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A B S T R A C T

of the dissertation for the degree of Doctor of Philosophy

FLORA DIVERSITY OF INTRAZONAL ECOSYSTEMS IN THE NORTH-EASTERN PART OF THE LESSER CAUCASUS

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INTRODUCTION

Relevance and degree of development of the topic. The climate of certain areas is highly variable depending on atmospheric processes. Vegetation cover also changes relative to the atmosphere condition, and it is difficult to explain these changes primarily due to the influence of climate. Sometimes it forms special vegetation that is not typical within the zone. Intrazonal vegetation which does not form an independent zone forms within the zonal vegetation cover. The vegetation of the relief elements of intrazonal character was very diverse: characterized with wetlands, flood meadows, water coast, saline and alkalinized vegetation, cryophilic meadows, tugai forests, subalpine, alpine, mountain xerophytes, rock-scree vegetation and etc. Along with phytocenoses of zonal character, the types of intrazonal vegetation found in the form of fragments within them are of special importance.

In certain periods, intrazonal vegetation prevails over zonal vegetation. Although the intrazonal vegetation does not cover very large areas, it is rich in fodder, food, medicinal, melliferous and essential oil plants. Economically important intrazonal plants are more common in flood meadows, saline areas, rocks and screes. Such important vegetation is beneficial not only for humans but also for animals and birds[1].

Complex research works were conducted towards the study of the flora and vegetation of the north-eastern part of the Lesser Caucasus.[2] However, the intrazonal vegetation of the area has not been studied in detail on scientific grounds. For this reason, it is extremely important to develop practical proposals and recommendations for the detection of taxonomic composition, bioecological features, life

[1] Ibadullayeva, S J. An overview of the plant diversity of Azerbaijan Biodiversity, Conservation and Sustainability in Asia / S.J.İbadullayeva, İ.M. Huseynova, M.Öztürk et al. (eds.), Springer Nature Switzerland AG, -2021: Vol.1.- p. 431-478.

[2] Гаджиев, В.Д. Высокогорная растительность Малого Кавказа (в пределах Азербайджана) / В.Д.Гаджиев, Д.А. Алиев, В.Ш. Кулиев, З.В. Вагабов - Баку: Элм, -1990, -211 с.

forms, coenoelements and geographical analysis of intrazonal flora in the north-eastern part of the Lesser Caucasus, distribution laws of vegetation, their effective use, protection and conservation.

The object and subject of the research. The object of the research is the plants distributed in the flora diversity of intrazonal ecosystems in the north-eastern part of the Lesser Caucasus. Its subject is to determine the taxonomic composition of the flora of the studied area, to study distribution patterns and directions of use.

Goals and objectives of the research. It consists of the studying the flora diversity of the intrazonal vegetation of the north-eastern part of the Lesser Caucasus, developing the scientific and practical bases of giving a modern classification of vegetation, its efficient use and protection.

At the same time, it is planned to fulfill the following tasks:

- Providing a complete inventory of the intrazonal flora in the north-eastern part of the Lesser Caucasus;
- Characterization of the intrazonal vegetation of the research area, separate study of swamp, meadow, steppe, flood-meadow, coast, alkalinized soils and forest vegetation;
- Providing a classification of intrazonal vegetation;
- Detection of anthropogenic effects on intrazonal vegetation;
- Development of measures for efficient use and protection of intrazonal vegetation

Research methods. Floristic, areological, phytocenological and other methods were used during the research. The species distributed in the intrazonal vegetation were named according to the modern nomenclature, and the plant groups formed by them were studied by experimental methods.

The main provisions submitted for defense:

✓ Clarification of the potential opportunities of intrazonal vegetation ensures the development of scientific bases for their efficient use and protection;

✓ River banks, wetland, flood meadows, different water basins, rocks and screes, hollow-meadows, tugai complexes, subalpine, alpine, mountain xerophytic vegetation are characterized by unique groups;

✓ Although the vegetation cover of intrazonal ecosystems is of an individual nature, it reflects the characteristics of the ecological conditions of the area where it is located;

Scientific novelty of the research. For the first time, an inventory of the intrazonal flora of the north-eastern part of the Lesser Caucasus was carried out, and it was found that the diversity of the flora consisted of 474 species belonging to 62 families and 250 genera.

Taxonomic structure, life forms, bioecological structure, geographical analysis of intrazonal flora, modern classification of vegetation are presented.

It has been determined that the intrazonal vegetation of the studied area is formed by the influence of edaphic factors - divided into the vegetation of river valleys, swamps, rock-screes, coast, bays, various water basins, saline and alkalinized soils.

For the first time, the patterns of distribution of intrazonal vegetation in the north-eastern part of the Lesser Caucasus were studied. It has been known that intrazonal vegetation reflects to a certain extent the regularities of the zonal vegetation where it is found, and due to the influence of factors, this vegetation turns into intrazonal vegetation.

Theoretical and practical significance of research. The materials described in the dissertation, the obtained results ensure the development of a system of measures for effective use and protection of intrazonal vegetation cover. The results on flora biodiversity are valuable for the compilation of the National Flora of Azerbaijan, regional floras and monographic collections of the vegetation of Azerbaijan.

Approbation and application. The main provisions of the dissertation work were discussed at the International Scientific Conference on current problems of modern chemical and biological sciences, Ganja (2016, 2017); Symposium on Euroasian Biodiversity, Antalya, Türkiye (SEAB-2016); Minsk, Belarus, (SEAB-2017); Kyiv, Ukraine, (SEAB-2018); at the XIX International Conference dedicated to the biological diversity of the Caucasus and southern Russia (Makhachgala, 2017); at the International Scientific Conference on current problems of modern natural and economic sciences, Ganja (2019, 2020); in the scientific council of Faculty of Chemistry-Biology

of Ganja State University (2015-2019); at the seminar and Scientific Council of the Institute of Botany, MSE RA.

On dissertation work 7 scientific articles, 10 theses (2 of them in AGRIS, РИНЦ) were published.

The organization where the dissertation work was performed. The dissertation work was performed at the Department of Botany of Ganja State University.

The structure and scope of the dissertation The dissertation consists of an introduction, seven chapters, a conclusion and a list of literature with 162 titles. There are 33 figures, 10 tables, and 1 map. In the structure of the dissertation title part and table of contents consist of 3 pages with 3403 characters, introduction - 4 pages with 6683 characters, the first chapter - 8 pages with 13713 characters, the second chapter - 5 pages with 7056 characters, the third chapter - 5 pages with 6212 characters, the fourth chapter - 24 pages with 27235 characters, the fifth chapter with 28 pages with 40285 characters, the sixth chapter - 15 pages with 22462 characters, the seventh chapter - 75 pages with 107108 characters, recommendations and conclusions - 2 pages with 2697 characters. The total volume of the dissertation consists of 181 pages of computer writing. The general text part of the dissertation (excluding figures, tables and the bibliography) consists of 236854 characters.

CHAPTER I. LITERATURE REVIEW ON THE STUDY OF INTRAZONAL VEGETATION

Dissertation interpretes a separate study of the rich, colorful nature and existing vegetation types of the Lesser Caucasus and a summary of the chronological analysis of scientific works and literature dedicated to the researches of botanists, geobotanists, zoologists, soil scientists, geographers and others.

CHAPTER II. NATURAL GEOGRAPHICAL CONDITIONS OF THE NORTH-EASTERN PART OF THE LESSER CAUCASUS

A brief description of the natural-geographic features of the research area was given, the relief, climatic conditions, hydrology, soil and vegetation cover of the area were analyzed.

CHAPTER III. MATERIAL AND METHODOLOGY OF RESEARCH

Researches were conducted in the north-eastern part of the Lesser Caucasus in the Hinaldagh (3370 m), Ganlidagh (2393 m), Kapaz dagh (3066 m) systems, in the Zayamchay, Shamkirchay, Korchay, Ganjachay, Kurakchay, Goshgarchay basins in 2015-2020. Data obtained from 5-year route and stationary studies were used in the preparation of the dissertation work. At the same time, the floristic, floristic-systematic, areological, botanical geographical, plant-sociological, statistical methods used in botany were taken into account. [3, 4].

The materials are stored in the Department of Botany of GSU. Materials of Tolmachev A.I., Hajiyev V.J., Yunatov A.A., Portenier N.N., Shkhagopsayev S.Kh., Novruzov V.S. and others were used in conducting research. In the analysis of the areals the concepts of Grossheim A.A., Mammadov T.S. were used with consideration of local materials. Life forms were given according to C.C.Raunkiaer and T.I.Serebryakov.

The works of researchers such as R.D.Yaroshenko (1967), A.R.Shennikov (1950, 1964), B.A.Bikov (1960, 1962, 1965), L.I.Prilipko (1970) etc. were used in the classification of vegetation.

Up to 500 herbarium materials covering the study area were collected. For adaptation of petrophytes to mountain systems, 45 high-altitude profiles were laid according to the work of S.Kh.Shkhagapsoev, 22 of which covered slopes and 23 the river basins. The profiles were laid in the Mount Kapaz system, Tovuz, Gadabey, Dashkasan mountain massifs, Esrikchay, Zayamchay, Goshgarchay and Ganjachay basins. Also, the route scheme of the research conducted in the north-eastern part of the Lesser Caucasus was drawn up in the form of a map (Figure 1).

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[3] Гроссгейм, А.А. Определитель растений Кавказа / А.А.Гроссгейм - Москва: - Наука, -1949, -747 с

[4] Портениер, Н.Н. Методические подходы, используемые при создании системы географических элементов флоры Кавказа // - Нальчик: Проблемы биологического разнообразия Северного Кавказа (тезисы докладов), КБГУ, - 2001, - с. 6-10.

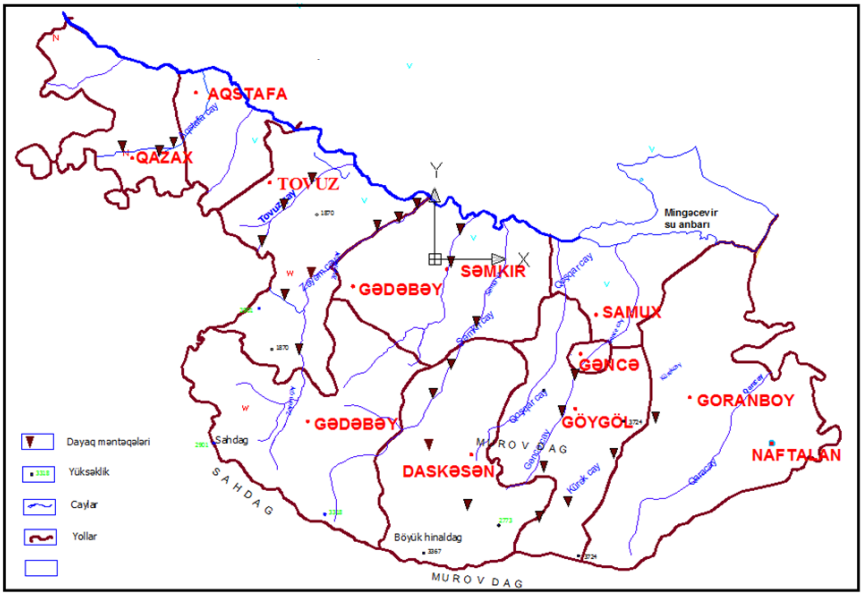

Figure 1. Route map of the research conducted in the north-eastern part of the Lesser Caucasus

Desktop studies were performed at the Department of Botany of GSU. It was studied on the basis of materials stored in the herbarium funds of Institute of Botany of MSE RA, BSU, ASAU and GSU. Researches were conducted according to the following scheme.

- Intrazonal vegetation of the middle and upper mountain belt (1600-2200 m)
- Intrazonal vegetation of subalpine and alpine zones (2200-2800 m)
- Intrazonal vegetation of subnival and nival belts (2800-3400 m)
- Intrazonal vegetation of forest, forest-steppe and shrubs (600-1800 m)
- Intrazonal vegetation of cryophilic meadows (2800-3200 m)
- Intrazonal vegetation of wetlands (400-2600 m)
- Intrazonal vegetation of river valleys (400-2200 m)
- Intrazonal vegetation of saline and alkalinized soils (400-450 m)

CHAPTER IV. FLORA BIODIVERSITY OF INTRAZONAL ECOSYSTEMS

As a result of the processing of literature data and field studies, it was found that the flora diversity of the intrazonal ecosystems of the north-eastern part of the Lesser Caucasus consists of 474 species of 62 families and 250 genera (Figure 2).

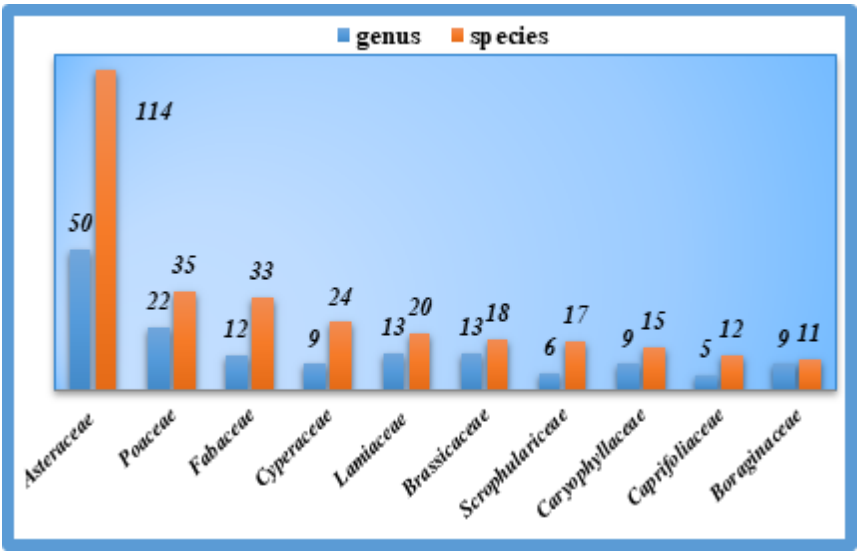

Figure 2. Leading families of intrazonal vegetation

Intrazonal vegetation of the north-eastern part of the Lesser Caucasus cover 299 species of 10 families and make up 63% of the flora. The families *Asteraceae* (114 species), *Poaceae* (35 species), *Fabaceae* (33 species), *Cyperaceae* (24 species), *Lamiaceae* (20 species), *Brassicaceae* (18 species), *Scrophulariaceae* (17 species), *Caryophyllaceae* (15 species), *Caprifoliaceae* (12 species), *Boraginaceae* (11 species) occupy the main place. The average density of the species in the family in the flora is 7.6%, and the average density of the genera is 4%.

The systematic composition of genera rich in species composition is reflected in the table below (Figure 3).

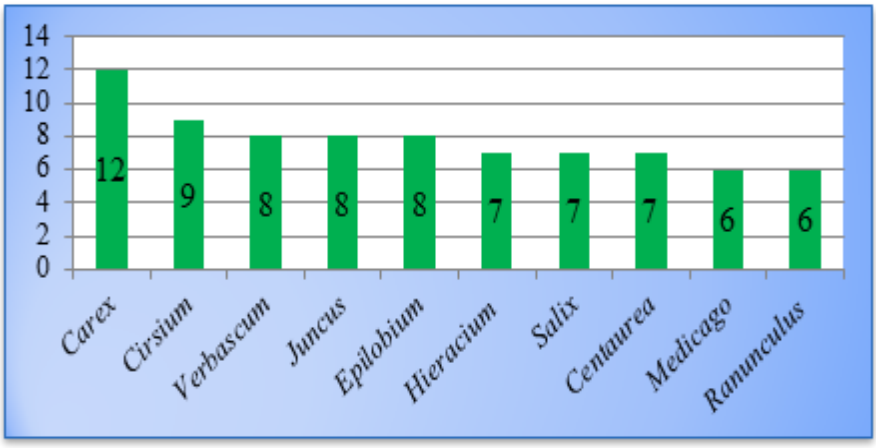

Figure 3. Leading genera of intrazonal vegetation

The analysis at the genus level shows that the genus *Carex* dominates with 12 species in the intrazonal vegetation of the study area and constitutes 2.5% of the studied flora. The genus *Cirsium* is represented by 9 species, each of *Verbascum*, *Juncus*, *Epilobium* genera by 8 species, each of *Hieracium*, *Salix*, *Centaurea* genera by 7 species, and each of *Medicago* and *Ranunculus* genera by 6 species.

The variety of mountain systems, river banks, marshy meadows, and saline areas covering intrazonal ecosystems has led to the non-homogeneity of the species composition and its formation under the influence of various ecological elements. The plant species found in intrazonal ecosystems mainly belong to the following ecological-phytocenological groups: high mountain deserts, cryophilic meadows, tall grasses, swamps, water-coastal vegetation, etc. Among the indicated ecological groups, there are also types of phytocenoses reflecting zonal characteristics. Since the flora of intrazonal ecosystems is formed in different ecological conditions, the bioecological characteristics of the species are not the same. The species distributed in intrazonal vegetation in the study area are grouped according to the following ecological groups (Figure 4).

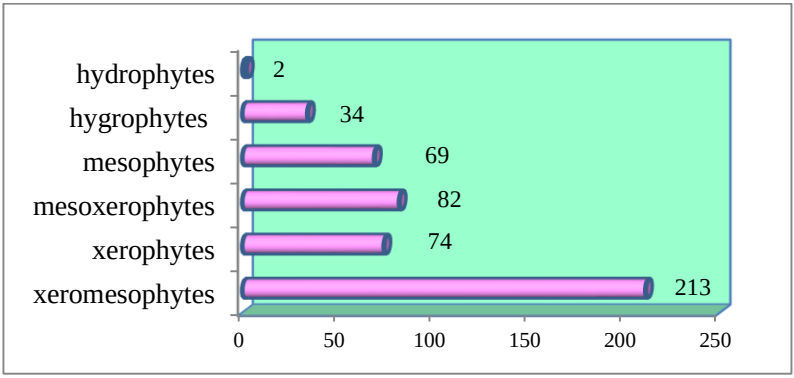

Figure 4. Ecological groups of species distributed in intrazonal vegetation

As it is seen from the table, xeromesophytes dominate in intrazonal vegetation and represented by 213 species which makes up 44.9% of the vegetation, xerophytes by 74 which makes up 15.6%, mesoxerophytes by 82 which makes up 17.3%, mesophytes by 69 which makes up 14.6%, hygrophytes by 34 species which makes up 7.2%, and hydrophytes by 2 species which makes up 0.4%.

The shortness of the vegetation period also affects the cycle of vegetative reproduction of many species.

Swamps in the study area are characterized by reed thicket, sedges and horsetail family. Marsh plants are characterized by a xeromorphic structure - a wax-like layer on leaves and stems, a strong development of the cuticle, and the presence of narrow leaves.

One of the integral parts of flora analysis is the determination of life forms of plants. Their composition, quantity ratio in the groupings provide not only information about the modern state of phytocenoses, but also provides necessary information about the historical information about the ways of their formation, future development paths, as well as about the possibilities of adaptation of plants to the current conditions. Indicators of life forms are the basis for the separation of different systematic groups and the creation of phylogenetic systems.

In recent decades, the expansion of research in this area has led to the emergence and wide dissemination of plant ecomorphology as

a free science.

The analysis of life forms of intrazonal vegetation in the north-eastern part of the Lesser Caucasus was carried out according to the system of Serebryakov and Raunkier.

In addition to these systems, during the analysis of life forms of the intrazonal vegetation of north-eastern part of the Lesser Caucasus, signs observed during field research were also used (Table 1).

Table 1

Analysis of life forms

Life forms		Species number	In %
According to the Serebryakov system			
1	Herbs (perennials)	284	60,3
2	Herbs (annuals)	145	30,6
3	Shrubs	29	6,1
4	Sub-shrubs	7	1,5
5	Trees	7	1,5
Total:		474	100
According to the Raunkier system			
1	Hemicryptophytes (Hc)	246	52,3
2	Therophytes (Th)	145	30,6
3	Chamaephyte (Ch)	36	7,6
4	Cryptophytes (C)	36	7,6
5	Phanerophytes (Ph)	7	1,5
6	Hydrophytes (H)	2	0,4
Total:		474	100

Based on Raunkier's classification, we classified hemicryptophytes to be species whose buds are at the ground level and are protected by a dead tissue cover and soil surface. Representatives of the *Asteraceae* (*Eupatorium cannabinum* L., *Filago arvensis* L., *Achillea tenuifolia* Lam. etc.), *Poaceae* (*Paspalum distichum* L., *Milium vernale* M.Bieb., *Agrostis gigantea* Roth. etc.), *Fabaceae* (*Ononis pusilla* L., *Medicago lupulina* L., *Lathyrus aphaca* L. etc.), *Ranunculaceae* (*Caltha palustris* L., *Ranunculus trichophyllus* Chaix.,

Clematis orientalis L. etc.), *Cyperaceae* (*Cyperus fuscus* L., *Isolepis setacea* R.Br. etc.) families prevailed here.

Therophytes include annual plants formed in the desert, semi-desert and steppes that spend the unfavorable period of the year in the seed state. Species such as *Filago arvensis* L., *Gnaphalium rossicum* Kipr., *Bidens tripartita* L., *Anthemis candidissima* Willd.ex Spreng., *Artemisia annua* L., *Senecio vernalis* Waldst.et Kit. etc. can be shown as an example.

Shrubs, semi-shrubs, and cushion plants that spread over the ground were classified as chamephytes. From chamaephytes in intrazonal vegetation species such as *Myricaria germanica* Desv., *Salix caprea* L., *Clematis orientalis* L., *Rosa canina* L., *Asparagus verticillatus* L., *Solanum dulcamara* L. can be shown as an example.

We have attributed intrazonal plants to cryptophytes, in which the buds remain below the ground and water. In the study area, from cryptophytes, species of families such as *Alliaceae* (*Allium convallarioides* Grossh.), *Poaceae* (*Polypogon monspeliensis* (L.) Desf.), *Cyperaceae* (*Carex riparia* Curtis.), *Juncaceae* (*Juncus inflexus* L. *J. bufonius* L.), *Convolvulaceae* (*Convolvulus cantabrica* L.), *Potamogetonaceae* (*Potamogeton berchtoldii* Fieber.), *Ceratophyllaceae* (*Ceratophyllum demersum* L.) etc. can be shown.

Phanerophytes were attributed those with buds in the air, that is, megaphanerophytes (trees taller than 30 m), mesophanerophytes (trees 8-30 m high) and microphanerophytes (trees and shrubs 2-8 m high). From phanerophytes, species such as *Salix aegyptiaca* L., *Alnus incana* (L.) Moench., *Prunus spinosa* L., *Tamarix romosissima* Ledeb. etc. can be shown as an example in the study area.

In the intrazonal vegetation formed in the north-eastern part of the Lesser Caucasus, hydrophytes were attributed those plants with vegetative shoots under water and which live in water *(Lemna trisuelia* L., *L. minor* L.)

During the study according to the occurrence areas (diversity) of the species, the intrazonal vegetation of the north-eastern part of the Lesser Caucasus was divided into several large ecological cenotic elements as steppe, forest, highland, petrophyte, wetland, semi-desert,

desert, indifferent (ruderal, weed) coenotic elements.

The steppe coenoelement combines species that are evolutionarily related to the steppe ecosystems conditions. Typical species of steppe coenoelement are *Euphorbia falcata, E.stricta, Linum austriacum, L.tenuifolium* etc.

The forest coenoelement mainly includes species of broad-leaved forests. Broad-leaved forest coenoelements include trees, woody shrubs and semi-shrubs, ivy and grass species (from trees *Alnus uncana, Ulmus glabra*, etc., from shrub plants - *Prunus spinosa, Rosa canina, R.villosa)*. Herbs are selected for their uniqueness and variety. Here, it is possible to find post-forest meadows and high grass.

The mixed forest coenoelement is found in the remnants of mid-mountain forests, in the ravines of the mid-mountain belt in the form of glades. *Salix exselca, S. triandra, Medicago lupulina, Geranium lucidum, Viola rupestris* and *Crataegus pseudoheterophylla* etc.

Representatives of subalpine tall grasses are mainly distributed in forest and subalpine zones. The species such as *Agrostis gigantea, Ranunculus baidarae, Thalictrum minus, Heracleum trachyloma* etc. were assigned to these coenoelements.

High-mountain coenoelements are divided into 3 subtypes: subalpine tall grasses, subalpine meadows, alpine meadows. Flora composition of phytocoenotic complexes of subalpine meadows differs according to ravines, humidity conditions and substrate characteristics. The species such as *Rorippa palustris, Reseda lutea, Amoria bobrovii, Campanula beauverdiana, Epilobium palustre, Swertia iberica* etc. were assigned to these coenoelements by us[5].

The alpine carpet coenoelement is mainly concentrated in the smooth plains and flat slopes in the upper parts. The composition of the carpet includes various species, and the height of the grass stand in that area varies mainly according to the relief and substrate

The petrophyte coenoelement includes rock-scree plants. Their flora composition is unique, and species found in ravines and stony

[5] Новрузов, В.С Кулиева Г.М. Криофильные луга и высокотравье как особый тип интразональной растительности северо-восточной части Малого Кавказа // Аграрная наука, - Москва: -2017, №2, 17, -с. 20-22

places were attributed by us.

Wetland ecosystems are caused by groundwater and abundant moist substrates. The elements of wetland, swamp and flood meadow are involved in the formation of vegetation. The species such as *Stachys palustris, Carex vulpina, C.diandra, Juncus inflexus, Orchis coriophora, Epipactis palustris*. are part of wetlands and flood meadows[6].

Petrophytes are also widespread in mountainous xerophytic zones. The species such as *Convolvulus lineatus, Paracaryum strictum, Scutellaria sedelmeyerae, Nepeta teucriifolia, Lallemantia iberica* etc. can be found here.

The species such *Heracleum trachyloma, Sideritis montana, Prunella vulgaris, Salvia verticillata* etc. can be found in forest ravines.

Weed, ruderal and adventive plant species are attributed to indifferent coenoelements by us. During our research in the north-eastern part of the Lesser Caucasus, species such as *Echium biebersteinii, Ajuga genevensis, Marribium propinquum, Solanum persicum* and etc. were attributed to these coenoelements.

The spread of these coenoelements was caused by unsystematic agricultural activities in the area, use as summer pastures, expansion of pastures by burning, and destruction of forest vegetation.

The analysis of species by coenoelement complexes shows that meadows and tall grasses prevail in the highlands. Forest formations are in the minority. Heliophytes and hydrophytes are not numerous here. These coenoelements are not found as zonal complexes but as intrazonal subelements within this or that vegetation type.

One of the integral parts of the flora analysis is the grouping of species with a similar areal into certain geographical elements. The analysis of geoelements makes it possible to clarify the ways of historical formation, origin, and migration of areals, and is a component of the general analysis of the flora. There have been different approaches among phytogeographers to the definition and

[6] Quliyeva, G.M. Cavadova G.M Gəncəçay hövzəsinin su-bataqlıq bitkiliyi // Azərbaycan Milli Elmlər Akademiyası Gəncə bölməs, Xəbərlər məcmuəsi, - Gəncə, -2019, № 4(78),- s.10-14

classification of geographical elements. The geographical elements of the flora are determined on the basis of modern areals.

The intrazonal vegetation of the north-eastern part of the Lesser Caucasus is defined by 4 geographical areal types (Figure 5).

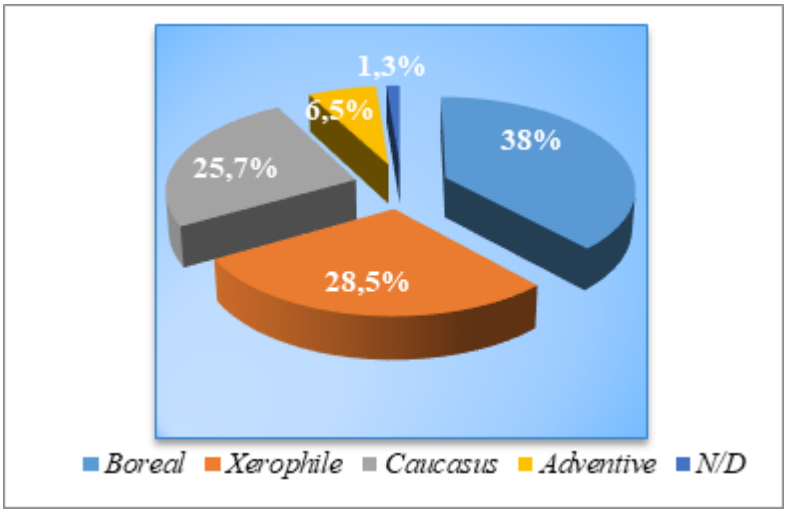

Figure 5. Geographical areal types

The Caucasian geographical areal type includes the areals within the borders of the Caucasus province. The areal type covers the Greater and Lesser Caucasus mountain systems.

The analysis of geographical elements shows that the majority of the species composition of the flora is made up of Caucasian species: *Carex hirta* L., *Galanthus transcaucasicus* Fomin., *Salix pseudomedemii* EL Wolf., *Rumex alpinus* L., *Gypsophila elegans* M. Bieb., *Ranunculus baidarae* Rupr., *Cardamine impatiens* L., *Draba nemorosa* L., *Rosa villosa* L., *Astragalus cicer* L. and etc. These species are diverse both in terms of ecological characteristics and geographical distribution. This can include rock screes, ravines, forest formations, and weeds.

The analysis of the north-eastern part of the Lesser Caucasus on the coenoelements shown that the species mostly belong to the rock-

scree ecotopes: *Hesperis matronalis* L., *Valeriana tiliifolia* (Troickij) V.E.Avet., *Draba nemorosa* L., *Epilobium algidum* M. Bieb. etc. The species such as *Heracleum chorodanum* DC.,*Viburnum opulus* L., *Cardamine impatiens* L. and etc. dominate in the forest formations. Caucasian elements are a minority in the formation of hydrophyte coenoses. From meadow plants *Geranium palustre* L., *Swertia iberica* Fisch.ex Boiss, *Stellaria persica* Boiss. etc, from weed plants *Sedum acre* L., *Taraxacum praticola* Dahlst.etc. are common.

The analysis of Caucasian species by zones shows that these elements are mostly concentrated in the subalpine zone (*Viola rupestris* F.W.Schmidt, *V. arvensis* Murray. etc.). It should be noted that the distribution of Caucasian species by zones has its own characteristic and specific features, which confirms the floragenetic diversity of species of the Caucasian areal type.

At the conclusion of the analysis of Caucasian elements, it can be concluded that this element has a great role in the formation of the intrazonal vegetation of the north-eastern part of the Lesser Caucasus, in the creation of the flora of separate zones, in the development of the main ecotopes and in the occurence of plant groups.

Species belonging to the Mediterranean and Iran-Turanian classes are grouped in the xerophilic areal type.

The characteristic species of the Mediterranean region include areals of two or more provinces of the Mediterranean and Caucasus regions. The species of this class do not have a great role in the formation of the intrazonal vegetation of the north-eastern part of the Lesser Caucasus. Its representatives are mainly found in mountain xerophyte (*Chenopodium vulvaria* L., *Glycyrrhiza glabra* L., *Silene iberica* Bieb. etc.) and in the forest zone, and a few in the subalpine zone.

Species included in the Iran-Turan class are distributed in several areas of Iran-Turan province. It covers *Tripleurospermum caucasicum* (Willd.)Hayek., *Cirsium rhizocephalum* C.A.Mey., *Trisetum rigidum* Roem.et Schult., *Arenaria rotundifolia* M.Bieb., *Cardamine uliginosa* M.Bieb. and etc. species in the study area. The species diversity of plants belonging to this class is mostly found in

the subalpine zone as in the Caucasian areal type, and to some extent in the alpine zone.

Species belonging to the Polearctic, Panboreal and Holarctic classes are grouped in the boreal areal type.

This includes species that are present in areals covering all provinces of the Holarctic and Boreal hemispheres existing in the Eastern and Western Hemispheres. Species of the boreal areal type play a key role in establishing the forest belt. In addition, these species are also widespread in the subalpine and alpine zones (*Carex cespitosa* L., *Poa trivialis* L., *Juncus compressus* Jasq., *Ulmus glabra* Huds. etc.).

Most of the species of the class are mainly distributed in high altitude zones. The sepcies such as *Viola rupestris* F.W.Schmidt., *Ajuga reptans* L. etc. can be shown. The species of this element are grouped by us into the following coenoelements. It was separated into rock-scree ecotopes (*Campanula latifolia* L., *Valeriana grossheimii* Vorosch.), wetland ecotops (*Juncus articulatus* L., *J.compressus* Jasq., *Carex cespitosa* L.), meadow ecotopes (*Campanula rapunculoides* L., *Ajuga genevensis* L.) and markedly indifferent ecotopes (*Asperugo procumbens* L., *Lappula patula* Asch.).

The Polearctic class includes the species of areals covering all three regions of the Holarctic world (Holarctic, Ancient Mediterranean and East Asia). Certain part of the poleotropic species is wild – ruderal (*Barbarea vulgaris* Opiz ex J.Presl., *Malva nicaeensis* All., *Asperugo procumbens* L), meadow plants (*Carex caucasica* Steven., *Trifolium repens* L., *Polygonum patulum* M. Bieb.), rock-scree (*Salvia verticillata* L, *Ziziphora tenuior* L.) plants.

The species belonging to the Panboreal class are widely distributed in the Borael regions of the Holarctic world in both hemispheres. Many studies have been conducted on the spread of the boreal type in the alpine and forest flora of the Caucasus.

The analysis of the distribution by altitude determines the distribution of most of the species belonging to the ponboreal class in the subalpine-alpine, forest zone. There are very few mountain xerophytic panboreal species in this zone.

The Holarctic class includes the species of natural areals of two

to three regions of the Holarctic world of the western and eastern hemispheres. A few species of the class are restricted to rock-scree ecotopes (*Oxyria digyna* Hill.). The remaining species are unevenly distributed on these coenoelements: meadow, forest flora (*Polystichum lonchitis* (L.) Roth etc.), wetland (*Primula auriculata* Lam., *Epilobium palustre* L.), weed–ruderal plants (*Poligonum patulum* M. Bieb., *Persicaria maculata* (Sibth.) Gray., *Galium odoratum* Scop., *Veronica beccabunga* L. etc.).

Due to their distribution in high zones, the species belonging to the holarctic class are active and are spread over two to three zones. The rest of the species are distributed in single-mountainous xerophyte, forest, subalpine and alpine zones.

The adventive areal type includes species that are somewhat widespread in two or more floristic regions. It includes 31 species. The species belonging to the adventive areal type are presented on the coenoelements determined by us. Rock and scree and devastated areas include species such as *Chenopodium album* L., *Cerastium glomeratum* Thuill., wetland vegetation - *Typha latifolia* L., *Potamogeton nodosus* Poir. *P. perfoliatus* L. and etc.

Thus, as a result of the conducted research, it was found that the species belonging to the Boreal areal type predominate and are represented by 180 species in the intrazonal vegetation and make up 38% of the vegetation, xerophilic areal type by 135 species and 28,5% of the vegetation, Caucasian areal type by 120 species and 25,7% of the vegetation, adventive areal type by 31 species 6,5% of the vegetation. The areal type of 6 species has not been determined, which makes up 1.3% of the intrazonal vegetation.

CHAPTER V. VEGETATION AND DYNAMICS OF INTRAZONAL ECOSYSTEMS IN THE NORTH-EASTERN PART OF THE LESSER CAUCASUS

Along with zonal vegetation, intrazonal vegetation also prevails in the Lesser Caucasus. As an intrazonal vegetation type, it is not typical for that natural zone, it does not form a free zone. It is formed by the influence of special edaphic factors. Occurs within one or more

zones. River valley vegetation, marsh vegetation, rock-scree vegetation, coast vegetation, bay vegetation and various water basin vegetation, saline and alkalinized soils vegetation belong to intrazonal vegetation.

The factors affecting the dynamics of the intrazonal vegetation of the north-eastern part of the Lesser Caucasus are multi-faceted and complex. It includes abiotic, biotic and anthropogenic factors. The influence of anthropogenic factors on the formation and succession of intrazonal vegetation is wider. Here the daily, monthly and annual fluctuation changes at the initial stage eventually turn into successions. However, despite this, intrazonal vegetation dynamics is not widely observed (Table 2).

Table 2

Grouping of intrazonal ecosystems

Study areas	*Family*	*Genus*	*Species*
Vegetation of flood and marshy meadows	18	36	80
Vegetation of saline ecosystems	13	21	36
Vegetation of cryophilic meadows	8	12	21
Intrazonal vegetation of ravines	14	26	55
Vegetation of Tugai forests	14	27	56
Intrazonal vegetation of Kurekchay	28	49	64
Intrazonal vegetation of Ganjachay	16	47	68
Intrazonal vegetation of Zayamchay	16	34	42

Vegetation of river valleys, swamp vegetation, rock-scree vegetation, coast vegetation and vegetation of various water bodies, vegetation of saline and alkali soils, vegetation of ravines, Tugai forests, cryophilic meadows belong to intrazonal vegetation.

In the study area, 7 plant associations were identified for the intrazonal vegetation of flood and swampy areas, of which 2 (*Bromus scopariseto - Juncus inflexsosum, Bromus scopariseto-Juncus inflexsosum)* are formed in flood meadows, 2 *(Carex vulpinaseto-Carex diandrasosum, Carex cesrpiteset–Carex dilutasosum)* in plain swamps, 3 (*Typha angustifoliceto-Phelum pratensosum, Phragmiies australiseto Scirpus sylvaticusosum, Tupha latifoliaceto-Sparganum erectumosum)* on the edges of water bodies. In the intrazonal vegetation

of flood and marshy areas, the families such as *Cyperaceae, Juncaceae, Poaceae, Ranunculaceae, Brassicaceae, Onagraceae, Lamiaceae* dominate.

Among the swamp phytocenoses, swampy forest vegetation is richer. Tree and grass vegetation are common here. The grass is distinguished by its rare color. The somewhat forest-like areas are rich in green mosses and mesophilic plants. There are a number of lakes such as Goygol, Maralgol, Aghgol, Zalligol in the territory of Goygol National Park. Traces of oligotrophic vegetation can also be found in areas that are somewhat poor in mineral nutrients. Despite the complete swamping of the land around the lakes, conditions are favorable for linden, willow, alder, aspen, poplar and other trees in the area. The height of the trees here is usually 15-20 m. They also differ in appearance. From grass plants, species of the genera such as *Equisetum, Veronica, Senecio, Poa, Galium, Carex* are predominant. In more humid areas, species of the genera *Equisetum* and *Carex* form underbrush.

Vegetation of saline soils is an important component of biological diversity in arid areas. Halophytic plants belong to intrazonal plants and can be found within several natural zones, because the presence of such plant types determines the salinization of the soil, which is related to the natural zone and climate. It is known that climate affects the distribution patterns of plants. The intrazonal nature of halophytic plants is mainly evaluated formally among dominants, and for this reason these plants are called zonal and also intrazonal.

Preservation of biodiversity of mountain ecosystem is one of the free problems of mountain regions. Cryophilic meadows are unique type of vegetation of snow-covered areas in the high mountains. The formation and spread of these meadows is largely determined by environmental conditions and lifestyle. They are more adapted to low-relief areas, where conditions are favorable for the accumulation of large masses. In these areas, the snow cover remains almost until the first half of summer, so the vegetation period here is sharply reduced.

They are more adapted to low-relief areas, where conditions are favorable for the accumulation of large masses. In these areas, the

snow cover remains almost until the first half of summer, so the vegetation period here is sharply reduced. This created conditions for the growth of bushes, mosses and lichens. The continuity of the season creates a limit for the development of this vegetation. Grass vegetation are more adapted to the nuances of the vegetation period, and they thrive better because there is no competition. The presence of a short vegetation period determines the extremely accelerated rhythm of vegetation development. Their vegetation - budding and flowering period is shorter than mountain vegetation.

Arctoalpine species that make up the general flora of cryophilic meadows form 2 associations: *Geranium albiflorum* and herb-biflorate violet. The floristic composition of cryophilic meadow types is poor. Some types of shrubs of the genus *Salix* are included in these types of vegetation. Flowering plants such as *Calamagrostis lapponica, Deschampsia glauca, Poa alpina, Lagotis minor, Pedicularis sudetica, Viola biflora, Geranium albiflorum, Potentilla delida, Stellaria peduncularis* are also characteristic of this area. *Veratrum lobelianum, Trollius europaeus* species are also characteristic for this area.

Forage plants do not occupy a large place in the floristic complex of ravine vegetation. Species such as *Saxifraga kolenatiana, S.juniperifolia, S.flagellaris, Draba bryoides, D.scabra, Sempervivum pumila, Andrsace barbula* etc. occupy an important place in the feed balance. In many cases, unsystematic grazing leads to impoverishment of grassland, erosion of slopes and formation of harmful and poisonous plants.

55 species of higher plants belonging to 14 families and 26 genera were identified in ravine flora based on determination of herbarium specimens collected in Chanlibel area ravines and literature source. Angiosperms make up 85.4% of the Chanlibel flora, of which 18% are monocotyledons and 67.0% dicotyledons. Five families, including legume (8), grass (7), aster (8), rose (8), pink (7) families dominate in the floristic spectrum of Chanlibel due to the richness of the species composition. The remaining 9 families are represented by only 1-2 species in the floristic spectrum and make up 41.9% of the Chanlibel flora.

Tugai forests are a special intrazonal landscape type that stretches in the form of a narrow strip along the rivers, and stretches in the form of ribbon along the banks of the Kura River. Unlike other forests, Tugai forests are peculiarly thick, densely bushy, with lianas, often impenetrable. In Tugai forests, species of the genus *Convolvulus* are wilding *Vitis* wrapped around trees and various shrubs such as *Prunus domestica*, *Crataegus pseudoheterophylla*, *Rosa canina, R. villosa*, *Berberis crataegina*, *Punica granatum*, *Swida australis*, *Rubus*, *Tamarix* and etc. which form impenetrable jungles.

Anthropogenic changes are weakly observed in the studied area. Grassy perennials form the basis of vegetation cover. Grass plants such as *Carex capillaris L, Mentha piperita L, Galium achurense Grossh, Ranunculus repens L, Stachys annua L, Lathyrus pratensis L.*- form edificatory dominance.

It was found that there are erosion forms that differ sharply from each other around the Kura River and Tugai forests have the ability to prevent erosion in the area.

The dynamics of intrazonal vegetation manifests itself more clearly in the vegetation of Zayamchay, Kurekchay and Ganjachay. The unique "island vegetation" of Zayamchay is formed in the area of Agbashli and Khinna valleys. "Island vegetation" is one of the original and unusual places of Zayamchay, and since it has an island character, the species composition is not very wide, as it is formed due to the seeds brought by the river waters. Forest, meadow, coast vegetation is found here. Species such as *Teucrium scordioides* L., *Ajuga reptans L, Siderites montana L., Mentha longifolia L., Carex diluta, C. cespitosa* and etc. from grass plants and *Tamarix smyrnensis* Bunge, *T. Ramosissima* L. etc. from sub-shrubs can be mentioned.

The geographical condition of the part of Zayamchay passing through the Khinna gorge creates conditions for the frequent loss of "island vegetation". Covering this area with tamarisk and dense reed vegetation is an indication of favorable moisture conditions. Species formed in the area have achieved the characteristic of tolerance in the process of adaptive evolution. Their ecological modification can act

as an indicator of the water environment. These species are adapted to the humidity conditions of the river throughout the year and are divided into ecological groups such as water-soil, water-helophytes, semi-submerged, floating-hygrophyte and fully submerged-hydatophytes. The mentioned ecological groups are characterized by their morphological uniqueness (long-stemmed, rosette type).

From March to June, large floods occur as a result of snow melting. During these months, 60-70% of the annual flow of the river flows. Such floods occurred in June 2016. As a result of the flood, 30 m^2 of "island vegetation" in the Khinna valley area of Zayamchay was completely destroyed.

CHAPTER VI. DISTRIBUTION PATTERNS, EFFICIENT USE AND PROTECTION OF INTRAZONAL VEGETATION IN THE NORTH-EASTERN PART OF THE LESSER CAUCASUS

Since intrazonal vegetation does not have a zonal character, regularity in its distribution is not observed. Intrazonal vegetation reflects to some extent the characteristics of the zonal vegetation in which it occurs. Under the influence of certain factors, this vegetation turns into intrazonal vegetation.

Food, fodder, melliferous, vitamin, essential oil, decorative and other important plants are also found in intrazonal ecosystems [7, 8].

The table below lists important species that are widespread in the study area and widely used. By using them effectively, the balance of natural complexes can be preserved (Table 3).

[7] Quliyeva, G.M. Kiçik Qafqazın şimal şərq hissəsinin intrazonal bitkiliyi məhsuldar qüvvə kimi // -Gəncə: Müasir təbiət elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans. II hissə, -2019, -s. 51-53.

[8] İsmayılova, Z.M., Quliyeva G.M. Kiçik Qafqazın şimal şərq hissəsinin intrazonal bitkiliyinin yayılma qanunauyğunluqları və səmərəli istifadə olunması // Müasir təbiət elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans. - Gəncə: II hissə, - 2017, - s. 28-30.

Table 3

Some useful species distributed in intrazonal vegetation

S	Genera	Species	Medicine	Food and feed	Dye	Decorative	With pollen and nectar	Essential oil
1	2	3	4	5	6	7	8	9
1	*Equisetum* L.	*E arvense*	+	+	+			
2	*Persicaria*(L.) Mill.	*P. hydropiper*	+	+	+			+
3	*Rumex* L.	*R. crispus*	+	+			+	+
4	*Berberis* L	*B. vulgaris*	+	+		+		
5	*Nasturtium* W.T.Ation.	*N. officinale*	+	+			+	
6	*Glycyrrhiza* Tourn.ex L	*G.glabra*	+	+	+	+	+	+
7	*Melilotus* Hill	*M. officinalis*	+	+	+		+	
8	*Tamarix* L.	*T. smyrnensis*	+		+	+	+	
9	*Hippophae* L.	*H. rhamnoides*	+	+		+	+	+
10	*Lythrum* L.	*L. salicaria*	+	+		+	+	+
11	*Carum* L.	*C. carvi*	+	+				+
12	*Daucus* L.	*D. carota*	+	+			+	+
13	*Mentha* L	*M.longifolia*	+	+		+	+	+
14	*Stachys* L.	*S. byzantina*	+			+	+	+
15	*Viburnum* L	*V. opulus*	+	+	+	+	+	+
16	*Achillea* L.	*A. millefolium*	+	+		+		+
17	*Anthemis* L.	*A.cotula*	+					+
18	*Artemisia* L.	*A. annua*	+	+	+	+		+
19	*Inula* L.	*I. helenium*	+		+	+	+	+
20	*Tussilago* L.	*T. farfara*	+	+			+	+

Rare and endangered species such as *Epipactis palustris* (L.) Crantz., *Ranunculus sceleratus* L., *Atriplex cana* Ledeb., *Viola rupestris* F.W. Schmidt., *Punica granatum* L., *Salix pentandra* L., *Tanacetum coccineum* (Willd.) Crierson., *Atropa belladonna* L., *Centaurea cheranthifolia* Willd. and etc. are also found in the study area.

Certain areas of the Lesser Caucasus are surrounded by wetland and flood meadows, forming intrazonal vegetation in that area.

Shrubs and sub-shrubs consisting of the species such as *Sphagnum sentrale* grow in mountainous swamps, in small areas, species such as *Capparis herbacea* (Willd.) Fici, *Sedum pallidum* M.Bieb., *Frangula alnus* Mill., *Datisca cannabina* L. species in hills. Plain swamps are richer in grass plants. In these areas near the coast, small forests belonging to species of the genus *Phragmites* Trin. are formed. Fragments of intrazonal vegetation are also observed along the basins of Ganjachay, Shamkirchay, and Tovuzchay. They are mainly elements of the Mediterranean Sea and are species that come ashore with flood waters. It includes species such as *Elymus repens*, *Achillea tenuifolia* Lam., *A. millefolium* L., *Hordeum murinum* (Link) Arcang.

Intrazonal plants have specific characteristics compared to zonal plants. Their populations have to gain adaptation opportunities with specific ecotopes in similar environmental conditions outside their range. For example: The morphological similarity between the rush jungles growing in the foothills and the species on the shores of Ganjachay and Shamkirchay is clearly noticeable [9] .

The restoration of a certain part of the study area that has been subjected to destruction, as well as the Tugai forests, can ensure the formation and restoration of intrazonal vegetation in the north-eastern part of the Lesser Caucasus.

Several series of associations were used to determine the dynamics of intrazonal vegetation and to evaluate its characteristics. Syngenetic, endoecogenetic, and exodynamic successions are observed among numerous reasons for the formation of intrazonal groupings of foothills under similar conditions and forms of ecosystem dynamics.

The characteristic features of all successions result in the suppression of one dominant species, taking its place, which is more related to the geographical position, moisture regime, inclination of slope, local soil and hydrological factors than to the climatic conditions of the area.

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[9] Novruzov V.S., Bayramova A.A., Guliyeva G.M. İntrazonal plantation and protection of the small Caucasus. // Sylwan Journal. Nr 3. Warszawa, Poland. 2017, P.238-245

CHAPTER VII. SYNOPSIS OF THE INTRAZONAL FLORA OF THE NORTH-EASTERN PART OF THE LESSER CAUCASUS

In this chapter, taking into account the regional characteristics of the north-eastern part of the Lesser Caucasus, extensive information is presented about the botanical description, growing area, and bioecological characteristics of the 474 species that are distributed in the intazonal vegetation type. Also, the names of each species distributed in this type of vegetation are given in Latin and Azerbaijani languages, and the species within the genera are characterized in alphabetical order.

RESULTS

1. As a result of the conducted research, for the first time, the flora of the intrazonal ecosystems of the north-eastern part of the Lesser Caucasus was studied and representation by 474 species belonging to 250 genera of 62 families was determined.
2. In the formation of intrazonal vegetation, the families such as *Asteraceae* (114 species), *Poaceae* (33 species), *Fabaceae* (33 species), *Cyperaceae* (24 species), *Lamiaceae* (20 species), *Brassicaceae* (18 species), *Scrophulariaceae* (17 species), *Caryophyllaceae* (15 species), *Caprifoliaceae* (12 species), *Boraginaceae* (11 species) take the main place. It was found that the average density of the species in the family is 7.5%, and the average density of the genera is 3.9%.
3. Analysis of life forms shows that in the intrazonal vegetation in the north-eastern part of the Lesser Caucasus, trees are represented by 7 species (1.5%), shrubs by 29 species (6.1%), subshrubs by 7 species (1.5%), perennials by 284 species (60.2%), annuals by 145 species (30.7%), also, phanerophytes by 7 (1.5%), chamephytes by 36 (7.6%), hemicryptophytes by 246 (52.2%), therophytes by 145 species (30.7%), and cryptophytes by 36 species (7.6%), hydrophytes by 2 species (0.4%)
4. According to the analysis of ecological groups, it was found that xeromesophytes dominate in intrazonal vegetation and represented

by 213 species (44.9%), xerophytes by 74 (15.6%), mesoxerophytes by 82 (17.3%), mesophytes by 69 (14.6%), hygrophytes by 34 species (7.2%), and hygrophytes by 2 species (0.4%).

5. The intrazonal vegetation of the north-eastern part of the Lesser Caucasus is grouped into 4 geographical areal types. It was found that Boreal areal type is represented by 180 species, xerophilic by 135, Caucasian by 120, adventive by 31 species. The areal type of 6 species was not determined.
6. 80 species belonging to 18 families and 36 genera were discovered for the flood and swampy meadows of the north-eastern part of the Lesser Caucasus, 36 species belonging to 13 families and 21 genera for saline ecosystems, 21 species belonging to 8 families and 12 genera for cryophilic meadows, 55 species belonging to 14 families and 26 genera for ravine flora, 56 species belonging to 14 families and 27 genera for the Tugai forests of the Kura coast, 64 species belonging to 28 families and 49 genera for Kurakchay ecosystems, 68 species belonging to 16 families and 47 genera for Ganjachay ecosystems and 42 species belonging to 16 families and 34 genera for Zayamchay ecosystems.
7. As a result of the research, it was determined that in intrazonal ecosystems, 20 species are used as medicine, 16 species as food and fodder, 15 species as essential oil, 13 species as flower pollen and nectar, 11 species as decorative, and 8 species as dye plants.

SUGGESTIONS AND RECOMMENDATIONS

1. Climate, soil and relief determine the diversity and distribution of the saline coenoses of ecosystems of the north-eastern part of the Lesser Caucasus. It is necessary to develop rarity criteria of plant groups and on the basis of them create a cadastre of rare and plant groups in need of protection of research areas.
2. As a result of the ineffective use of intrazonal vegetation as zonal vegetation for a long time and lack of improvement measures, the vegetation in some areas has been severely degraded, many rare species and plant groups are in danger of extinction, conditions for erosion, landslides and floods have arisen. A system of

phytomeliorative measures should be implemented that will allow the restoration of vegetation cover.

Scientific works published according to the topic of the dissertation

1. Bayramova, A.A., Quliyeva G.M. Kiçik Qafqazın Şimal Şərq hissəsinin su bataqlıq bitkiliyi // -Gəncə: Azərbaycan Milli Elmlər Akademiyasının Xəbərlər məcmuəsi, -2015. № 4 (62), -s. 12-19.
2. Quliyeva, G.M. Cavadova, E.F. Kiçik Qafqazın şımal şərq hissəsinin subasar və bataqlıqlaşmış çəmənliklərinin bitki örtüyü // Müasir kimya və biologiya elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans, - Gəncə: III hissə, - 2016, - s. 172-175.
3. Ismayılova, Z.M., Kuliyeva G.M. The biological diversity of the coastal vegetation of the North-Eastern part of the Smaller Caucasus. // Symposium on Euroasian Biodiversity SEAB-2016, abstract book. Antalya, Turkey. -p. 217
4. Новрузов, В.С., Кулиева Г.М. Криофильные луга и высокотравье как особый тип интразональной растительности северо-восточной части Малого Кавказа // Аграрная наука, - Москва: - 2017, №2, 17, -с. 20-22
5. Quliyeva, G.M. Kürəkçayın intrazonal bitkiliyi və dinamikası // - Gəncə, Gəncə Dövlət Universiteti, Elmi Xəbərlər, - 2017, №1, - s. 107-110.
6. İsmayılova, Z.M., Quliyeva G.M. Kiçik Qafqazın şimal şərq hissəsinin intrazonal bitkiliyinin yayılma qanunauyğunluqları və səmərəli istifadə olunması // Müasir təbiət elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans. - Gəncə: II hissə, - 2017, - s. 28-30.
7. Ismayılova, Z.M., Kuliyeva G.M. Tuqay woods a mean of intrazonal vegetation species. Symposium on Euroasian Biodiversity, Minsk, Belarus, SEAB-2017, p. 370.
8. Новрузов В.С., Кулиева Г.М., Джавадова Э.Ф. Флора и растительность субнивального пояса Гянджачайского бассейна // Материалы XIX Международной Конференции с элементами научной школы молодых ученых. Биологические разнообразия

Кавказа и Юга России, -Махачкала: -2017, с.233-235
9. Novruzov, V.S. İntrazonal plantation and protection of the small Caucasus / V.S.Novruzov, A.A.Bayramova, G.M.Kuliyeva [et al] // Sylwan Journal. N 3. Warszawa, Poland -2017, -p. 238-245
10. Ismayılova, Z.M., Kuliyeva, G.M. Flora biodiversity of Chenlibel massive // Symposium on Euroasian Biodiversity SEAB-2018, abstract book. Kyiv: Ukraine. -p. 370
11. Quliyeva, G.M. İntrazonal ekosistemlərin antropogen deqradasiyası // - Akademik Cəlal Əliyev və bioloji müxtəlifliyin genetik ehtiyatları. Respublika elmi praktik konfransın materialları. - Gəncə: - 2018, - s. 143-147
12. Quliyeva, G.M. Kiçik Qafqazın Şimal Şərq hissəsinin şoranlaşmış ekosistemlərinin bitki örtüyü // Akademik V.I.Ulyanişevin 120 illiyinə həsr olunmuş simposiumun tezisləri - Bakı -2018, - s. 61.
13. Quliyeva, G.M. Kiçik Qafqazın şimal şərq hissəsinin intrazonal bitkiliyi məhsuldar qüvvə kimi // Müasir təbiət elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans. II hissə, - Gəncə: II hissə, -2019, -s. 51-53.
14. Quliyeva, G.M. Zəyəmçayın "Ada bitkiliyi" və onun dinamikası // -Bakı: Azərbaycan Aqrar Elmi jurnalı, -2019, № 2, -s. 147-148.
15. Quliyeva, G.M. Gəncəçay hövzəsinin su-bataqlıq bitkiliyi / G.M.Quliyeva, E.F.Cavadova // - Gəncə: Azərbaycan Milli Elmlər Akademiyası Gəncə bölməsi, Xəbərlər məcmuəsi, - 2019, № 4 (78), - s. 10-14
16. Quliyeva, G.M. Kriofil çəmənlər–yüksək dağlıqların əsas bitkilik tipi kimi // Müasir təbiət və iqtisad elmlərinin aktual problemləri mövzusunda Beynəlxalq Elmi Konfrans, II hissə, Gəncə, 2020, s. 69-71
17. Новрузов В.С., Кулиева, Г.М. Флористическое разнообразие интрозональной экоситемы субальпийского пояса Товузчайского бассейна. // - Нижневартовск, Бюллетен науки и практики. - 2021, № 5, с. 18-23

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