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# Protected, Rare and Medicinal Plant Species of the Buiratau State National Natural Park (Republic of Kazakhstan)

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**Abstract:** The State National Natural Park (SNNP) "Buiratau" is the youngest. The purpose of our study was an independent botanical and geographical survey of the vegetation cover of the SNNP "Buiratau" and a summary of the work of botanists from Kazakhstan and Russia who worked at different times in the protected area. The results showed that depending on the geographical location (Kazakh upland, steppe zone) of the territory of the SNNP "Buiratau", this natural complex has a very diverse botanical features. In these types of vegetation of this territory, there are both Red Data Book and rare and endemic plants. The real treasure of the park is the black alder and birch forests, the peculiarity of which is that some species (Alnus glutinosa (L) Gaertn, Betula Kirghisorum Sav.-Rysz.) are in the Red Book and are very few in number. A particularly important role in this natural complex is played by economically valuable, especially medicinal, plant species and their resource potential. After analyzing the above, it should be noted that the SNNP "Buiratau" is a unique natural environment which has characteristic endemic and rare plant species. The territory also has 10 species of plants listed in the Red Book and 26 species of rare and endangered species. It also has a peculiarity in economic relations because large resources of economically valuable plant species are concentrated in this territory.

**Keywords:** Flora, Endemic, Rare, Biomorphology, Small Hills

## Introduction

Currently, 12 national natural parks are organized in Kazakhstan. The Buiratau State National Natural Park (SNNP) is the youngest. It was established in 2011 and includes three previously existing protected areas: The Natural Park "Buiratau", the zoological reserves "Belodymovsky", and "Yereymentau", and the territory originally reserved for the Yereymentau State Reserve. At present, the total area of SNNP “Buiratau” is 88,968 hectares (Rubtsova *et al*., 2016).

The territory of the Buiratau SNNP is located within the steppe zone in the transition zone between the subzones of mildly arid and drought steppes. According to the physical-geographical zoning of Kazakhstan, the territory of the national park is located within the Central Kazakhstan hills (TsDZ and GIS, 2014). The main ecosystems are represented by semi-arid and drought steppes with an altitudinal belt in the province of the Karaganda-Chingiztau dry-steppe low-hill terrain and in the area of the Yereymentau-Karkaraly mountainous hillocky territory (Karamysheva and Rachkovskaja, 1973; Isachenko and Rachkovskaya, 1961; Nikolaev, 1999).

According to the vegetation map of the Buiratau SNNP (SSR, 1976), the territory of the national park is presented: Arid steppes on mountain black humus soils because most of the territory is within the Kazakh hillocky area; dry steppes on dark chestnut soils; petrophyticsteppes on rocks, stony and gravelly soils; meadow, forest and shrub vegetation (the last types of vegetation are not separated on the map). Forest vegetation is represented by birch, pine, aspen and black alder forests. The shrub type of vegetation

is diverse; these are Willows, mesophytic shrub communities of honeysuckle, wild rose, hawthorn, and cotoneaster; xerophytic communities of caragana and spirea; petrophytic shrub communities composed of Cossack juniper.

The property of Buiratau Park is relic black alder forests and birch groves that grow near the southern border of the park (SSR, 1979; Storozhenko, 1967).

The botanical originality of the Buiratau SNNP determines the need for constant monitoring of the vegetation cover. On the basis of monitoring, it is necessary to rationally plan the recreational impact and other types of nature management that are possible on the territory of the national park. This will preserve unique ecosystems and ensure the sustainable development of adjacent territories (Aidarkhanova and Koblanova, 2018).

The purpose of our work is to make an independent botanical and geographical survey of the vegetation of the Buiratau SNNP and a summary of the work of botanists from Kazakhstan and Russia who worked at different times in the protected area. The article presents a part of the results obtained, devoted to the biological characteristics of protected, rare and medicinal plant species of the national natural park (Center for Remote Sensing and GIS Terra, 2005; Karamysheva, 1961; Karamysheva and Rachkovskaya, 1975).

## Materials and Methods

The material for the analysis of protected, rare and economically valuable species of flora was the reports of expeditions, collected herbarium materials and herbariums stored in the fund of the Buiratau SNNP and in the fund of the Karaganda Buketov University, geobotanical descriptions. The main research method was route reconnaissance. Office processing was carried out according to generally accepted botanical methods. When identifying plants, books such as "Flora of Kazakhstan" (1999) and "Key to Plants of Central Asia" (1974) were used. All species names are given according to the summary "List of vascular plants of Kazakhstan" (Abdulina, 1998). Protected species (rare and endangered) species are identified using the Red Book of the Kazakh SSR (1981), the Red Book of the Republic of Kazakhstan (2006), and the Red Book of Kazakhstan (2014) (Baitulin, 2014). Attribution to medicinal plants occurred in accordance with medicinal plants themselves were studied in the course of field research at the branches of the Buiratau SNNP (Center for Remote Sensing and GIS Terra, 2005; Karamysheva, 1961; Karamysheva and Rachkovskaya, 1975). The study of the object employed a range of rigorous scientific methods tailored to ensure comprehensive analysis and documentation.

The floristic method encompassed the inventory of floristic diversity by compiling a thorough list of vascular plant species inhabiting the study area. Additionally, a detailed reference herbarium was developed to serve as a scientifically validated documentary basis for verifying the taxonomic composition of the flora.

The phytosociological (geobotanical) analysis concentrated on the examination of syntaxa within natural phytocoenoses that form the vegetation cover of the region. This involved an in-depth evaluation of the phytocoenotic structure, spatial organization and species composition of plant communities.

Drude's method was employed to perform a quantitative assessment of species abundance and dominance, enabling their systematic ranking and classification according to their frequency of occurrence.

Furthermore, significant attention was dedicated to the development and adherence to herbarium protocols, including advanced techniques for plant drying in strict compliance with established standards. Emphasis was also placed on ensuring the long-term preservation of herbarium specimens under controlled microclimatic conditions to maintain their scientific integrity and usability.

## Results and Discussion

In recent years, the flora of SNNP has been actively studied. Thus, according to F.M. Ismailova and Kupriyanov (2014), the floristic composition was estimated at 498 species belonging to 73 families and 277 species of plants. Of these, the divisionHorsetails -4 species; division Ferns -5 species; division Gymnosperms -3 species; division Angiosperms 486 species (Kupriyanov, 1995).

When comparing the Assessment of the floristic richness of the national park, we compare it with the flora of the entire territory of the Central Kazakhstan hillocky area, within which the main part of the Buiratau Park is located. The flora of the small hills includes 1453 plant species. On the territory of Buiratau Park, one-fifth of the flora of this peculiar region is represented in terms of botanical and geographical terms (Kupriyanov *et al*., 2014). The representatives of cereals (Poaceae), Compositae (Asteraceae) and legumes (Fabaceae) are characterized by the greatest number of species. The most multi-species genera include wormwood (Artemisia), feather grass (Stipa), astragalus (Astragalus), and onions (Allium). The typical steppe representatives of families and genera form the basis of cenofloras (Ishmuratova *et al*., 2017).

In the work of G.F. Pryadko 2021 to the abstract flora of the Buiratau National Natural Park to the list of 498 species (publications of Kupriyanov 2014), another 100 plant species were added, previously identified by the author for this territory. In 1981-1985, the author conducted field research in the hillocky area of Yereymentau (Yereymentau district of Akmola region and Osakarov district of Karaganda region) to substantiate

the YereymentauState Reserve. It is proposed to include in the new edition of the Red Book of Kazakhstan very rare species found in the Buiratau National Park: *Allium shaerocephalon, Caragana leucophloea, Rhinactinidiaeremophila, Trinia muricata.* These species are rare not only in the Central Kazakhstan hillocky areas but also throughout Kazakhstan, *and Allium shaerocephalon* is known only within the Buiratau National Park.

In addition, we note that according to the report "Flora of vascular plants" of the Buiratau SNNP for the period 2012-2016 (2017), carried out under the supervision of M. Yu. Ishmuratova and the report on the topic: "Assessment of the species composition and current state of the populations of medicinal plants of the Buiratau SNNP for 2018" (2019), carried out under the guidance of Molodejnyi village the flora of the SNNP already has 610 species, of which 288 species and 75 families' plants, including Horsetails -4 species; Ferns -5 species; Gymnosperms -3 species and Angiosperms -598 species. We adhere to this number of species in our work (Molodezhny, 2018; Minakov *et al*., 2019; Sinitsyn, 1982).

Analysis of our own materials and works of predecessors allowed us to identify a number of endemics, as well as valuable medicinal and state-protected plant species. The last category combines rare and endangered plant species listed in the Red Book of Kazakhstan (Baitulin, 2014). As shown in Table (1), the species composition of rare and endangered plants within the Buiratau SNNP is remarkably diverse, encompassing seven genera distributed across four distinct families. This taxonomic variety underscores not only the ecological significance of the park but also the critical necessity for targeted conservation efforts to safeguard these vulnerable species and their habitats.

An important characteristic of rare and endangered plant species is their bioecological status, which includes adaptive mechanisms, habitat preferences and biological traits. Table (2) provides data on the bioecological indicators of plant species listed in the Red Book of Kazakhstan that grow within the territory of Buiratau SNNP. This information helps assess the state of their populations and identify necessary conservation measures.

**Table 1:** Species composition of plants of Buiratau SNNP, listed in the red book of Kazakhstan

| Family | Genus | Species |
|---|---|---|
| *Betulaceae* | Alnus | *Alnus glutinosa (L) Gaertn (Joseph Gärtner, 1791)* |
| | *Betula* | *Betula Kirghisorum Sav. – Rysz.( Paul Amédée Ludovic Savatier)* |
| *Ranunculaceae* | *Adōnis* | *Adonis wolgensis (Christian von Steven, 1817)* |
| | | *Adonis villosa Lebed.( Carl Friedrich von Ledebour, 1824)* |
| | | *Adonis vernalis (Carl Linnaeus, 1753)* |
| | Pulsatilla | *Pulsatilla patens Mill.(Philip Miller)* |
| | | *Pulsatilla flavescens (Zucc.) Juz (Joseph Gerhard Zuccarini, 1937).* |
| *Liliaceae, Melanthiaceae* | Tulipa | *Tulipa patens ex Schult. et Schult. fil.(Joseph August Schultes, Julius Hermann Schultes, 1829)* |
| | Paris | *Paris guadrifolia L. (Carl Linnaeus, 1753)* |
| *Poaceae* | Stipa | *Stipa pennata L. (Carl Linnaeus, 1753)* |

**Table 2:** Bioecological indicators of protected plant species of Buiratau SNNP, listed in the Red Book of Kazakhstan

| No. | Species name (in Latin and Russian) | Life form, economic importance | Abundance (according to Drude) | Humidity Habitat | Living environment according to light | Growing in a salty environment | Peculiarity |
|---|---|---|---|---|---|---|---|
| 1 | *Alnus glutinosa (L) Gaertn* | *Tree, rare. Agash, Sirek tur*; Medicinal, in the production of leather, lacquer, woodworking etc | Cop 2 | *Moisture-loving, hygrophyte;* in a very humid environment, swampy forests, floodplain, lowland swamps, etc | *Photophilous, shade-tolerant;* Forest growing character of the forest-steppe, steppe zones | | Exists up to 80-100 years |
| 2 | *Betula Kirghisorum Sav. – Rysz.* | *Tree, endemic*, Medicinal, in folk medicine, food, essential oils | Sp | *Mesophyte*: island pine forests, steppe lowlands. | *Photophilous, micro thermal, mesotrophic* | | |
| 3 | *Adonis wolgensis* | *perennial herbs*, medication. Decorative | Sol | *Mesophyte*; Mezhosopochnye gorges, lowlands, different feather grass steppes | Forest edge, dry meadows | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | *Adonis villosa Lebed* | *Multigelt. herbal*, folk med., honey plant | Sp | *mesophyte* | Rocky hillsides | | |
| 5 | *Adonis vernalis* | *perennial herbal*, medicinal | sp | *mesophyte* | Edge of the forest, dry meadow | | Up to 100 years |
| 6 | *Pulsatilla patens Mill* | *Perennial herbal*, in folk medicine, poisonous | Sp | *Mesoxerophyte* | *Photophilous*, coniferous forests and dry slopes | | |
| 7 | *Pulsatilla flavescens (Zucc.) Juz* | *Perennial herbal*, decorative, in folk medicine, poisonous | Sp | *Mesoxerophyte* | *Photophilous*, rocky, dry slopes | | |
| 8 | *Tulipa patens ex Schult. et Schult. fil* | *perennial herbal*, decorative | Sp | *xerophyte* | *Photophilous*, rocky steppes on bare rocks along river banks | Often found on saline soil | |
| 9 | *Paris guadrifolia L* | *Perennial herbal*, in folk medicine, poisonous | sp | *Mesophyte;* Moist soil forests, shrubs and river banks | In partial shade | | |
| 10 | *Stipa pennata L* | *Perennial herbal*, decorative fodder | Sp | *Mesophyte;* The indicator of meadow-steppe conditions does not tolerate excessive humidity | *Photophilous*, dry, rocky areas | | Up to 75 years old |

Figure (1) illustrates the distribution of plants according to the humidity of the Buiratau SNNP, included in the Red Book of Kazakhstan. Of the above-identified 10 species listed in the Red Book of Kazakhstan, most can be attributed to perennial herbaceous plants and mesophytes, and mesoxerophytes predominate in ecological morphologies.

On the territory of the SNNP "Buiratau" from the general list of species of rare and endangered plants of this region grow 26 (*Alnus glutinosa, Betula Kirghisorum, Pulsatilla patents, Stipa pennata, Tulipa patents, Amygdalus nana, Artemisia glauca, Artemisialatifolia, Barbareaarcuate, Barbarea stricta, Cáltha palustris, Cardamine impatiens, Crepissibirica, Dianthus acicularis, Glechoma hederacea, Gypsophilarupestris, Lychnischalcedonica, Paris Guardiola, Poa remote, Prunella vulgaris, Pteridium pinetorum, Scrophulariaalata, Silene incurvifolia, Sphaerophysasalsula, Adonis wolgensis, Pulsatilla flavescens*), which is 4.26%.

According to life forms, the studied objects were divided as follows: herbaceous biennials -2 species, herbaceous perennials -21 species, shrubs -1 species, and trees -2 species. The results of observations showed that the dominant position among the life forms of rare and protected species is occupied by herbaceous perennials; trees and herbaceous biennials are in second place, and shrubs are in third place.

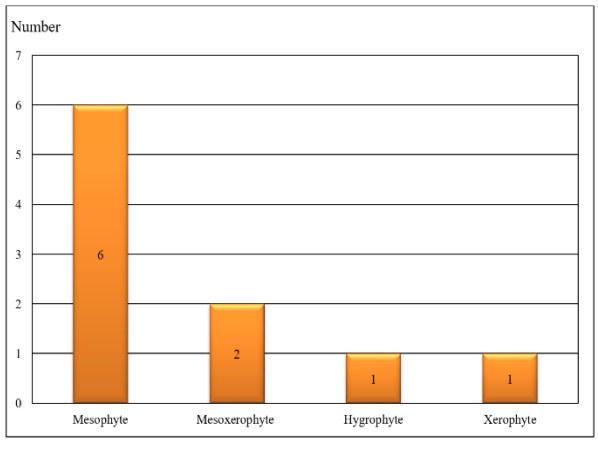


**Fig. 1:** The distribution of plants according to the humidity of the Buiratau SNNP, included in the Red Book of Kazakhstan

According to the presented Table (3), the analysis of ecological fitness of rare and protected plant species of the SNNP "Buiratau" showed that out of 26 plant species: Mesophytes -13, mesoxerophytes -1, xerophytes -7, xeropetrophytes -1, mesohygrophytes -2, hygrophytes - 2. How it can be seen from the results obtained, the main proportion of rare and protected species is represented by mesophytes, which indicates a sufficient degree of moisture in the SNNP "Buiratau" and the formation of a significant degree of meso- and microrelief, which allows the formation of more humid environmental conditions.

It can be assumed that new finds can be expected on the territory of this natural-geographical object, which may be unique for the vegetation cover of the northeastern rocky hills.

According to the survey results presented in Table (4), we identified endemic plant species for the Buiratau SNNP, including representatives of 7 species from 6 genera and five families.

**Table 3:** Bioecological indicators of rare and protected plant species of the

| No. | Species name | Life form | Abundance (according to Drude) | According to the humidity | According to the light | Inhabitants of the salty environment |
|---|---|---|---|---|---|---|
| 1 | Alnus glutinosa | Tree | In the alder association - $Cop_2$ In the forb-birch association - sol | + (hygrophilous, hygrophyte) Mesophyte predominates | + (photophilous) | |
| 2 | Betula Kirghisorum | Tree | In the birch association - $Cop_2$ | + hygrophilous) | +-(shade-tolerant) | |
| 3 | Pulsatilla patents | Perennial, herbaceous plant, geophyte (poisonous) | sp | + (hygrophilous) | +- (shade-tolerant) | |
| 4 | Stipa pennata | Perennial, herbaceous plant | $Cop_3$ | - (xeromorphic graminoid) | + photophilous | |
| 5 | Tulipa patents | Perennial, herbaceous plant | Sp | + (hygrophilous) Xerophyte, xeropetrophyte | Shade-tolerant | Often found in weedy areas |
| 6 | Amygdalus nana | Bush | sp | - xerophyte (drought-resistant) | + photophilous | |
| 7 | Artemisia glauca | Perennial, herbaceous plant | $Cop_1$ | - xerophyte (drought-resistant) | Withstands heat, frost | |
| 8 | Artemisia latifolia | Perennial, herbaceous plant | $Cop_1$ | - xerophyte (drought-resistant) | + photophilous | |
| 9 | Barbarea arcuate | Perennial, herbaceous plant | Sp | Mesophyte, mesotroph | Can grow in a semi-shaded place | |
| 10 | Barbarea stricta | Biennial, herbaceous plant | sp | Mesophyte(hygrophilous, weedy) | Photophilous | |
| 11 | Cáltha palustris | Perennial herbaceous plant (poisonous) | Sp | Hydrophyte | Light-loving, shade-tolerant | |
| 12 | Cardamine impatiens | Biennial, herbaceous plant | sp | Mesophyte (hygrophilous) | Shade-loving | |
| 13 | Crepissibirica | Perennial, herbaceous plant | sp | mesophyte | Photophilous | |
| 14 | Dianthus acicularis | Perennial shrub | $Cop_1$ | xerophyte | drought resistant | |
| 15 | Glechoma hederacea | Perennial herbaceous plant (poisonous) | $Cop_2$ | Mesophyte (hygrophilous) | Shade-tolerant | |
| 16 | Gypsophila rupestris | Perennial, herbaceous plant | $Cop_1$ | xerophyte | Photophilous | |
| 17 | Lychnis chalcedonica | Perennial, herbaceous plant | sp | Mesophyte (moisture-loving, | Photophilous | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | drought-resistant) | | |
| 18 | Paris guadrifolia | Perennial herbaceous plant (poisonous) | Sp | mesophyte | Shade-loving | |
| 19 | Poa remota | Perennial, herbaceous plant | Sp | Mesophyte (hygrophyte) (hygrophilous) | thermophilic | |
| 20 | Prunella vulgaris | Perennial herbaceous plant (poisonous) | Sp | Mesophyte (hygrophilous) | Light-loving, shade-tolerant | |
| 21 | Pteridium pinetorum | Perennial, grassy, fern | Sp | Mesophyte (hygrophilous) | Photophilous | |
| 22 | Scrophulariaalata | Perennial, herbaceous plant | Sp | Mesophyte (hygrophilous) | Photophilous | |
| 23 | Silene incurvifolia | Perennial, herbaceous plant | Sp | mesophyte | Photophilous | |
| 24 | Sphaerophysasalsula | Perennial herbaceous plant (poisonous) | Sp | Mesophyte (moisture-loving, weedy ) | Photophilous | Grows in weedy soil |
| 25 | *Adonis wolgensis* | Perennial, herbaceous | Sp | xerophyte | Photophilous | |
| 26 | *Pulsatilla flavescens* | Perennial, herbaceous (poisonous) | Sp | Mesoxerophyte | Photophilous | |

**Table 4:** Species composition of Buiratau SNNP endemic plant species

| Family | Genus | Species |
|---|---|---|
| *Betulaceae* | *Betula* | *Betula kirghisorum* |
| *Euphorbiaceae* | *Euphorbia* | *Euphórbiamicrocárpa* |
| *Apiaceae* | *Trinia* | *Trinia muricata* |
| *Lamiaceae* | *Thymus* | *Thymus rasitatus* |
| *Asteraceae* | *Seratula* | *Serratulakirghisorum* |
| | | *Serratuladissecta* |
| | *Phalacrachena* | *Phalacrachena calva* |

As can be seen from Table (5) in terms of ecological confinement, most endemic species belong to mesophytes, mesoxerophytes and xeromesophytes; in relation to light, many are photophilous and shade-tolerant. The dominant position among life forms is herbaceous perennials.

An important source of practically useful substances is medicinal and essential oil plants, the components of which are used in the food, perfumery and cosmetic industries and also have antimicrobial, anti-inflammatory, fungicidal, wound healing, antiviral and other types of biological activity (Molodezhny, 2018).

Biologically active compounds isolated from medicinal and aromatic plants, as well as their individual components, have been used by humans since ancient times as medicinal, antiseptic, perfumery and protective agents (repellents, attractants and others) (Karamysheva and Rachkovskaja, 1973; Isachenko and Rachkovskaya, 1961). At present, the production of components based on medicinal and essential oil plants is widely developed in many countries of the world. The world's production of essential oil exceeds 150 thousand tons, and that of medicinal raw materials exceeds 450 thousand tons.

The flora of any region contains in its composition economically valuable components that are of practical importance for human activity. Specially protected territories are also carriers of economically valuable, including medicinal plants. This potential of the flora allows the use of these species for breeding research and biodiversity conservation.

Diverse in terms of species and landscape, the flora of the Buiratau SNNP makes it possible to identify many valuable sources of plant materials that are used or were previously used in the national economy. For many plant species in Kazakhstan, only fragmentary information is still available.

As a result of field research on the branches of the Buiratau SNNP, a taxonomic list of all types of medicinal plants was determined and compiled (Karamysheva, 1961). According to them, the medicinal plants of the Yereymentaubranch are 231 species, and in the "Belodymovsky" branch, the list includes 274 taxa of these plant species.

**Table 5:** Bioecological indicators of Buiratau SNNP endemic plant species

| No. | Species name | Life form | Abundance (according to Drude) | According to the humidity | According to the light | Inhabitants of the salty environment |
|---|---|---|---|---|---|---|
| 1 | *Betulakirghisorum* | tree | In the Birch Association - Cop $_2$ | Mesophyte, moisture-loving | Photophilous | |
| | | | In the forb-birch association - sol | | | |
| 2 | *Euphorbia microcarpa* | perennial herbaceous | Cop $_1$ | xeromesophyte | Photophilous | |
| 3 | *Trinia muricata* | biennial herbaceous | Sol | mesophyte | Shade-tolerant | |
| 4 | *Thymusrasitatus* | semi-shrub | Sol | xerophyte | Petrofit | |
| 5 | *SerratulaKirghisorum* | perennial | Sp | Mesoxerophyte | Photophilous | Grows on the weedy, swamp-stony steppe |
| 6 | *Serratuladissecta* | perennial | Sp | Mesophyte, ephemeroid | Shade-tolerant | |
| 7 | *Phalacrachenacalva* | perennial | Sol | Mesoxerophyte | Photophilous | |

Table (6), Fig. (2) indicates the results of studying the species composition of the flora of vascular plants showed that 231 species of medicinal plants belonging to 152 genera and 51 families grow on the territory of the Buiratau SNNP in the Yereymentau branch and 274 species of medicinal plants grow in the Belodymovsky branch assigned to 165 genes and 55 families.

The largest number of species was noted in the Asteraceae family -48 in the Ereymentau branch and 53 species in the Belodymovsky branch; the second position is occupied by the Rosaceae family -22 and 28 species, respectively, and the third position is occupied by the Fabaceae family -16 and 17, respectively. The most abundant species in terms of the number of medicinal plants are wormwood, willow, cinquefoil, plantain and others.

As can be seen from Table (7), the analysis of plant life forms showed that the largest group is perennial herbaceous plants –175 and 205 species.

In Fig. (2), a similar trend can be observed, where perennial herbaceous plants also dominate, accounting for 205 species. Such data underline the ecological importance and widespread distribution of this plant life form in the studied region.

The second position is occupied by bushes -20 species, and the third - by annual herbaceous plants (16 species). The number of other life forms is very small.

According to Table (8), Fig (3), among the ecological groups, mesophytes predominate -110 and 141 species; the second position is occupied by xerophytes -70 and 73 species and the third by hygrophytes -35 and 38 species, respectively.

To complement this analysis, Fig. (3) provides a detailed overview of the life forms of medicinal plants in the same branches, offering additional insights into their structural and ecological diversity.

According to the previous analyses, the ecological structure of vascular plants in the territory of the Buiratau SNNP was also dominated by mesophytic plant species. Their indicator was 45.5%, and numerous xerophytics and mesoxerophytic plants accounted for 25.9% and 15.06%, respectively. The smallest were plants -succulents, the indicator of which is only 0.4% (Molodezhny, 2018).

According to the geobotanical map of the GNPP "Buyratau," the territory is predominantly covered by diverse herbaceous-feather grass steppes and mixed herbaceous-feather grass steppes, which extend across the entire area, including the enclave characterized by arid and dry steppe landscapes. These steppes represent the dominant vegetation types in the park, reflecting the area's ecological specificity. The western part of the park exhibits a distinct difference from the eastern part, primarily due to the dominance of woody and shrub vegetation, which gives this region its unique appearance. In contrast, the eastern part of the nature park is largely characterized by steppe vegetation, where mixed herbaceous-feather grass steppes and diverse herbaceous-feather grass steppes occupy most of the area, forming a continuous cover. Scattered throughout the park, the flora of mixed herbaceous-feather grass-shrub steppes appears in localized patches, adding to the diversity of vegetation types. Meanwhile, plants of mixed herbaceous-sagebrush-feather grass steppes are found occupying smaller and more fragmented areas, predominantly in the northeast and southeast of the park. This mosaic of vegetation types highlights the rich and varied ecological structure of the territory.

Among the 231 Yereymentau and 274 Belodymovsky species of medicinal plants, 56 species are used in official medicine. These are great burnet, hill-growing saltwort, wreath-bearing sawwort, elecampane, felon herb, spatterdock, great nettle, Marshall's thyme, Ural liquorice and others (Minakov *et al*., 2019). Most of the species belong to plants used in folk medicine -175 (Yereymentau branch) and 218 (Belodymovsky branch) species (Sinitsyn, 1982).

**Table 6:** Taxonomic composition of medicinal plants in the study area

| No. | Family | Number of species, pcs. | | % of the total number of species | |
|---|---|---|---|---|---|
| | | Yereymentau | Belodymovsky | Yereymentau | Belodymovsky |
| 1 | Apiaceae | 7 | 9 | 3.03 | 3.28 |
| 2 | Asparagaceae | 1 | 1 | 0.43 | 0.36 |
| 3 | Aspleniaceae | 1 | 1 | 0.43 | 0.36 |
| 4 | Asteraceae | 48 | 53 | 20.77 | 18.24 |
| 5 | Betulaceae | 2 | 3 | 0.87 | 1.09 |
| 6 | Boraginaceae | 4 | 4 | 1.73 | 1.45 |
| 7 | Brassicaceae | 14 | 18 | 6.06 | 6.56 |
| 8 | Campanulaceae | 2 | 2 | 0.87 | 0.72 |
| 9 | cannabaceae | 2 | 2 | 0.87 | 0.72 |
| 10 | Caprifoliaceae | 1 | 1 | 0.43 | 0.36 |
| 11 | Caryophyllaceae | 6 | 7 | 2.59 | 2.55 |
| 12 | Chenopodiaceae | 7 | 8 | 3.03 | 2.91 |
| 13 | Convolvulaceae | 2 | 2 | 0.87 | 0.72 |
| 14 | Crassulaceae | 3 | 3 | 3.03 | 1.09 |
| 15 | Cupressaceae | 1 | 1 | 0.43 | 0.36 |
| 16 | Cyperaceae | - | 1 | | 0.36 |
| 17 | Dipsacaceae | 2 | 2 | 0.87 | 0.72 |
| 18 | Dryopteridaceae | 1 | 1 | 0.43 | 0.36 |
| 19 | Eleagnaceae | 1 | 1 | 0.43 | 0.36 |
| 20 | Ephedraceae | 1 | 1 | 0.43 | 0.36 |
| 21 | Equisetaceae | 2 | 4 | 0.87 | 1.45 |
| 22 | Fabaceae | 16 | 17 | 6.93 | 6.2 |
| 23 | Fumariaceae | 1 | 1 | 0.43 | 0.36 |
| 24 | Frankeniaceae | 1 | 1 | 0.43 | 0.36 |
| 25 | Gentianaceae | 1 | 1 | 0.43 | 0.36 |
| 26 | Geraniaceae | 3 | 3 | 3.03 | 1.09 |
| 27 | Glosulariaceae | - | 2 | | 0.72 |
| 28 | Hypolepidaceae | - | 1 | | 0.36 |
| 29 | Iridaceae | 1 | 1 | 0.43 | 0.36 |
| 30 | Lamiaceae | 12 | 17 | 5.19 | 6.2 |
| 31 | Lemnaceae | 1 | 1 | 0.43 | 0.36 |
| 32 | Liliaceae | 1 | 1 | 0.43 | 0.72 |
| 33 | Limoniaceae | 1 | 1 | 0.43 | 0.36 |
| 34 | Linaceae | 1 | 1 | 0.43 | 0.36 |
| 35 | Lythraceae | 1 | 1 | 0.43 | 0.36 |
| 36 | Malvaceae | 1 | 1 | 0.43 | 0.36 |
| 37 | Nymphaceae | 1 | - | 0.43 | - |
| 38 | Onagraceae | 3 | 3 | 3.03 | 1.09 |
| 39 | Parnassiaceae | - | 1 | | 0.36 |
| 40 | Pinaceae | 1 | 1 | 0.43 | 0.36 |
| 41 | Plantaginaceae | 3 | 6 | 3.03 | 2.189 |
| 42 | Poaceae | 1 | 1 | 0.43 | 0.36 |
| 43 | Polygalaceae | 1 | 1 | 0.43 | 0.36 |
| 44 | Polygonaceae | 9 | 9 | 3.89 | 3.28 |
| 45 | Primulaceae | 3 | 3 | 1.29 | 1.09 |
| 46 | Ranunculaceae | 10 | 12 | 4.33 | 4.379 |
| 47 | Rhamnaceae | 1 | 1 | 0.43 | 0.36 |
| 48 | Rosaceae | 22 | 28 | 9.52 | 10.21 |
| 49 | rubiaceae | 4 | 4 | 1.73 | 1.45 |
| 50 | Salicaceae | 7 | 8 | 3.03 | 2.91 |
| 51 | Scrophulriaceae | 10 | 13 | 4.33 | 4.74 |
| 52 | Solanaceae | 1 | 1 | 0.43 | 0.36 |
| 53 | Typhaceae | 2 | 2 | 0.86 | 0.72 |
| 54 | Urticaceae | 1 | 1 | 0.43 | 0.36 |
| 55 | Valerianaceae | 2 | 2 | 0.86 | 0.72 |
| 56 | Viburnaceae | - | 1 | - | 0.36 |
| | Total | 231 | 274 | 100 | 100 |

**Table 7:** The ratio of life forms of Buiratau SNNP medicinal plants, branches: YereymentauandBelodymovsky

| Life form | Number, types, pcs. | | % of the total number of species | |
|---|---|---|---|---|
| | Yereymentau branch | Belodymovsky branch | Yereymentau branch | Belodymovsky branch |
| Tree | 6 | 8 | 2.59 | 2.91 |
| Bush | 20 | 27 | 8.65 | 9.85 |
| Shrub | 4 | 1 | 1.73 | 0.36 |
| Semi-shrub | 2 | 1 | 0.86 | 0.36 |
| Perennial herbaceous | 175 | 205 | 75.76 | 74.81 |
| Biennial herbaceous | 8 | 9 | 3.46 | 3.28 |
| Annual herbaceous | 16 | 24 | 6.93 | 8.75 |
| Total | 231 | 274 | 100 | 100 |

**Table 8:** Ecological groups of Buiratau SNNP medicinal plants, branches YereymentauandBelodymovsky

| Ecological group in relation to humidification conditions | Number, types, pcs. | | % of the total number of species | |
|---|---|---|---|---|
| | Yereymentau branch | Belodymovsky branch | Yereymentau branch | Belodymovsky branch |
| Hydatophyte | 1 | 1 | 0.43 | 0.36 |
| Hydrophyte | 4 | 5 | 1.73 | 1.82 |
| Hygrophyte | 35 | 38 | 15.15 | 13.86 |
| Mesophyte | 110 | 141 | 47.62 | 51.45 |
| Mesoxerophyte | 5 | 6 | 2.16 | 2.18 |
| Xeromesophyte | 6 | 10 | 2.59 | 3.64 |
| Xerophyte | 70 | 73 | 30.3 | 26.64 |
| Total | 231 | 274 | 100 | 100 |

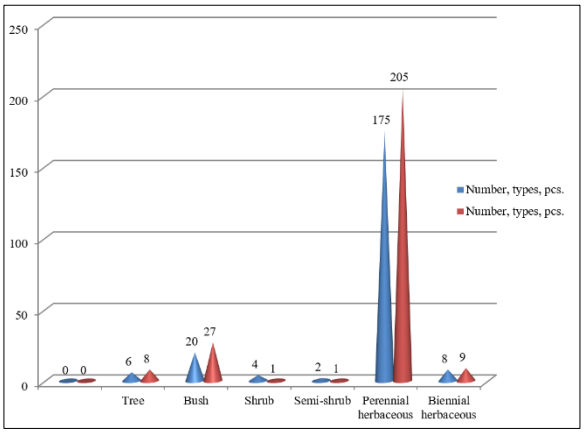


**Fig. 2:** Life forms of Buiratau SNNP medicinal plants, branches: YereymentauandBelodymovsky

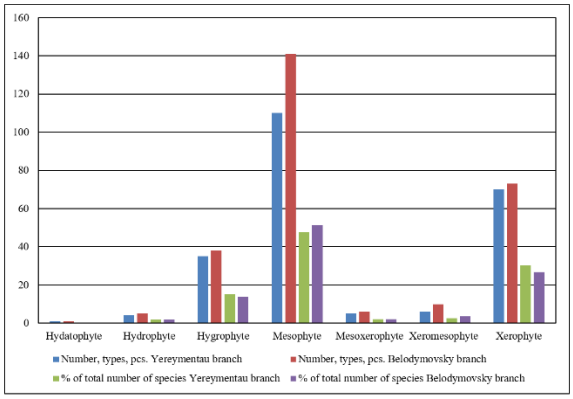


**Fig. 3:** Life forms of Buiratau SNNP medicinal plants, branches: Yereymentauand Belodymovsky

In Fig. (4), you can observe the detailed distribution of vegetation types across the GNPP "Buyratau." This map illustrates the dominance of steppe vegetation, variations between the western and eastern regions and the localized presence of specific plant communities such as woody-shrub vegetation and diverse herbaceous steppes.

The vegetation map of the Buiratau State National Natural Park highlights the distribution of key plant communities, including habitats that support protected, rare and medicinal plant species. The map underscores the ecological importance of the park as a refuge for biodiversity, with unique areas such as petrophytic steppes and mixed herbaceous-shrub steppes providing critical environments for rare species. These habitats are essential for the conservation of medicinal plants and other valuable flora, emphasizing the need for ongoing protection and sustainable management of this natural heritage.

## Conclusion

Summing up, it is great to note that Depending on the geographical location (Kazakh hillocky area, steppe zone) of the territory of the Buiratau SNNP, this natural complex has a very diverse botanical peculiarity. In this territory's vegetation, there are both RedBookData and rare and endemic plants. The real treasure of the park are black alder and birch forests, the peculiarity of which is that some species (*Alnus glutinosa (L) Gaertn*, *Betula Kirghisorum Sav. - Rysz.)* are in the Red Book and very few in number. A particularly important role in this natural complex is played by economically valuable, especially medicinal, plant species and their resource potential.

On the territory of the park, many research works are carried out annually in various directions and with various goals. But despite this, the territory is located within the Kazakh hillocky area, and the main ecosystems are represented by mildly dry and dry steppes with an altitudinal belt and dry steppe low mountains of the mountainous hillocky territory. Also, the peculiarities of climatic conditions cause changes in the life forms of plant communities, which is connected with these data; further research on this object is of interest for geobotanical work.

After analyzing the above, it should be noted that the Buiratau SNNP is a unique natural environment that has characteristic endemic and rare plant species. The territory also has 10 plant species listed in the Red Book and 26 species of rare and endangered species. It also has a peculiarity in economic relations due to the large resources of economically valuable plant species being concentrated in this territory.

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## Author's Contributions

**Kenzhina Kulpash Dakenovna:** Collected material in natural conditions, organized expeditions, processed specimens, analyzed results, and contributed to the manuscript.

**Almagul Kali:** Led the research, developed the concept, hypothesis, and methodology, coordinated project work, oversaw field studies, analyzed data, and edited the manuscript.

**Turlybekova Gulzhazira Kantarbaevna:** Conducted field studies, analyzed data morphologically/biochemically, reviewed literature, and contributed to the article's conclusion.

**Tulegenova Symbat Erzhankyzy:** Performed data analysis, statistical processing, manuscript editing, and ensured data reliability for publication.

**Tulegenova Assel Rustemova:** Assisted with statistical processing, developed the research concept, formulated hypotheses, and defined objectives.

**Jussupova Nurgul:** Organized and executed field studies, analyzed data, developed the hypothesis, and contributed to manuscript sections and literature review.

The authors read and approved the final manuscript.

### Ethics

There are no ethical issues in this study.

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