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CHARACTERISTICS OF STEPPE VEGETATION OF DARIDAG

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ХАРАКТЕРИСТИКА СТЕПНОЙ РАСТИТЕЛЬНОСТИ ДАРИДАГА

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Abstract. The article provides information about the steppe vegetation type of the Darıdag area. The study determined that the cereal-miscellaneous mountain xerophytic steppe vegetation is locally widespread at an altitude of 1500-1900 m above sea level in Darıdag. This vegetation type is primarily found on steppe brown and grey-brown soils. A distinctive characteristic of the steppe vegetation is its predominance of grasses, with a notable absence of trees, and the presence of unique plant organisms that thrive in steppe conditions. The main dominants of the subalpine groupings of true steppes characteristic of the steppes of the Darıdag area are the dense grass-forming species *Festuca valesiaca*, *Stipa lessingiana*, *Koeleria pyramidata*, and *Agropyron pectinatum*. Despite the short-rooted *Bromus riparius* species being characteristic of the local vegetation, the grouping formed by its dominance is very random. The steppe vegetation type in the area is classified into two formation classes, two formation groups, and 12 associations.

Аннотация. Представлена информация о степном типе растительности Дарыдагского района. В результате исследования установлено, что на высоте 1500-1900 м над уровнем моря в Дарыдаге локально распространена злаково-разнотравная горная ксерофитная степная растительность. Этот тип растительности распространен преимущественно на степных коричневых и серо-коричневых почвах. Отличительной особенностью степной растительности является преобладание трав при заметном отсутствии деревьев, а также наличие уникальных растительных организмов, произрастающих в степных условиях. Основными доминантами субальпийских группировок настоящих степей, характерных для степей Дарыдагского района, являются густотравные виды *Festuca valesiaca, Stipa lessingiana, Koeleria pyramidata* и *Agropyron pectinatum*. Несмотря на то, что короткокорневищный вид *Bromus riparius* является характерным для местной растительности, группировка, образованная его доминированием, очень случайна. Степной тип растительности на территории района подразделяется на два формационных класса, две формационные группы и 12 ассоциаций.

Keywords: Darıdag, stepe, vegetation type, formation, association.

Ключевые слова: Даридаг, степь, тип растительности, формация, ассоциация.

Previously, the author provided information about the mountain-xerophytic type of vegetation of the Darydag region in the article “Mountain-Xerophytic Vegetation Type Found in Daridag” [1].

In the Darıdag area, steppe vegetation is more prevalent than in other regions. At altitudes ranging from 1500 to 1900 metres above sea level, the presence of cereal-multifoliate mountain

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xerophytic steppe vegetation is documented, albeit on a localised basis. This vegetation type is primarily found on steppe brown and grey-brown soils. The distinctive characteristic of the steppe vegetation is its predominance of grasses and the presence of unique plant organisms that are endemic to this ecosystem. These organisms are distinguished by their ability to thrive in harsh climates, contributing to a vibrant biological community. The distinctive leaves of steppe plants contribute to their aesthetic appeal, which can be described as delicate and charming. The steppe's floral kingdom is further distinguished by its vibrant spectrum of floral hues. Furthermore, each species of steppe plant emits a distinctive scent that pervades the atmosphere, contributing to the creation of a unique and specialised ecosystem. Their ability to withstand extreme conditions, including drought and heat, is a testament to their resilience and adaptability [18, 19].

The distribution of desert plants is indicative of their adaptability and the significance of their role in biodiversity conservation.

Material and research methods

The steppe flora of the Daridag area, which was selected as the object of the study, has not been the subject of any previous research, although many botanists conducting research in the Nakhchivan Autonomous Republic have herbarised steppe plants. However, this has not been sufficient to determine the full composition of steppe flora. It is noteworthy that the mountain xerophytic vegetation in the region has been the subject of general studies, with only a select number of areas having been the focus of purposeful research [3, 5].

Despite the fact that the vegetation of the Darıdag area has been the subject of general study, no detailed information has hitherto been provided about the vegetation of the area. Specifically, while the inventory of natural forage areas and mountain steppe vegetation cover throughout the republic has been the subject of detailed study, the information provided in the extant studies is already outdated.

Discussion and conclusions of the study

In the course of the research undertaken in the steppe zone, geobotanical principles were employed in conjunction with a process of mutual averaging and quantitative sorting of images. Indicators were determined using the dominant-determinant approach (indicators of environmental conditions). In addition, edificators, co-edificators, dominants and other characteristic species were identified. This enabled an ecological-phytocenotic classification of the steppe vegetation to be carried out.

Deserts are unique and irreplaceable zones in the biosphere, playing a vital functional role. Concurrently, in view of the diminution of the areas occupied by natural ecosystems, deserts appear to be the areas most affected by economic activity not only on a global scale, but also within the territory of the Nakhchivan Autonomous Republic.

A similar result can be obtained when comparing biomes in terms of the proportion of endemic and subendemic species that have become extinct or lost landscape significance over the historical period from approximately the 17th century to the present.

A considerable number of species that are endemic to the desert biome have become extinct, their numbers have declined significantly, or they have become entangled in anthropogenic ecosystems where their existence is entirely dependent on human activity.

Existing patches of steppe ecosystems are seldom extensive. However, the remaining areas of steppe ecosystems are sufficiently extensive to support viable populations of mobile vertebrates and accommodate the full range of diversity of steppe assemblages.

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The uncontrolled utilisation of steppe landscapes has culminated in the comprehensive eradication of steppe ecosystems across extensive regions. The intensive and protracted utilisation of these landscapes has precipitated deleterious alterations in the steppe vegetation, manifesting in phenomena such as the deterioration of phytocenoses and the degradation of vegetation. This has led to a marked decline in the steppe's capacity for self-regulation and restoration, resulting in a progressive state of deterioration. The most deleterious consequence of the degradation of the natural state of steppe groups is the loss of the stability of dominant plant species, which, during intensive grazing of territories, leads to the complete destruction of dominant species or their loss of stability.

Ecosystems become unstable and lose their capacity to sustain and regenerate their structure and function. Plant groups that are heavily affected and, as a result, severely damaged, develop in completely unusual directions for natural ecosystems and form atypical biotopes. Consequently, highly perilous processes become unstoppable.

The classification of the vegetation of the Caucasus, and more specifically the Nakhchivan Autonomous Republic, has been the subject of extensive research by numerous prominent botanists of the present era. In general, the establishment of substantial syntaxonomic units of vegetation is a matter that is rarely contested. However, when attempting to ascertain the extent of a particular vegetation type and its associated syntaxon, contentious issues emerge. The primary challenges in quantifying the vegetation of the "mountain steppe" are, firstly, the paucity of data on adjacent vegetation types and transitional groups between them, and secondly, the substantial modification of the vegetation cover characteristic of the steppes due to anthropogenic influences, particularly the persistent grazing of territories. Furthermore, the region exhibits a high degree of heterogeneity in natural conditions, which leads to significant variations in vegetation composition across short distances.

This approach is adopted on the basis that methodology, underpinned by ecological, floristic and florogenic principles, is the most appropriate for establishing a genetic classification of vegetation. The proposed classification of the plant type "mountain steppes" is hereby presented. It is important to note that these principles are more applicable to the subtype of "true steppes". Other subtypes, which are practically transitional to other vegetation types, are determined mainly on the basis of biomorphic features, and their extent is determined by floristic indicators.

In certain instances, researchers have theorised that the vegetation of the steppe may be a consequence of the destruction of forest vegetation. This hypothesis may also be applicable to the Daridag area.

P. M. Nuriyev, who conducted research on the steppe vegetation of the Autonomous Republic, has documented the presence of 690 wild species, classified into 218 genera, within the steppe vegetation [21].

V. V. Hatamov, an expert in the field of steppe vegetation in Azerbaijan, has documented 336 species of flowering plants in the high-mountainous and xerophytic-shrub-steppe regions of the autonomous republic [18].

A. Sh. Ibrahimov and other researchers who studied the economic importance of the vegetation of the Nakhchivan Autonomous Republic expressed divergent opinions in the study of the steppe vegetation [16, 20].

Notwithstanding the foregoing, detailed information about the vegetation of the Darıdag area has not been provided to date.

Mountain steppes are defined as a floristic type, characterised by a particular type of vegetation, which is found in both temperate and mountain warm-temperate climates. These groupings unite groups of oligothermic xerophilous herbaceous perennials, primarily meadow

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grasses, as well as representatives of steppe cryoxerophytic grass polycarpia, which are distinguished by their prolonged vegetation periods. In the Daridag area, steppe plants occupy the main areas of the territory, covering wider areas than in other areas. Notably, at elevations ranging from 1500 to 1900 metres above sea level, the vegetation is characterised by a distinctive form of mountain xerophytic steppe, exhibiting a variegation of cereal characteristics. The distribution of cereal-variegated mountain xerophytic steppes in these regions is predominantly characterised by the presence of steppe brown and grey-brown soils.

The present condition of pastures and grazing areas within the republic cannot be considered satisfactory. The precipitous rise in population and the concomitant demand for new biological resources and additional costs, in conjunction with the intensive exploitation of natural vegetation, the aspiration to achieve the requisite outcomes without effecting any modifications to the prevailing environmental control system, have engendered such a state of affairs. This has resulted in a considerable deterioration of the ecological balance, characterised by substantial soil erosion, degradation of natural ecosystems, depletion of pastures and grazing areas, and pollution, among other issues.

In the contemporary era, conducting a thorough and exhaustive study of flora and vegetation is imperative for the development of the most rational measures for the restoration, protection and enhancement of natural plant groups [3, 7, 12].

Given the preponderance of pastures in the autonomous republic within the steppe zone, a region that has undergone significant anthropogenic modification, there is an evident necessity for a comprehensive study of the contemporary status of the steppe flora and vegetation. The initial phase of the study should entail a scientific evaluation of the contemporary status and developmental trends of biogeocenoses, encompassing the characteristics of natural vegetation and an inventory of biogeocenoses. This is the foundation for formulating measures to ensure the efficient utilisation of natural resources. It is important to note that the steppe flora of the Darydag region has not yet been the subject of any deliberate study, despite the fact that numerous botanists engaged in research in the Nakhchivan Autonomous Republic have collected steppe plants for their herbaria. However, this has clearly not been sufficient to ascertain the complete composition of the steppe flora.

In this study, an attempt will be made to address several of the aforementioned questions regarding the mountain steppes of the region, with a particular focus on the Darydag area. The principal objective of this study is to address the existing lacunae in the extant literature concerning the flora and vegetation of the mountain steppes of the Nakhchivan Autonomous Republic. To this end, the following specific tasks have been delineated: a detailed study of the current state of the vegetation of the mountain steppes of the Darydag area of the Nakhchivan Autonomous Republic, the classification of vegetation within the type of "mountain steppes" and the detailed characteristics of individual syntaxons, a detailed comparative analysis of the steppe flora, clarification of floristic zoning, study of the history of the formation and development of the flora and vegetation of the Darydag mountain steppes. The study will also encompass the general characteristics of natural feeding grounds in the steppe zone, as well as the identification of rare and endangered species and plant groups that require protection.

In this study, steppes are considered as a single plant type that covers one of the high mountain belts. From a floristic perspective, it can be regarded as a partial flora. However, it is acknowledged that such a partial flora is not an isolated, closed system, but rather interacts with the surrounding flora.

The issue of the geographical position of the Nakhchivan Autonomous Republic within the system of botanical-geographical zoning of Transcaucasia has been a subject of interest for the scientific community for many years. Nevertheless, a consensus remains elusive regarding the

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precise affiliation of this diminutive territory with any particular floristic province. A more fruitful approach would be to explore the relationship between the Nakhchivan Autonomous Republic and the geographical position of Transcaucasia. The rationale behind this assertion lies in the fact that the Nakhchivan Autonomous Republic is situated within the zone of intensive influence of the centres of development of the Caucasian, Anatolian and Atropatena flora, at the intersection of the Boreal and Ancient Mediterranean semi-kingdoms. The Southern Transcaucasia is located at the foot of the extensive Zangezur and Daralayaz mountain ranges, which form a single region in terms of geomorphology of the Nakhchivan Autonomous Republic. In general, the conducted research also examined in detail the floristic relationships between individual parts of the mountainous areas of the Nakhchivan Autonomous Republic and adjacent areas, as well as high mountainous areas [2, 15].

In conclusion, a comprehensive study of the mountainous regions of the Nakhchivan Autonomous Republic from a floristic perspective reveals that the region's flora does not constitute a single floristic complex. The classification of its individual components into distinct phytochorions is a valid and logical approach. Conversely, a substantial array of species is endemic to the mountainous region as a whole, signifying the uniformity and similarity of the processes underlying florogenesis throughout its expanse. Secondly, all parts of the high-mountainous areas are subject to mutual influence, and, conversely, each of its parts is subject to a strong influence of the flora bordering it [5, 11].

The primary steppe communities of the Daridag area have not been adequately preserved to date, and only small fragments of their subalpine vegetation remain. The Stipa species in the meadows are gradually decreasing, but the main floristic core is preserved. The primary steppes have been superseded by secondary steppe communities, which are dominated by bearded grass (*Bothriochloa ischaemum*), and their structure often shares significant similarities. Secondary steppe communities, dominated by burning grass (*Bothriochloa ischaemum*), have emerged as a consequence of anthropogenic influences and often exhibit structural similarities to their primary steppe counterparts.

As a consequence of geobotanical research undertaken in the area, it was determined that the steppe vegetation of a cereal-multifoliate mountain-xerophytic nature is pervasive in the area at altitudes of 1500-1800 m above sea level, particularly on stony-gravelly southern and southeastern slopes. This vegetation is comparatively rich in terms of species composition and exhibits distinct ecological characteristics from other groupings [13, 14, 17].

Despite the presence of rocky and stony areas and the adoption of a local form in many regions, the vegetation of the Darıdag area is considered to be the primary vegetation type in terms of volume. In particular, within the northern and northwestern exposures, the incorporation of mixed shrub vegetation within the grouping serves to enhance species diversity and introduces distinct phytocenological characteristics. These plant groupings frequently colonise harsh terrain, becoming impoverished in species composition and assuming an open groupings form. In other regions of the autonomous republic, the presence of mesophytic elements in the relatively high-altitude grain-mixed mountain steppes has been observed to result in an enriched composition, resulting in a meadow-steppe nature and an ecologically mesophytic environment. However, in the Darıdag area, this phenomenon is not consistently observed, and although the composition of these groupings becomes relatively rich in altitude, the plant species are notable for their xerophytic nature.

Indeed, the mountain steppe vegetation of the Darıdag area, as in other regions, constitutes a type of transitional zone between high mountain steppes and mountain-meadow communities. However, the plant communities exhibit marked ecological differences depending on the

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geographical location of the area. The vegetation of these phytocenoses is predominantly composed of perennial plants. Of particular note is the perennial presence of various types of cereals within these groupings. These phytocenoses invariably manifest as open groupings. In the more inhospitable and stony regions of the cereal-variegated mountain-xerophyte groupings, there are also instances of sedge-thyme-loamy plants, which are not particularly characteristic of these areas and primarily manifest themselves locally [8-10].

In the cereal-mixed mountain-xerophyte groupings, cereal plants are the dominant species in areas with fine soil. Conversely, in stony-gravelly areas, the dominance of representatives of mixed herbaceous species with different compositions is manifested, and the previous stratification gradually changes.

Among the cereal species that dominate the composition of cereal-variegated mountain-xerophyte groups, *Festuca sclerophylla* Boiss. Ex Bisch., *Stipa hohenackeriana* Trin.& Rupr., *S.holosericea* Trin., *S.lessingiana* Trin. &Rupr., *Phleum phleoides* (L.) H.Karst, *Poa bulbosa* L., *P. pratensis* L., *Koeleria eriostachya* Pancic, *Trisetum rigidum* (M.Bieb.) Roem.&Schult., *Bromus variegates* M.Bieb., *Dactylis glomerata* L., etc. plant species are often found. These species, particularly *Festuca sclerophylla* Boiss., are of particular interest in this context. Ex Bisch., species belonging to the genus *Stipa*, manifest themselves as dominant species of the group in various areas. In areas where certain species of cereals prevail, particularly in regions characterised by a prevalence of herbaceous-sedge associations, cereals undergo germination and form dense turf in the substantial soil regions of the area.

Notwithstanding the xerophytic nature of the Darıdag area, the plant species that constitute the groups in these areas complete their vegetation periods with great rapidity, in accordance with the appropriate ecological conditions.

The mixing of various types of grasses in different areas, depending on the soil characteristics of the area, into the composition of cereal-mixed cenoses creates a special background in the general appearance of the phytocenosis, causing a change in the composition of the grouping. Of the various grasses that cause this change, the most common in the area are *Thymus kotschyanus, Th. collinus, Teucrium orientale, T.polium, Scutellaria sevanensis, Dianthys cretaceus, Hypericum elongatum, Potentilla recta, Ziziphora clinopodioides, Tanacetum aureum., Senecio vernalis, Galium verum, Allium woronovii, Filipendula vulgaris, Centaurea virgata, Prangos ferulacea, P.uloptera* and other plant species, which are included in the composition of the phytocenoses, create more colour. In groupings of cereals, cereals predominate and constitute the initial layer. This phenomenon is particularly prevalent in regions characterised by fine soil. Notable cereals include *Festuca sclerophylla, Thinopyrum intermedium, Stipa ehrenbergiana, S. capillata, Koeleria macrantha* and *Trisetum flavescens*, which play a pivotal role in the development of phytocenoses.

In plant groups comprising a mixture of cereals, cereals predominate, forming the initial layer. This phenomenon is particularly prevalent in regions characterised by fine soil. Notably, they are among the most prevalent types of cereals and play a pivotal role in the formation of phytocenoses.

During the summer months, which are characterised by high precipitation, plants belonging to the eponymous 'ephemeroid' category, including *Poa bulbosa*, among numerous other species inhabiting the 'cereal-variegated mountain-xerophytic vegetation' ecosystem, undergo a blooming and seed-setting process prior to the onset of high temperatures, which invariably result in the death of their above-ground components. The dominant species of the subalpine groupings of the true steppes characteristic of the steppes of the Darıdag area are the dense grass-forming species *Festuca valesiaca, Stipa lessingiana, Koeleria pyramidata* and *Agropyron pectinatum*. Although the short-rooted species *Bromus riparius* is characteristic of the vegetation of the area, the grouping formed by its dominance is very rarely encountered.

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In the relatively stony areas of the region, cereals are often replaced by various grasses, including *Thymus kotschyanus, Th. collinus, Galium verum, Senecio vernalis, Teucrium polium, Centaurea squarrosa, Scutellaria sevanensis, Ziziphora rigida, Z. biebersteiniana, Dianthus cretaceus, Tanacetum kotschyi, Alissum turkestanicum,* and *Filipendula vulgaris*, amongst others. It is evident that the prevalence of cereal species is undergoing a gradual decline. In certain instances, legume species such as *Astragalus arguricus, A. regelii, Onobrychis transcaucasica,* and *Medicago caerulea* are incorporated into the mixture with the intention of enhancing the colouration (Table).

Table

STRUCTURE AND SPECİES COMPOSİTİON OF CEREAL-DİVERSE STEPPE VEGETATİON

№	*Species name*	*Abundance, point*	*Height with cm*	*Tier*
1	*Festuca sclerophylla* Boiss. ex Bisch.	2-3	70-150	I
2	*Thinopyrum intermedium* (Host) Barkworth & D.R.Dewey.	1-2	45-75	I
3	*Teucrium polium* L.	2	12-27	III
4	*Stipa ehrenbergiana* Trin. & Rupr.	2	40-60	II
5	*S. capillata* L.	2-3	35-65	II
6	*Prangos ferulacea* Lindl.	1-2	40-70	I
7	*Koeleria pyramidata* (Lam.) P.Beauv.	2-3	15-60	II
8	*Koeleria macrantha* (Ledeb.) Schult.	1-2	15-30	III
9	*Trisetum flavescens (*L.) P.Beauv.	3	35-75	I
10	*Thymus kotschyanus* Boiss& Hohen.	3-4	8-16	IV
11	*Agropyron cristatum* (L.) Gaertn.	1-2	35-47	II
12	*Scutellaria sevanensis* Sosn. ex Grossh.	1-2	15-18	IV
13	*Dianthus cretaceus* Adams	2	15-38	III
14	*Centaurea virgata* Lam.	2-3	25-55	II
15	*Tanacetum aureum* (Lam.) Greuter.M.V.Agab.& Wagenitz.	1	10-15	IV
16	*Tanacetum* kotschyi (Boiss.) Grierson	1-2	16-25	IV
17	*Prangos uloptera* DC.	1	30-35	III
18	*Pastinaca glandulosa* Boiss. & Hausskn	1-2	25-30	III
19	*Ziziphora. biebersteiniana* (Grossh.) Grossh.	3	10-25	IV
20	*Z. clinopodioides* Lam.	2-3	25-30	III
21	*Plantago atrata* Hoppe.	1-2	10-32	III
22	*Allium woronowii* Miscz. ex Grossh.	1	5-10	IV
23	*Filipendula vulgaris* Moench	14-5	35-40	III
24	*Onobrychis transcaucasica* Grossh.	4	40-55	II
25	*Medicago lessingii* Fish. & C.A.Mey. ex. Kar.	3-4	20-75	I
26	*Astragalus arguricus* Bunge	1-2	25-30	III
27	*A.echinops* Aucher.ex. Boiss.	1-2	25-30	III
28	*Galium verum* L.	1-2	30-35	III
29	*Senecio vernalis* Waldst. &Kit.	4-5	13-60	II
30	*Thymus collinus* M.Bieb.	1-2	10-25	IV
31	*Hedysarum atropatanum* Bunge. ex Boiss.	1	10-20	IV

With the arrival of spring, the area seems to come alive. Plant species develop one after the other. In particular, the rapid development and flowering of ephemerals and ephemeroids add to the colour of the area. These species complete their growing season, flower and seed before the temperatures drop. It is evident that cereal-herb steppe areas are subject to extensive grazing, thereby engendering conditions conducive to the transformation of the phytocenosis, the

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acceleration of soil erosion, and the incursion of non-native plant species into the area. This phenomenon culminates in alterations to the forage composition of the pastures. Accordingly, the steppe vegetation of the Darıdag area is classified in the following manner.

Type: Steppe vegetation

Formation class: Mountain xerophytic steppes with cereals and various herbs
Formation: *Stipeta capillatae*
Association:
1. *Stipa capillata*
2. *Stipa capillata - Festuca valesiaca -varioherbosum*
3. *Stipa capillata - Atraphax spinosa - Herbosae*
4. *Stipa capillata - Thymus kotschyanus - Astragalus arguricus*
5. *Stipa capillata - Festuca sclerophylla - Thymus kotschyanus-varioherboso*
6. *Varioherboso – qraminoso - fructosum*
7. *Varioherboso – qraminoso - Stipa capillata*
8 *Varioherboso – qraminoso - Pastinac armeniaca*
9. *Festuca sclerophylla – varioherboso - Stipa capillata*

Formation class: Gariga-type steppes
Formation: *Varioheboso – fructosum*
Association:
1. *Spiraea crenata - Rhamnus pallasii - varioherboso*
2. *Fructoso - varioheboso - festucetum*
3. *Fructoso - Thymus kotschyanus - Festuca valesiaca - Astragalus euoplus - A. cicer*

Conclusions

The areas of the Darıdag region are distinguished by the presence of plant species that are characteristic of steppe vegetation. The main dominants of the subalpine groupings of true steppes characteristic of th steppes of the Darıdag area are the dense grass-forming species Festuca valesiaca, Stipa lessingiana, Koeleria pyramidata and Agropyron pectinatum. The steppe vegetation of the Darıdag area has been classified into two formation classes two formation groups, and 12 associations.

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