c/ha (30.4%) forbs and in spring 5,9 c/ha (30.0%) grasses, as well as.

Productivity of *Artemisieta* phytocenosis in autumn of 2017 was determined as follows: (in wet mass) 6.3 c/ha (42.6%), in winter 4.7 c/ha (31.8%) and in spring 3.8 c/ha (25.6%), in spring (dry mass) 1,6 c/ha (16.2%) grasses, 1,0 c/ha (10.1%) legumes and in autumn 4,2 c/ha (26.3%) forbs.

Productivity of *Artemisieta* phytocenosis in autumn 2018 was determined as follows: (in wet mass) 5.2 c/ha (41.9%), in winter 3,9 c/ha (31.5%) forbs, in spring 2.1 c/ha (16.9%) grasses and 1.2 c/ha (9.7%) legumes (Figure 4).

Based on the results of the biochemical analyzes of the main forage plants in the vegetation cover of the *Artemisieta* formation, it can be seen that hygroscopic moisture in the biochemical composition is 13.0%, in absolute dry matter crude ash - 6.6%, crude protein - 8.9%, crude fat - 2.7%, crude fiber - 26.8% and NFE 42.0%. Based on forage quality (nutritional value) of this formation, 44.2 forage units and 4.5 digestible proteins were determined in 100 kg forage.

In general, based on the productivity, forage unit and optimal use (grazing) norms of *Artemisieta* formation, it is concluded that the winter pasture area where phytocenosis is spread belongs to the medium quality group or category.

[35] Gurbanov, E.M., Huseynova, H.Z. Classification and productivity of winter pastures in Lankaran-Mugan botanical-geographical region //Journal of Life Sciences & Biomedicine, -2021. Vol. 3(76), №1, –p. 84-90.

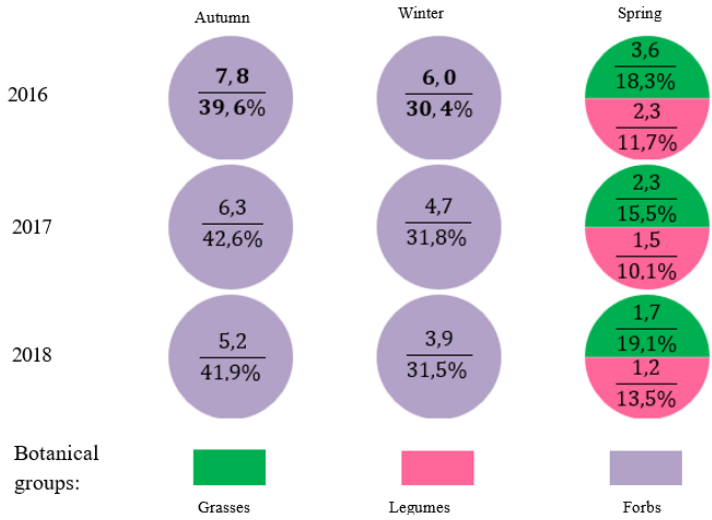


Figure 4. Variability of productivity of *Artemisieta* formation according to botanical groups (in wet mass, cent/%) by seasons

Productivity, forage quality and capacity of *Petrosimonieta* formation. The productivity of this formation was determined in the saline soils of the winter pastures of the Neftchala district (shown in contour No. 52).

Productivity of *Petrosimonieta* phytocenosis in the autumn of 2016 was (in wet mass) 5.3 c/ha (43.0%), in winter 3.4 c/ha (27.6%) forbs, in spring 2.0 c/ha (16.3%) grasses and 1.6 c/ha (13,0%) legumes (Figure 5).

Productivity in 2017 was determined as follows: in wet mass in spring - 3.7 c/ha (37.7%), in winter 3.0 c/ha (30.6%) forbs; in spring 1.8 c/ha (18.4%) grasses and 1.3 c/ha (13.3%) legumes.

Productivity in the autumn of 2018 was as follows: (in *Petrosimonieta* phytocenosis) in forbs on wet mass - 3.4 c/ha (38.2%), in winter - 2.6 c/ha (29.2%); in spring 1.9 c/ha (21.4%) grasses and 1.0 c/ha (11.2%) legumes.

Biochemical indicators of the biochemical analysis of the main for- age plants found in *Petrosimonieta* phytocenosis include hygroscopic moisture - 12.0%, crude ash - 5.8%, crude protein - 5.3%, crude fat - 2.6%, crude fiber - 29.1% and NFE - 45.2%.

Based on forage quality or nutritional value of *Petrosimonieta* formation, 36.0 forage units and 2.3 digestible proteins were

determined in 100 kg forage. The load of the pasture (1.1 heads per hectare) was determined taking into account the indicators - forage unit, productivity in dry mass, as well as the period of use of the pasture (210 days) and the daily forage rate (1.3 forage units) of the small cattle. In this regard, *Petrosimonieta* formation is included in the low quality (category) group based on productivity (8.6 c/ha in edible mass), forage unit and optimal grazing rate.

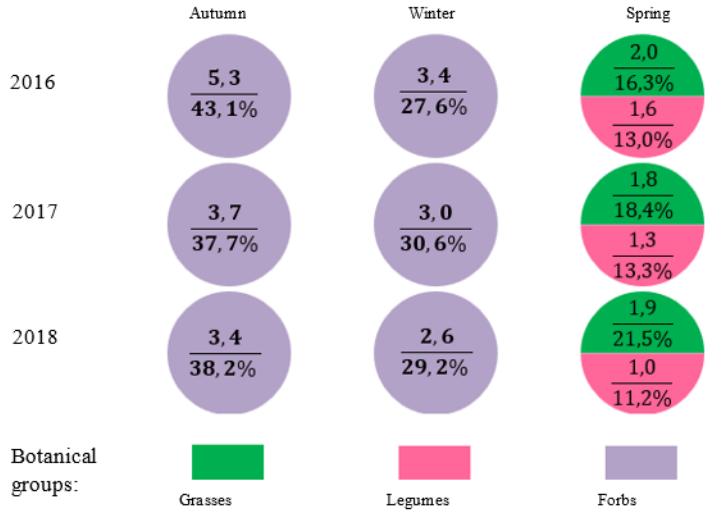


Figure 5. Variability of productivity of *Petrosimonieta* formation according to botanical groups (in wet mass, cent/%) by seasons

6.2. Productivity, forage quality and capacity of village-adjacent pasture areas. Climatic parameters of Siyazan (Khachmaz) and Astara (Lankaran) meteorological stations for the years 2016-2018 were examined to study the productivity and forage quality of village-adjacent grazing areas in common use of municipal property in the Caspian coastal area, as well as to determine the capacity and quality groups of grazings.

Productivity, forage quality and capacity of *Salsoleta-Artemisiosum* formation. Productivity of this formation typical of semi-desert vegetation is designated in the village-adjacent grazing areas (shown in contour No. 28) formed in the brackish gray-brown soils of the Boyuk and Kichik Hamya administrative-territorial

district of the Siyazan region in the Samur-Shabran lowland located in the northern part of the Caspian coast.

Productivity (in wet mass) of the *Salsoletum-Artemisiosum* phytocenosis in the village-adjacent grazing area studied in the autumn of 2016 by botanical grass groups was as follows: 8,3 c/ha (44,2%); in winter 5,4 c/ha (28,7%) forbs and in spring 3,2 c/ha (17,0%) grasses and 1,9 c/ha (10,1%) legumes.

Productivity (in wet mass) of the *Salsoletum-Artemisiosum* in the autumn of 2017 was as follows: 5,8 c/ha (35.8%), in winter 5,0 c/ha (30.9%) forbs and in spring 3.3 c/ha (20.4%) grasses and 2,1 c/ha (12.9%) legumes.

Productivity of this phytocenosis in the autumn of 2018 (in wet mass) was as follows: 5.3 c/ha (36.3%), in winter 4,6 c/ha (31.5%) forbs; in spring 2.9 c/ha (19.9%) grasses and 1.8 c/ha (12.3%) legumes (Figure 6).

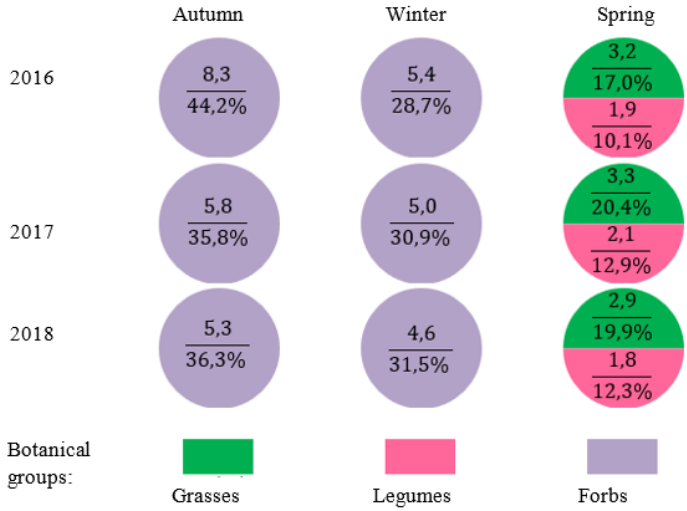


Figure 6. Variability of productivity of *Salsoletum-Artemisiosum* formation according to botanical groups (in wet mass, cent/%) by seasons.

The biochemical composition of phytocenosis according to the main forage plants recorded and collected in the *Salsoletum-Artemisiosum* formation is as follows: hygroscopic moisture - 12.4%, crude ash -7.4% in absolute dry matter, crude protein-10.0%, crude fat - 3.1%, crude fiber - 25.2% and NFE - 41.9%.

The productivity of *Salsoletum-Artemisiosum* formation studied

in the village-adjacent grazing area in the territory of Siyazan district is determined as follows: on dry mass, productivity – 11.0 c/ha, 53.3 forage units per 100 kg of forage, the period of use of the grazing area -245 days, the daily forage rate for small cattle - 1.3 forage units, for large cattle - 3.9 forage units. The grazing load (with head count) was calculated. Taking into account the productivity, nutritional value and capacity (optimal grazing) of the formation, the saltwort-wormwood phytocenosis belongs to the good quality group.

Productivity, forage quality and capacity of *Paliuruseta-Sambucusetum-Cynodonosum* formation. The productivity of this phytocenosis was determined in *Paliuruseta-Sambucusetum-Cynodonosum* formation distributed on padzol yellow soil in village-adjacent grazing area (shown in contour No.106) of Shiyakaran municipality of Astara administrative district located in the southern part of the Caspian coast (Figure 7).

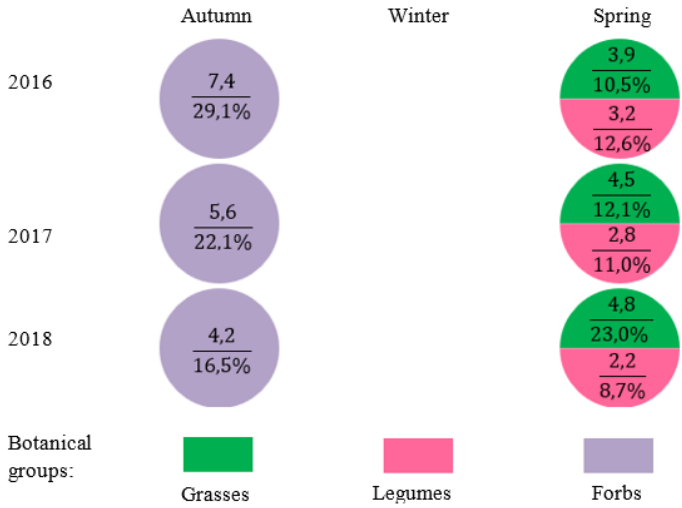


Figure 7. Variability of productivity of *Paliuruseta-Sambucuse-tum-Cynodo-nosum* formation according to botanical groups (in wet mass, cent/%) by seasons.

The productivity of *Paliuruseta-Sambucusetum-Cynodonosum* formation in the spring of 2016 was determined as follows: in wet mass, grasses 7.4 c/ha (29.1%), legumes 3.2 c/ha (12.6%); in autumn - forbs 3.9 c/ha (10.5%).

In 2017, the dynamics of the productivity of the formation, as we

mentioned before, directly depends on the air temperature and the rate of precipitation in the territory of Astara region. Thus, the air temperature in the spring in this region reached 12.40C, and the rate of precipitation - 119 mm.

In the spring of that year, the average productivity of the formation (in wet mass) decreased by 1.3 times compared to the previous year.

In the spring of 2018, the productivity (in wet mass) of the *Paliuruseta-Sambucusetum-Cynodonosum* formation was lower (about 3 times) than in previous years (this indicator is explained by the effect of air temperature and precipitation). In this regard, productivity in the spring of that year was as follows: grasses 4.2 c/ha (16.5%), legumes 2.2 c/ha (8.7%); in autumn forbs 4.8 c/ha (13.0%), as well as 3.5 c/ha (9.4%) grasses and 1.7 c/ha (4.6%) legumes. Biochemical composition of *Paliuruseta-Sambucusetum- Cynodonosum* phytocenosis was as follows: hygroscopic moisture - 14.0%, crude ash - 7.7% in absolute dry matter, crude protein - 8.5%, crude fat - 2.6%, crude fiber - 27.00% and NFE - 40.2%. Based on forage quality or nutritional value of formation, 50.2 forage units and 5.1 digestible proteins were determined in 100 kg forage.

The productivity of the formation in terms of dry mass is determined as 7.5 c/ha, 50.2 forage units per 100 kg of forage, the period of use of the grazing area -245 days, the daily forage rate for small cattle - 1.3 forage units, for large cattle - 3.9 forage units. Based on this, the grazing load (with head count) was calculated. The grazing area is included in the middle category group.

It should be noted that the productivity and nutritional value of the semi-desert, saltwort desert and hollow-meadow vegetation common in the natural winter pastures and village-adjacent grazing areas of the Caspian coast under study lays the basis for the environmental assessment of the soils where these phytocenoses are formed.

6.3. Ecological assessment of natural forage areas. Conducting research on protection of biodiversity in the period of modern scientific and technical progress, as well as investigating the effective use, productivity and nutritional value of plant and soil cover of natural forage areas; management and monitoring of pastures, i.e. assessment and forecasting of environmental control, is

of great importance for the ecological assessment of winter pastures and village-adjacent grazing areas in the Caspian coastal area.

Environmental assessment of *Artemisieta* formation. The vegetation cover of the *Artemisieta* formation distributed in the winter pasture area of Neftchala district, which is located in the southern part of the Caspian coast developed on gray soils. Here, the productivity of the "plant block" in terms of dry mass is determined as 10.4 c/ha and 44.2 forage units per 100 kg of forage (Figure 8), and the grazing rate is calculated as 1.7 head of cattle per hectare (table 9). Phytoecological parameters of under pasture lands - bioclimatic potential (0.8-1.80); the amount of humus (1.6%) was accepted as the main criterion in the "soil block". In this sense, the ecological (bonitet) score of gray soils, bonitet class (VII-VIII) was specified and assessed with 66 points.

As a result of agro-production grouping of under pasture lands (in the land block) based on productivity of phytocenosis, forage unit, grazing rate, as well as amount of humus in gray soils where they are distributed, ecological score and class (VII-VIII), it was determined that vegetation of *Artemisieta* formation is widespread in good or II group quality soils.

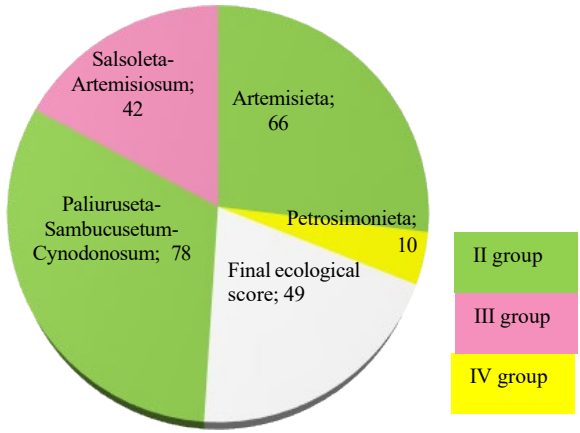


Figure 8. Ecological (bonitet) scores and quality groups of lands where phytocenoses are spread on *Artemisieta*, *Petrosimonieta*, *Salsoleta- Artemisiosum* and *Paliuruseta-Sambucusetum-Cynodonosum* formations in the Caspian Sea coastal area

Table 9. Productivity, forage unit of formations and phytoecological parameters of its soils in the natural forage areas of the Caspian Sea coastal area by vegetation.

Phytoecological parameters of soils	Types			
	Semi-desert	Desert	Semi-desert	Hollow-meadow
	Formations			
	Artemisieta	Petrosimonieta	Salsoleta-Artemisiosum	Paliuruseta-Sambucusetum-Cynodonosum
	Soil block			
Productivity (dry mass, c/ha)	10,4	8,6	11,0	7,5
Forage unit (in 100 kg of forage)	44,2	36,0	53,3	50,2
Grazing norm	1,7	1,1	1,8 0,6	1,2 0,4
Bioclimatic potential	0,8-1,80	0,8	0,8	3,00-4,40
Fertility indicator:	Soil block			
	Gray	Saline	Gray-brown	Yellow-podzol
Humus content, in %	1,6	0,3-0,8	1,0	3,0
Ecological (bonitet) score (scale)	66	10	42	78
Bonitet class	VII-VIII	I	V-VI	VII-VIII
Agroproduction (quality) groups	II group (good)	V group (conditionally useless)	III group (average)	II group (good)

Note: The indicators related to the "plant block" are given based on the geobotanical studies and biochemical researches conducted by us.

Ecological assessment of *Petrosimonieta* formation. Phytocenosis is common in saltwort desert vegetation in saline soils with low fertility in the territory of Neftchala district. The productivity of the corresponding formation, forage unit, grazing rate and indicators in the "soil block" recorded in the winter pasture area of the region have decreased compared to the *Artemisieta* formation (Figure 8). Thus, the main reason for the decrease in productivity of vegetation cover, forage unit and pasture load is the aridification of climate conditions in recent years, soil degradation (salinization, erosion) on the Caspian coast, and the succession and thinning as a result of excessive grazing of cattle in the winter pastures of the area, as well as increase of poisonous and harmful plants.

The productivity of this formation in dry mass is determined as 8.6 c/ha, 36.0 forage units per 100 kg of forage and grazing rate as

1.1 head of cattle per hectare. In this regard, the bioclimatic potential of the ecological parameters of the soils in the pasture area is determined to be 0.8; the amount of humus - 0.3-0.8%. Thus, the ecological or bonitet score of the saline soils where that phytocenosis formed was evaluated with 10 points.

Thus, from the agro-production grouping of winter pasture soils based on the amount of humus, bonitet score and class (I), it is clear that vegetation cover of the *Petrosimonieta* formation is found in conditionally unsuitable (group V) soils.

Ecological assessment of the *Salsoleta-Artemisiosum* formation. The vegetation cover of the *Salsoleta-Artemisiosum* formation recorded in the village-adjacent grazing area of the Siyazan district located on the Caspian coast occurs on gray-brown soils.

As reflected in Table 9, productivity of the corresponding phytocenosis on the "plant block" (in terms of dry mass) is determined as 11.0 c/ha, 53.3 forage units per 100 kg of forage; the grazing rate is calculated as 1.8 head of small cattle and 0.8 head of large cattle per hectare. In this regard, ecological parameters of the under pasture lands - bioclimatic potential 0.8 and the amount of humus 1.0% was accepted as the main criterion in the "soil block". Thus, the ecological or bonitet score of the gray-brown soils where this phytocenosis is spread was estimated as 42 points by specifying the amount of humus and the bonitet class (V-VI) (Figure 8). In particular, the fact that the gray-brown soils belong to the bonitet class (V-VI) means that the formation belongs to the medium-quality (group III) agro-production grouping.

Ecological assessment of *Paliuruseta-Sambucusetum- Cynodonosum* formation. Vegetation cover of this formation was recorded on yellow-podzol soils in the village-adjacent grazing areas of Shiyakaran administrative-territorial district of Astara region, located on the Caspian coast. So, as in parts of the Caspian coast, it is important to study the productivity, forage quality and the ecological assessment of soil fertility of the vegetation cover (typical to hollow-meadow vegetation) in Lankaran lowland, as well as in the grazing area in the territory of the mentioned region.

In general, the geobotanical composition, the productivity and nutritional value of the natural forage areas of the Caspian coast were

evaluated with ecological or bonitet scores according to the "plant block" and its parameters, as well as the "soil block" according to the fertility indicators. As a result, agro-production groups of soils where semi-desert, desert and hollow-meadow vegetation formed were discovered. *Artemisieta* is represented by 66 points, *Petrosimonieta* by 10, *Salsoleta-Artemisiosum* by 42 and *Paliuruseta-Sambucusetum-Cynodonosum* by 78.

Thus, the ecological assessment of the natural forage areas of the Caspian Sea coastal zone can be used in the implementation of actions on Land Cadastre, which is considered an important government event. Therefore, based on the ecological assessment of pastures and grazing areas, enrichment of the forage base of animal husbandry in our country, creation of agrophytocenoses to increase productivity and forage quality, its efficient use and improvement may necessitate the implementation and management of phytomeliorative measures.

CHAPTER VII. MEASURES FOR THE PROTECTION OF CASPIAN SEA COASTAL FLORA, EFFICIENT USE AND IMPROVEMENT OF PHYTODIVERSITY

In recent years, the country has paid special attention to biodiversity issues and much work has been done in this area, including the adoption of various legislations taking into account the importance of biodiversity. An effective form of *in situ* protection of biodiversity in the regions and achieving the stability of ecosystems is the organization of various types of specially protected natural areas (National Parks, State Nature Reserves, Sanctuaries) and etc, as well as the implementation of greening on the Caspian coastal area.

7.1. Measures for the protection of flora. In order to protect the flora and fauna of the Caspian Sea coastal area of Azerbaijan, five (5) National Parks (Samur-Yalama, Absheron, Shirvan, Gizilaghaj and Hirkan) were created.

For the first time, National Parks on the Caspian coast were studied by us with the aim of protecting their flora and vegetation.

The digression of flora and vegetation cover is intensifying as a result of cattle grazing in forest phytocenoses on the territory of National Parks, cutting of trees and bushes, as well as the

construction and use of anthropogenic landscape (irrigation, collector, oil field, etc.), including the influence of natural factors. For this reason, it was proposed to implement a number of measures aimed at protecting the wild flora of the territory. In particular, to prevent wind erosion or deflation that may occur in the coastal strip of the region, phytomeliorants suitable for the given area were selected for blown sand stabilization in coastal and plain areas.

7.2. Measures for efficient use of phytodiversity. Despite the fact that ecological-geobotanical studies are carried out for the effective use of biodiversity, including phytodiversity, the implementation of relevant measures remains tense.

Artemisieta, *Petrosimonieta*, *Salsoleta-Artemisiosum,* and *Paliuruseta-Sambucusetum-Cynodonosum* phytocenoses spread in parts of the Caspian coastal zone are not effectively used by legal entities and individuals. Here, the digression of the vegetation cover is intensified due to cattle grazing more than the norm. Therefore, a system of measures for the proper use of phytodiversity has been developed to prevent such negative effects[36] (table 10).

Appropriate measures include partial grazing (enclosure-pasturing system) of pastures-grasslands, creating pasture rotation depending on soil and climatic conditions and determining the load of those areas, optimal grazing periods. According to the load and quality groups of the pasture-grazing area, grazing from October-November to May 10 is purposeful for the efficient use of phytodiversity.

As can be seen from Table 10, simplificated improvement measures should be carried out by sowing the seeds of valuable forage plants such as *Artemisia lercheana* 2-6 kg/ha, rigid ryegrass 5-8 kg/ha, creeping cypress 4-6 kg/ha etc. in *Artemisieta* phytocenosis; dendroid saltwort 8-10 kg/ha, tall wheatgrass 6-8 kq/ha and etc. in *Salsoleta-Artemisiosum* phytocenosis for sowing in wormwood phytocenosis. According to our research, it has been established that 1,7 heads of small cattle are grazed per 1 hectare of wormwood formation in the winter pastures of the Neftchala district.

[36] Qurbanov, E.M., Hüseynova, H.Z. Cənubi Xəzər Sahilində (Astara Rayonu Timsalında) Bitki Örtüyünün Öyrənilməsi və Səmərəli İstifadəsi //-Bakı: Bakı Üniversiteti "Xəbərlər" Təbiət elmləri Seriyası, -2018. № 4, -s. 41-52.

Table 10. Measures for the effective use and improvement of phytodiversity in winter pastures and village-adjacent grazings of the Caspian coastal area by formations. Note: " +" sign is recommended, " -" sign is not recommended.

Formations	Name of measures	Optimal grazing period		8-enclosure-pasturing system	Harmful and poisonous plants to be destroyed	Forage plants for sowing		
		start.	end.			period	Name	norm kg/ha
Artemisieta	Effective use	10/X	10/V	+	Broadleaved pepperweed Wavy-leaf fleabane Capitate poppy Common stork's-bill Broadleaf cottonrose Scabrous milkwort	15/X	Artemisia lercheana Swiss ryegrass Creeping cypress Blue Lucerne Bulbous bluegrass	2-6 5-8 4-6 3-7 2-5
Petrosimonieta	Fundamental improvement	15/X I	15/IV	-	Buassye lettuce Caperbush Arabian thistle Spring erysimum Shober nitrebush	15/XII	Artemisia lercheana Rigid ryegrass Creeping cypress Blue Lucerne Desert wheatgrass	2-4 4-6 8-10 5-7 7-9
Salsoleta-Artemisiosum	Effective use, simplificated improvement	10/X I	5/V	+ +	Reddish onion Turkustan alison Spiny cocklebur Maiden-leaved hrysanthemum Wild radish	20/X	Dendroid saltwort Tall wheatgrass Artemisia lercheana Creeping cypress Japanese brome Alfalfa	8-10 6-8 2-4 4-6 6-8 4-7
Paliuruseta-Sambucusetum-	Simplificated improvement	25/I V	20/XI	-	Paliurus Dwarf elder Shovits thistle Hircanian Knapweed Caucasian eryngo	10/IX	Bermuda grass Common succoryn Arabian lucerne White sweet clover Foamy amoria	10-12 4-8 5-7 2-5 6-9

It can be concluded that in addition to taking measures to effectively use the natural forage areas of the Caspian Sea coastal area, it is also necessary to improve phytodiversity.

7.3. Measures for the improvement of phytodiversity.

Measures for simplificated improvement. Based on productivity, nutritional value, capacity of grazing areas and quality group of the *Salsoleta-Artemisiosum* (Siyazan district area) and *Paliuruseta-Sambucusetum-Cynodonosum* (Astara district) formation studied in the natural forage areas of the Caspian Sea coastal area, measures were developed for the simplificated improvement of phytodiversity.

These measures were also applied in the *Paliuruseta-Sambucusetum-Cynodonosum* formation (village-adjacent grazing area) where the grass cover is very sparse and less productive in the phytocenosis[37,38].

In the studied *Salsoleta- Sambucusetum- Artemisieta* formation (in the village-adjacent grazing area of Boyuk and Kichik Hamya municipality within Siyazan district), it is appropriate to destroy the reddish onion (*Allium rubellum*), Turkustan alison (*Alyssum desertorum)*, spiny cocklebur (*Xanthium spinosum*) that cattle do not eat. It is recommended to sow the seeds of forage plants (in autumn - November) such as dendroid saltwort (*Salsola dendroides*) – 8-10 kg/ha, tall wheatgrass (*Agropyrum elongatiforme*) – 6-8 kg/ha, *Artemisia lercheana* – 2-4 kg/ha for simplificated improvement in the corresponding phytocenosis. At the same time, it is necessary to regulate the water-air regime of the soil, to give organic and mineral fertilizers in accordance with agrotechnical rules, and to apply 1-2 cents/ha of nitrogen and 3-4 cents/ha of phosphorus fertilizers to these improved areas. Among other things, the yield can be increased by 1-2 times through the provision of artificial "raining" on grazing areas in the area of Siyazan district, as well as through the creation of

[37] Qurbanov, E.M., Hüseynova, H.Z. Siyəzən rayonu Xəzər sahili kənd ətrafı örüşlərin bitki örtüyü // Müasir təbiət və iqtisadi elmlərinin aktual problemləri. Beynəlxalq Elmi Konfrans. Gəncə Dövlət Universiteti, -Gəncə: -2019. II hissə, -s.11-14.

[38] Qurbanov, E.M., Hüseynova, H.Z. Şirvan milli parkın Xəzər sahili bitkiliyi // Gənc Tədqiqatçıların III Beynəlxalq Elmi Konfransı. Bakı Mühəndislik Universiteti. -Bakı: -29-30 aprel, -2019. -s.227-331.

a “basin” irrigation network. One of the measures for simplificated improvement is to enrich the low-yielding, trampled grazing area with perennial mesophytic plants (in *Paliuruseta-Sambucusetum-Cynodonosum* phytocenosis). This can be implemented by sowing seeds of bermuda grass (*Cynodon dactylon*) – 10-12 kg/ha, white sweet clover *(Melilotus alba*) – 6-9 kg/ha and etc. to soil surface by packing. Following the simplificated improvement of the semi-desert and hollow-meadow vegetation in the Caspian Sea coastal area, after the vegetation of the grass cover, measures for efficient use should be implemented.

Measures for fundamental improvement. In order to enrich the forage source of sheep farming in the southern part of the Caspian coast, to create agrophytocenosis or “cultivated pasture”, fundamental improvement of winter pastures is important. Due to the inefficient use of *Petrosimonieta* phytocenosis of desert vegetation and lack of improvement measures, the species composition of the vegetation cover decreased, the density in the structure became sparse, its productivity decreased and subjected to degradation. Therefore, it is recommended to implement measures for the fundamental improvement of the relevant plant coenosis in the territory of Neftchala region based on the geobotanical parameters.

From this point of view, during the fundamental improvement, it is advisable to wash out salts from the plowed area of saline soils to a depth of 25-30 cm in the vegetation cover of the *Petrosimonieta* formation using a drainage-collector network. In particular, depending on the condition of the plowing, this area should be treated several times. After the fields are prepared for sowing, *lerchian* wormwood (*Artemisia lercheana*), Swiss ryegrass (*Lolium rigidum*), mock cypress *(Kochia prostrata* (L.) Schrad.) and etc. xerophytic forage plants suitable for soil-climate conditions should be sown per hectare with 2-10 kg of seeds and “cultivated pasture” with high productivity by regulating the water-air regime of the soil be created. At this time, channel and collector water flowing towards the sea can be used. Before the implementation of measures, the fertility indicator (ecological parameters) of saline soils - humus, moisture conditions and other factors should be taken into account.

It should be noted that in order to prevent the erosion process,

the bushes should not be cut on the edge of the channel and collector in the winter pastures of the Lankaran-Mugan region; and it is advisable to plant shrubs belonging to drought-resistant tamarisk *(Tamarix),* pomegranate (*Punica)*, olive (*Olea*) and etc. genera that adapt to soil and climatic conditions.

In general, according to the results of multi-year geobotanical studies and researches, implementation of measures for the protection of flora in the Caspian coastal zone, the efficient use of natural forage areas, and the improvement of phytodiversity on floristic and ecological-phytocenological grounds are relevant in the protection of biodiversity. Therefore, the scientific bases of the protection of the wild flora of the Caspian coast, the effective use and improvement of phytodiversity have been studied in the territory of Azerbaijan.

The scientific and practical recommendations developed for the application or implementation of the above-mentioned measures in production were presented to the Ministry of Ecology and Natural Resources, Ministry of Agriculture and State Service for Property Issues under the Ministry of Economy. Ecological-geobotanical map of the northern, middle and southern part of the Caspian coast; the map regarding botanical-geographical zoning and the new distribution area of plant species has been registered in the Intellectual Property Agency of the Republic of Azerbaijan, and a certificate has been issued in this regard[39,40,41].

[39] Qurbanov, E.M., Hüseynova, H.Z. Azərbaycan Respublikası ərazisində Xəzər sahilinin botaniki-coğrafi rayonlaşdırılmasının xəritəsi/ Azərbaycan Respublikası əqli mülkiyyət agentliyi. Əsərin qeydiyyatı haqqında şəhadətnamə. №11147. - Bakı: 2019. - 1 v.

[40] Qurbanov, E.M., Hüseynova, H.Z. Azərbaycan Respublikası Siyəzən rayonu ərazisində "Siyəzənneft" neft və qazçıxarma idarəsinin ərazisində olan çirklənmiş torpaqların ekoloji-geobotaniki xəritəsi/ Azərbaycan Respublikası əqli mülkiyyət agentliyi. Əsərin qeydiyyatı haqqında şəhadətnamə. № 14/C-11057-20. -Bakı: 2020. - 1 v.

[41] Qurbanov, E.M., Hüseynova, H.Z. Xəzər sahili botaniki-coğrafi rayonları ərazisində bitki növlərinin yeni arealna dair xəritəsi [Xəritə] /Azərbaycan Respublikası əqli mülkiyyət agentliyi. Əsərin qeydiyyatı haqqında şəhadətnamə. №11145. - Bakı: -2019. - 1 v.

RESULTS

1. A conspectus of the wild flora of the Caspian coast was prepared and it was found that 1054 species of plants included in 506 genera belonging to 124 families were distributed. Of these, 40 species (3,8%) are mosses (*Bryophyta)*, 17 species (1,5%) fern-like (*Polypodiophyta*), 5 species (0,5%) horsetail (*Equisetophyta)*, 1 species (0,1%) gymnosperm (*Gymnospermae*) and 992 species (94,1%) angiosperm (*Angiospermae*).

2. In terms of the number of genera, *Astragalus* L. takes first place (15 species); *Trifolium* is represented by 12, *Veronica* by 11, *Carex, Medicago* and *Vicia* by 10 species each (30 species*); Avena, Bromus, Ranunculus, Galium* and *Orobanche* by 9 species each (45 species); *Cyperus, Atriplex, Salsola* and *Euphorbia* by 8 species each (32 species); *Poa, Chenopodium, Lathyrus, Lepidium, Geranium, Plantago, Centaurea* and *Scirpus* by 7 species each (56 species); *Verbascum, Linaria, Cerastium, Papaver, Sisymbrium* and *Nonnea* by 6 species each (36 species); *Trigonella, Juncus, Rumex, Polypogon, Amoria, Halothamnus, Gypsophila, Erodium, Viola, Lythrum, Artemisia, Carduus* and *Tragopogon* by 5 species each (65 species), as well as other genera by 296 species. There are 210 species in genera represented by few representatives (1-4 species). In general, all species were determined to be concentrated in 506 genera.

3. The analysis of plants (1054 species) distributed in the area flora according to life forms or biomorphs shows that therophytes dominate with 479 (45.5%) species, as well as hemicryptophytes are represented by 287 (27,2%) species, cryptophytes by 150 (14,2%), phanerophytes by 67 (6,4%), bryochamephytes by 40 (3,8%) and chamephytes by 31 (2,9%). Biomorphological analysis identified 956 species (90.7%): annuals 478 (45,4%), perennials – 428 (40,6%), biennials 50 (4,7%); shrubs 44 (4,2%); trees 23 (2,2%); semishrub 15 (1,5%); subshrubs 9 (0,8%) and semi-subshrub 7 (0,6%).

4. Based on ecological groups (according to water demand and granulometric composition of soils) xerophytes were registered with 199 18.9%) species, xerohalophytes with 4 (0.4%), halophytes with 53 (5.0%), haloxerophytes with 10 (0.9%), halomesophytes with 5 (0.5%), halopsammophytes with 78 (7.4%), psammoxeromesophytes with 20

(1.9%), psammohalophytes with 6 (0.6%), psammomesophytes with 28 (2.7%), psammomesoxerophytes with 2 (0.2%), psammohydromesophytes with 7 (0.7%), mesophytes with 151 (14.3%), mesoxerophytes with 197 (18.7%), mesopsammophytes with 39 (3.7%), mesohalophytes with 4 (0.4%), mesohydrophytes with 28 (2.6%), hydrophytes with 73 (6.9%), hydromesophytes with 15 (1.4%) and hydroxeropsammophytes with 4 (0.4%) in the flora of the Caspian coast.

5. Analysis of the division of species into 9 habitat types according to groups of botanical and geographical elements shows that on geographical habitat types, Ancient Mediterranean with 474 species (45.0%) and boreal with 349 (33.1%) type elements take the first and second place, then followed by desert - 82 (7.8%), ancient (tertiary) - 47 (4.5%), Caucasus - 36 (3.4%), adventive - 27 (2.5%), teppe - 13 (1.2%), unspecified - 15 (1.4%) and cosmopolitans - 10 (1.0%). New distribution areas of 21 species were discovered in botanical-geographical regions.

6. Endemic species were assessed according to IUCN criteria, and it was determined that out of them, 40 (65.6%) is classified in NE, 6 (9.8%) in VU, 5 (8.2%) in DD, 4 (6.6%) in EN, 3 (4.9%) in CR, 2 in (3.3%) NT and 1 (1.6%) in LC categories.

7. In the flora of the Caspian coast, 176 endemic species are found in botanical-geographical regions, of which 78 species are from the Caucasian range and 98 species are from the Azerbaijani range. Including, 12 species of Caucasian endemics (15.4%) and18 species (18.4%) of Azerbaijan endemics were found in Samur-Shabran lowland; 14 species (18%) of Caucasian endemics and 18 species (18,4%) of Azerbaijan endemics in Caspian coastal lowland; 14 species (18.0%) of Caucasian endemics, 27 species (27.6%) of Azerbaijan endemics in Absheron; 16 species (20.5%) of Caucasian, 19 species (19.4%) of Azerbaijan endemics in Gobustan; 3 species (3.8%) of Caucasian, 2 species (2.0%) of Azerbaijan endemics in Lankaran-Mughan; 15 species (19.2%) of Caucasian, 12 species (12.2%) of Azerbaijan endemics in Lankaran lowland, and 4 species of Caucasian endemics and 2 species of Azerbaijan endemics in other botanical-geographic regions.

8. Based on the ecological-geobotanical descriptions of the vegetation cover distributed on the Caspian coast, 7 types, 25 formation classes, 125 formation groups and 179 associations were recorded in phytocenoses.

9. “Geobotanical map of the natural vegetation of the northern, middle and southern Caspian coastal zone in the territory of Azerbaijan”, “Botanical-geographical zoning map of the Caspian coast in the territory of the Republic of Azerbaijan”, and “Map of new distribution areas of plants in the territory of botanical-geographic regions in the flora of the Caspian coast” at the level of formation groups shown in the scheme on the vegetation classification of Caspian coast were compiled on the basis of a modern computer program geographic information system (GIS).

10. Productivity of semi-desert, desert and hollow-meadow vegetation formed in the Caspian coastal ecosystem; productivity of *Artemisieta* (in mass) was determined as 10.4 c/ha and 44.2 forage units per 100 kg of forage, and the grazing rate was calculated as 1.7 head of cattle per hectare, in *Petrosimonieta, Salsoleta-Artemisiosum* (in dry mass) – 11.0 c/ha, 53.3 forage units per 100 kg forage; grazing rate – 1.8 head of small cattle and 0.8 head of large cattle per hectare and this was also determined in other formations (in 2016-2020) and forage quality, capacity and ecological assessment was carried out.

11. The recommendations developed on the protection of biodiversity and flora in the Caspian coast ecosystem in the territory of the Republic of Azerbaijan, and the effective use of vegetation cover have been sent to the relevant authorities.

RECOMMENDATIONS FOR PRODUCTION

1. “Geobotanical map of the natural vegetation cover of the Caspian Sea coastal zone in the territory of Azerbaijan” compiled by us for the first time on the basis of a modern computer program for the protection of the biodiversity, as well as wild flora and vegetation of the Caspian coast within the territory of the Republic of Azerbaijan, and the indicators on the productivity, forage quality, pasture capacity, including ecological and economic evaluation of lands can be used by the State Service for Property Issues under the Ministry of Economy of the Republic of Azerbaijan.

2. The creation of “cultivated pastures and grazings” for the purpose of efficient use and improvement of winter pastures and village-adjacent grazings on the Caspian coast, as well as reliable supply of

food products to the population, is of great importance in strengthening the forage base of cattle breeding, including nomadic sheep farming. In connection with the above, based on geobotanical research, we gave recommendations for the implementation of these measures by the Ministry of Agriculture of the Republic of Azerbaijan. In this regard, these recommendations should be taken into account when leasing winter pastures, as well as village-adjacent grazings located on the coast of the Caspian Sea, to individuals and legal entities.

3. Recommendations developed for the purpose of implementation of the issues of recording, monitoring and protection of flora of rare and endangered species distributed in the territory of National Parks on the Caspian coast have been submitted to the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan.

Recommendations play an important role in the protection of biogeocenoses, as well as natural phytocenoses and biotopes, in the ecosystem of Samur-Yalama, Absheron, Shirvan, Gizilaghaj and Hirkan National Parks on a scientific and methodological basis. In connection with this problem, it is appropriate to organize

"Stationaries" within the parks for the protection of endemic, subendemic, endangered species on the Caspian coast, and their bioecological research, to distribute photographs of wild flora and fauna in the form of booklets and posters, and to organize outreach and propaganda activities among the public for the purpose of protecting flora and fauna species.

The main content and scientific provisions of the dissertation are reflected in the following articles and theses:

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