

## Data Paper

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## Rare and endemic plant species of the flora of Kostanay Region

Based on research conducted in the territory of Kostanay Region from 1995 to 2025, eight endemic plant species belonging to five families and seven genera have been recorded in the region. Rare and endangered plant species listed in the Red Book of the Republic of Kazakhstan are represented in Kostanay Region by 18 taxa: *Convallaria majalis* L., *Ornithogalum fischerianum* Krasch., *Alnus glutinosa* (L.) Gaertn., *Betula tianschanica* Rupr., *Dianthus capitatus* subsp. *andrzejowskianus* Zapal., *Drosera rotundifolia* L., *Chimaphila umbellata* (L.) W.P.C. Barton, *Lilium martagon* L., *Tulipa sylvestris* subsp. *australis* (Link) Pamp., *Tulipa suaveolens* Roth., *Nymphoides peltata* (S.G. Gmel.) Kuntze, *Dactylorhiza maculata* subsp. *fuchsii* (Druce) Hyl., *Epipactis palustris* (L.) Crantz., *Koeleria macrantha* subsp. *macrantha*, *Stipa pennata* L., *Adonis volgensis* Stev., *Pulsatilla patens* (L.) Mill., *Pulsatilla patens* subsp. *flavescens* (Zucc.) Zämelis (= *Pulsatilla flavescens* (Zucc.) Juz.). The data were obtained through a review of literature sources and during numerous botanical expeditions conducted by the authors in the Kostanay Region. All collected specimens are deposited in the Herbarium of Kostanay Regional University (KSPI). This article presents precise locality data for endemic and rare plant species of the region, which may contribute to improving their protection and to the development of targeted conservation measures.

**Keywords:** location data, flora revision, rare plant species, endemic plant species, flora of the Republic of Kazakhstan, flora of Kostanay Region, Red Book of Kazakhstan, international herbaria.

### Introduction

Issues of plant endemism and the protection of rare and endangered species are key elements in floristic research for any region, including the Republic of Kazakhstan (RK). In recent decades, opportunities for revising flora have significantly increased. Firstly, due to the online publication of collections from some of the world's richest herbaria, such as the Komarov Botanical Institute (LE) and Lomonosov Moscow State University (MW). Secondly, through the emergence of websites like IPNI (since 1999) and GBIF (since 2001), which provide access to global biodiversity data on flora and fauna.

As a result of a more detailed study of species distributions, we clarified the ranges of many plants. It was often found that some species are much more widely distributed than previously known during the compilation of The Flora of Kazakhstan (1956–1964) [1] and the last major floristic review of Kostanay Region [2]. Accordingly, certain species previously considered endemic to the Republic of Kazakhstan are no longer recognized as such. At the same time, new species have been discovered, whose known distribution is limited to the territory of Kazakhstan [3, 4]. Therefore, the list of endemic species of Kazakhstan within the region, published by the authors, differs significantly from earlier records.

The list of rare species occurring in Kostanay Region and included in the Red Book of Kazakhstan was also considerably revised due to the most recent edition of the Red Book and changes in nomenclature. The results of the floristic revision of the region are also reflected in several previously published articles [5–12].

### Experimental

#### Sampling Methods

The material was obtained through the study of the following herbaria: A. Baitursynuly Kostanay Regional University (acronym: KSPI), Komarov Botanical Institute (LE), Lomonosov Moscow State University (MW) [13], Institute of Plant and Animal Ecology, Ural Branch of RAS (SVER), Institute of Botany and Phytointroduction (AA), as well as official websites: International Plant Names Index (IPNI) [14], Global Biodiversity Information Facility (GBIF) [15], Plants of the World Online (POWO) [16]. The taxonomic position and distribution of published species were clarified using the above-mentioned sites. Herbarium da-

tabases were utilized to compile a comprehensive species list based on updated taxonomic data. As a result of the analysis of current distribution data, the authors determined the status of each species.

A database was created summarizing families and species. For each species, the Latin name is provided according to the International Plant Names Index (IPNI) [14]. The label text from herbarium specimens was used to determine collection dates and precise locations.

The final, verified checklist of vascular plants of Kostanay Region (1,145 species from 452 genera and 101 families) was published by the authors in 2024 [17].

#### *Geographic Coverage*

General Information: Kostanay Region is an administrative area in northern Kazakhstan, covering 196,001 km<sup>2</sup>, with a population of 864,550 (as of 2022).

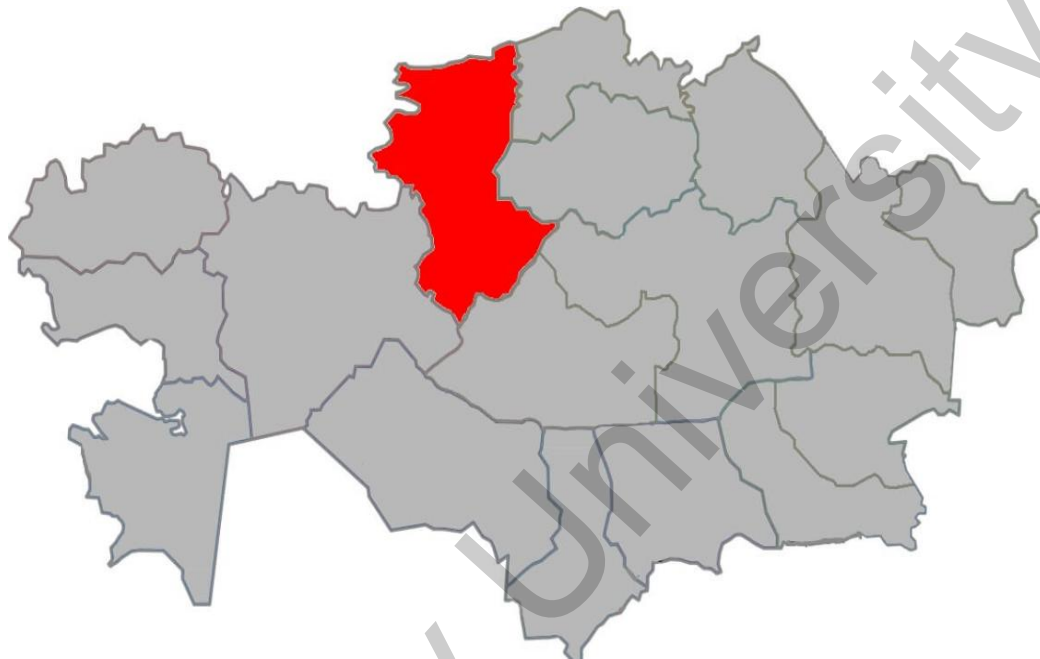


Figure 1. Kostanay Region on the map of Kazakhstan

In Figure 1, Kostanay Region is marked in red in the north of the Republic of Kazakhstan. Geographical coordinates of the region: center (Kostanay city): 53°12'00" N, 63°38'00" E, north (Zverinogolovoe village): 54°45' N, 64°86' E, south (Torgai village): 49°63' N, 63°49' E, west (Zhitikara city): 52°16' N, 61°22' E, east (Sarykol village): 53°31' N, 65°53' E [18].

Relief: most of the north of the region is occupied by the southwestern edge of the West Siberian Lowland, to the south of it is the Turgai plateau; in the west of the region is the undulating plain of the Trans-Ural plateau, and in the southeast are the spurs of the Sary-Arka. The territory is characterized by a relatively flat terrain. The average altitude above sea level varies from 200 to 400 m [17].

### *Results and Discussion*

#### *Taxonomic Coverage*

The vascular plant flora of Kostanay Region includes 1,145 species, 452 genera, and 101 families. The taxonomic structure is dominated by the division Magnoliophyta, with a small proportion of pteridophytes and gymnosperms. The ratio of monocots to dicots in Magnoliophyta is approximately 1:3.8. The leading family in the flora is Asteraceae Dumort. (196 species), followed by Poaceae Barnhart — 91 species, Fabaceae Lindl. — 76 species, Amaranthaceae Juss. — 75 species, Brassicaceae Burgett — 62 species, Caryophyllaceae Juss. — 49 species, Cyperaceae Juss. — 43 species, Rosaceae Juss. — 42 species, Plantaginaceae Juss. — 32 species, Apiaceae Lindl. — 32 species. The composition of leading families reflects the general floristic patterns typical of the arid and semi-arid zones of Kazakhstan [17].

*Traits Coverage*

In the Kostanay Region, 8 species endemic to Kazakhstan, belonging to 5 families and 7 genera, were identified based on the revision of endemic vascular plants of Kazakhstan [12]. The Red Book of the Republic of Kazakhstan includes rare and endangered species, 18 of which are found in this region (Tab. 1).

Table 1

**Endemic, Rare, and Endangered Species in the Territory of Kostanay Region**

№	Family	Species name	Herbarium	Conservation Status	Endemism
1	Asteraceae	<i>Artemisia camelorum</i> Krasch.	MW	Not Evaluated	ED RK
2	Asteraceae	<i>Jurinea transuralensis</i> Iljin	AA	Not Evaluated	ED RK
3	Amaranthaceae	<i>Climacoptera turgaica</i> (Iljin) Botsch.	MW	Not Evaluated	ED RK
4	Amaranthaceae	<i>Petrosimonia hirsutissima</i> (Bunge) Iljin	MW	Not Evaluated	ED RK
5	Asparagaceae	<i>Convallaria majalis</i> L.	KSPI	Vulnerable, KK RK	not ED
6	Asparagaceae	<i>Ornithogalum fischerianum</i> Krasch.	KSPI	Vulnerable, KK RK	not ED
7	Betulaceae	<i>Alnus glutinosa</i> (L.) Gaertn.	KSPI	Vulnerable, KK RK	not ED
8	Betulaceae	<i>Betula saviczii</i> V.N. Vassil.	LE	Not Evaluated	ED RK
9	Betulaceae	<i>Betula tianschanica</i> Rupr.	KSPI	Vulnerable, KK RK	not ED
10	Caryophyllaceae	<i>Dianthus capitatus</i> subsp. <i>andrzejowskianus</i> Zapal	KSPI	Vulnerable, KK RK	not ED
11	Droseraceae	<i>Drosera rotundifolia</i> L.	MW	Critically Endangered	not ED
12	Ericaceae	<i>Chimaphila umbellata</i> (L.) W.P.C. Barton	KSPI	Vulnerable, KK RK	not ED
13	Fabaceae	<i>Astragalus chaetolobus</i> Bunge	MW	Not Evaluated	ED RK
14	Liliaceae	<i>Tulipa auliekolica</i> Perezhogin	LE	Not Evaluated	ED RK
15	Liliaceae	<i>Tulipa turgaica</i> Perezhogin	LE	Not Evaluated	ED RK
16	Liliaceae	<i>Tulipa sylvestris</i> subsp. <i>australis</i> (Link) Pamp.	SVER	Vulnerable, KK RK	not ED
17	Liliaceae	<i>Tulipa suaveolens</i> Roth	KSPI	Vulnerable, KK RK	not ED
18	Liliaceae	<i>Lilium martagon</i> L.	KSPI	Critically Endangered	not ED
19	Menyanthaceae	<i>Nymphoides peltata</i> (S.G. Gmel.) Kuntze	KSPI	Vulnerable, KK RK	not ED
20	Orchidaceae	<i>Dactylorhiza maculata</i> subsp. <i>fuchsii</i> (Druce) Hyl.	KSPI	Vulnerable, KK RK	not ED
21	Orchidaceae	<i>Epipactis palustris</i> (L.) Crantz	KSPI	Vulnerable, KK RK	not ED
22	Poaceae	<i>Koeleria macrantha</i> (Ledeb.) Schult	MW	Vulnerable, KK RK	not ED
23	Poaceae	<i>Stipa pennata</i> L.	SVER	Vulnerable, KK RK	not ED
24	Ranunculaceae	<i>Adonis volgensis</i> Stev.	SVER	Vulnerable, KK RK	not ED
25	Ranunculaceae	<i>Pulsatilla patens</i> (L.) Mill.	KSPI	Vulnerable, KK RK	not ED
26	Ranunculaceae	<i>Pulsatilla patens</i> subsp. <i>flavescens</i> (Zucc.) Zämelis	KSPI	Vulnerable, KK RK	not ED

KK RK — Red Book of Republic of Kazakhstan, ED RK — Endemic of Republic of Kazakhstan

The following species (Tab. 2) from the Orchidaceae family grow in the territory of Kostanay Region and are recommended for inclusion in the new edition of the “Red Book of the Republic of Kazakhstan”.

List of Orchidaceae species occurring in the territory of Kostanay Region

№	Species name	Herbarium	Instance collection point	Conservation Status	Endemism
1	<i>Dactylorhiza incarnata</i> (L.) Soó	MW	Naurzum State Nature Reserve, 20 km east of Aksuat village	absent	not ED
2	<i>Dactylorhiza incarnata subsp. cilicica</i> (Klinge) H.Sund.	MW	Naurzum State Nature Reserve, 5 km southwest of Aksuat village	absent	not ED
3	<i>Dactylorhiza salina</i> (Turcz. ex Lindl.) Soó	MW	Naurzum State Nature Reserve, wet meadow near spring outlets, north of the Naurzum pine forest	absent	not ED
4	<i>Epipactis atrorubens</i> (Hoffm.) Bess.	LE, KSPI	Uzunkol District, vicinity of KrasnyeBorki village	absent	not ED
5	<i>Gymnadenia conopsea</i> (L.) R. Br.	LE	Semiozyorny District, Aman-Karagay forest, edge of a salt flat	absent	not ED
6	<i>Malaxis monophyllos</i> (L.) Sw.	LE	Mendykara District, mossy area near a spring by the lake	absent	not ED
7	<i>Spiranthes australis</i> (R.Br.) Lindl.	MW	Mendykara District, mossy lake near Borovoye village	absent	not ED

#### Temporal Coverage

The study of vascular plant flora in Kostanay Region spans approximately a 100-year period. The collections conducted by A.G. Voronov, F.N. Rusanov, and others in the Naurzum Nature Reserve during the first half of the 20th century are of particular historical and scientific importance. Herbarium specimens from that period are preserved in Russia, in Saint Petersburg, at the Herbarium of the Komarov Botanical Institute (LE), as well as at the Herbarium of Lomonosov Moscow State University (MW). Later collections from the Naurzum Reserve are also stored at MSU's Herbarium (MW). Collections from the late 20th century, led by Professor P.G. Pugachev, were primarily carried out by students of Kostanay Pedagogical University and are labeled accordingly. Over the past 30 years, the authors of this article, researchers from Kostanay Regional University (KRU), namely Y.V. Perezhogin, Zh.T. Suyundikova, O.V. Borodulina, and others, have studied the flora of Kostanay Region. Their materials are stored in the herbarium of A. Baitursynuly Kostanay Regional University (acronym: KSPI).

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#### Data Resources

Number of data packages: 2

Titles of data packages: 1. Endemic and Rare Species of Kostanay Region, 2. List of Orchidaceae Species Occurring in Kostanay Region

Data Format: CSV

Description: The databases contain species lists, including 26 endemic and rare species (1st database) and 7 species from the Orchidaceae family (2nd database). Each entry includes information on taxonomic names, the names of herbaria where specimens are stored, collector names and specimen numbers, precise collection locations in nature, conservation status, and endemism within the Republic of Kazakhstan (Tab. 3).

Column Descriptions for Plant Species Dataset

Column Label	Column Description
Family	Plant family
Genus	Plant genus
Species	Species epithet
Author	Author of the species name
Herbarium	Abbreviation of the herbarium where the specimen is stored
Collector Number	Serial number assigned to a specific collection by the botanist or collector group
Collector Name	Name(s) of the person(s) who collected the herbarium specimen
Collection Time	Collection date, as indicated on the herbarium label
Instance Collection Point	Description of the specific location where the specimen was collected
Conservation Status	Conservation status according to the Red Book of Plants of the Republic of Kazakhstan
Endemism	Indicates whether the species is endemic to the Republic of Kazakhstan or not

### Conclusions and Recommendations

1. Eight endemic species from five families and seven genera grow in the territory of Kostanay Region.
2. Two species previously listed as endemic in The Flora of Kazakhstan have been synonymized and are no longer considered endemic: *Betula kirghisorum* Sawicz and *Linaria dolichocarpa* Klokov.
3. *Astragalus kustanaicus* Popov, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 10: 16 (1947). Naurzum State Nature Reserve, steppe, 05.06.2009, collected by students of Kostanay State Pedagogical Institute (KSPI01892). Kostanay Region, Semiozyorny (= Auliekol) District, 1.8 km southwest of the Dievsky state farm, 09.06.1964, Samorodov Yu., Lodinova T. (MW0846220).  
Listed in POWO as an endemic species of the Republic of Kazakhstan. However, it is not endemic, as it was also found in Orenburg Region, Russian Federation (Orenburg Oblast, Sol-Iletsk District, Troitsky Chalk Hills, slope of a chalk hill, 05.06.2015) [19].
4. Rare and endangered plant species listed in the Red Book of the Republic of Kazakhstan are represented in Kostanay Region by 18 taxa (species and subspecies): *Convallaria majalis* L., *Ornithogalum fischerianum* Krasch., *Alnus glutinosa* (L.) Gaertn., *Betula tianschanica* Rupr., *Dianthus capitatus* subsp. *andrzejowskianus* Zapal., *Drosera rotundifolia* L., *Chimaphila umbellata* (L.) W.P.C. Barton, *Lilium martagon* L., *Tulipa sylvestris* subsp. *australis* (Link) Pamp., *Tulipa suaveolens* Roth., *Nymphoides peltata* (S.G. Gmel.) Kuntze, *Dactylorhiza maculata* subsp. *fuchsii* (Druce) Hyl., *Epipactis palustris* (L.) Crantz, *Koeleria macrantha* subsp. *macrantha*, *Stipa pennata* L., *Adonis volgensis* Stev., *Pulsatilla patens* (L.) Mill., *Pulsatilla patens* subsp. *flavescens* (Zucc.) Zämelis (= *Pulsatilla flavescens* (Zucc.) Juz.).
5. The following species from the Orchidaceae family grow in Kostanay Region and are recommended for inclusion in the next edition of the “Red Book of the Republic of Kazakhstan”: *Dactylorhiza incarnata* (L.) Soó, *Dactylorhiza incarnata* subsp. *cilicica* (Klinge) H. Sund., *Dactylorhiza salina* (Turcz. ex Lindl.) Soó, *Epipactis atrorubens* (Hoffm. ex Bernh.) Bess., *Gymnadenia conopsea* (L.) R.Br., *Malaxis monophyllos* (L.) Sw., and *Spiranthes australis* (R.Br.) Lindl.
6. The results of this research provide a revised checklist that will contribute to updating information on rare and endemic plants in the forthcoming edition of The Flora of Kazakhstan.

### Conflict of interest

The authors declare no conflict of interest.

### Author contribution

The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript: **Perezhogin Yu.V.** — conceptualization, investigation, methodology, data collection; **Borodulina O.V.** — data curation, analysis, supervision, writing draft; **Suyundikova Zh.T.** — conducting the fieldwork and sample collection.

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### Қостанай облысының флорасындағы сирек және эндемикалық өсімдік түрлері

1995–2025 жылдар аралығында Қостанай облысы аумағында (Солтүстік Қазақстан) жүргізілген көпжылдық зерттеулер нәтижесінде, бұл өңірде Қазақстан Республикасына ғана тән 5 тұқымдас пен 7 туысқа жататын 8 эндемикалық өсімдік түрі өсетіні анықталды. Еліміздің Қызыл кітабына енгізілген сирек және жойылып бара жатқан өсімдіктер түрлері Қостанай облысында 18 таксонмен (түрлер және тұртармақтары) көрсетілген, атап айтқанда: *Convallaria majalis* L., *Ornithogalum fischerianum* Krasch., *Alnus glutinosa* (L.) Gaertn., *Betula tianschanica* Rupr., *Dianthus capitatus* subsp. *andrzejkowskianus* Zapł., *Drosera rotundifolia* L., *Chimaphila umbellata* (L.) W.P.C. Barton, *Lilium martagon* L., *Tulipa sylvestris* subsp. *australis* (Link) Pamp., *Tulipa suaveolens* Roth., *Nymphoides peltata* (S.G. Gmel.) Kuntze, *Dactylorhiza maculata* subsp. *fuchsii* (Druce) Hyl., *Epipactis palustris* (L.) Crantz., *Koeleria macrantha* subsp. *macrantha*, *Stipa pennata* L., *Adonis volgensis* Stev., *Pulsatilla patens* (L.) Mill., *Pulsatilla patens* subsp. *flavescens* (Zucc.) Zämelis (= *Pulsatilla flavescens* (Zucc.) Juz.). Материалдар Қостанай облысы

аумағындағы әдеби дереккөздерді талдау және авторлардың көптеген ботаникалық экспедициялары нәтижесінде жиналды. Барлық материалдар Ахмет Байтұрсынұлы атындағы Қостанай өңірлік университетінің Гербарий қорында (қысқартылған атауы — КСПИ) сақталған. Мақала Қостанай облысы аумағында өсетін сирек және эндемиялық өсімдіктердің таралуы туралы нақты мәліметтерді ұсына отырып, олардың тиімді және нысаналы қорғау шараларын әзірлеуге мүмкіндік береді.

*Кілт сөздер:* орналасқан жері туралы мәліметтер, флораларды санау, өсімдіктердің сирек түрлері, өсімдіктердің эндемиялық түрлері, Қазақстан Республикасының флорасы, Қостанай облысының флорасы, Қазақстан Республикасының Қызыл кітабы, халықаралық Гербарийлер

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## Редкие и эндемичные виды растений флоры Костанайской области

В результате многолетних исследований на территории Костанайской области (Северный Казахстан) в 1995–2025 гг. выяснилось, что на ней произрастают 8 эндемичных (для Республики Казахстан) видов из 5 семейств и 7 родов. Редкие и исчезающие виды растений, внесенные в Красную книгу Республики Казахстан, на территории Костанайской области представлены 18 таксонами (виды и подвиды): *Convallaria majalis* L., *Ornithogalum fischerianum* Krasch., *Alnus glutinosa* (L.) Gaertn., *Betula tianschanica* Rupr., *Dianthus capitatus* subsp. *andrzejowskianus* Zapal., *Drosera rotundifolia* L., *Chimaphila umbellata* (L.) W.P.C. Barton, *Lilium martagon* L., *Tulipa sylvestris* subsp. *australis* (Link) Pamp., *Tulipa suaveolens* Roth., *Nymphoides peltata* (S.G. Gmel.) Kuntze, *Dactylorhiza maculata* subsp. *fuchsii* (Druce) Hyl., *Epipactis palustris* (L.) Crantz., *Koeleria macrantha* subsp. *macrantha*, *Stipa pennata* L., *Adonis volgensis* Stev., *Pulsatilla patens* (L.) Mill., *Pulsatilla patens* subsp. *Flavescens* (Zucc.) Zämelis (= *Pulsatilla flavescens* (Zucc.) Juz.). Материалы собраны в результате обработки литературных источников и многочисленных ботанических экспедиций авторов по территории Костанайской области. Хранятся материалы в гербарном фонде Костанайского регионального университета имени Ахмет Байтұрсынұлы (акроним КСПИ). Данная статья приводит конкретные данные о местонахождении эндемичных и редких видов на территории Костанайской области, что позволит эффективно защищать их и разработать дополнительные точечные меры охраны.

*Ключевые слова:* сведения о местонахождении, ревизия флоры, редкие виды растений, эндемичные виды растений, флора Республики Казахстан, флора Костанайской области, Красная книга РК, международные Гербарии

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