PAPER • **OPEN ACCESS**

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To cite this article: B-Ts B Namzalov *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **315** 072004

IOP Conf. Series: Earth and Environmental Science **315** (2019) 072004 doi:10.1088/1755-1315/315/7/072004

Rare plants in the focus of the modern concept of biodiversity (on the example of Transbaikal)

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Abstract. Rare plants are endemic and relict species, and plants that are on the borders of their ranges. Only in the flora of the steppes of the Baikal Siberia, 48 endemic species are known, i.e., 7.0% of the total structure of the flora. In addition to endemics, relicts are typical for the historical phytogeography of Siberia. Twenty-seven of them belong to the oldest tertiary. It is often observed that the historical phytogeography of Siberia contains very little information about relict vegetation communities in comparison to a large volume of Pleistocene steppe relict species, for example. Logically one can assume that if species are preserved, it is likely to find islands of former vegetation, relict phytocenoses. Fragments of these communities are combined with tundra groups, forming relict tundra-steppe landscapes in the mountains of the Sayan mountains and Tuva. For the first time taking Transbaikal as an example, an approach for a holistic view of rare plant species in accordance with the concept of biodiversity is proposed. This means the disclosure of this phenomenon not only on the species, but also on the coenotic and landscape levels. As a result, rare plant species are represented in systemic integrity at three conjugate levels: 1. Characteristics of a unique species as a system of uneven-age individuals; 2. Analysis of plant communities with dominance or participation of the species under consideration; 3. Description of the original landscape with the development of rare phytocenosis. The holistic and related discovery of the biology and ecology of endemic, relict and boundary populations of plant species will serve as a basis for creating a valuable scientific synthesis, the Atlas of the unique gene pool of natural flora.

1. Introduction

Rare plants are understood to be three categories of plant organisms. They are endemic and relict plant species, and species that are on the borders of their habitats (boundary species) or constitute disjunction in the form of small populations of species within its general wide area.

A broad interpretation of the concepts, endemic and relic, is required from the standpoint of the concept of biodiversity with its multilevel approach. At the same time, not only the investigation of population systems of individuals of relict and endemic plants, as well as boundary species (*L alpha - species level*), but also communities with their dominance or participation (*B beta - coenotic level*), and landscape complexes, including rare species and phytocenoses in the region (*Y gamma - ecosystem level*). It should be noted that at the present stage the concept of relics in geobotany is mainly considered at the species level. They are associated with specific phytocenoses or landscape

features only in isolated cases. In this aspect, the analysis and characteristics of Pleistocene relics given by I.M. Krasheninnikov considered to be classical [1], E.M. Lavrenko [2].

It should be noted that there is no contingency in the interpretation of some key concepts regarding in general, the concept of relics in the historical phytogeography of Siberia and Central Asia. Very little information about the remaining fragments of relict vegetation of this time is available with the obvious admission of the presence in the structure of the modern mountain-steppe vegetation of Southern Siberia of relict species of the cold-arid Late Pliocene or Pleistocene epoch [1, 2]. Logically one can assume that if species are preserved, it is likely to find islands of former vegetation, relict phytocenoses. Indeed, these peculiar communities are well represented on the surfaces of ancient pedimens in the highlands of the Southeast Altai [3]. Often, phytocenoses of cryophyte steppes are combined with areas of tundra vegetation on contrasting ecotopes in terms of edaphic and hydrothermal conditions, forming original tundra-steppe landscapes, the development of which in the Sayan and Tuva Mountains is reported by L.I. Malyshev and I.M. Krasnoborov [4].

The heat and hydrocarbon flows increased in the intermountain of the Lake Baikal hollows. The discharge of thermal and mineralized water, salinization of fault landscapes is typical. Here, the centers of the newest endemism, the Lake Baikal phytogeographic node in the mountain valleys of the Lake Baikal and Transbaikal were revealed [5]. The relict plants preserved from the past geological epochs are found in local refuges. They are very sensitive to changes in the natural environment. The relict species, as well as endemic ones, never appear to dominate the landscapes of Transbaikal [3]. Often they are confined to the rocky slopes of the remnants, composed of the oldest (Paleozoic) granitoids, Paleogene carbonate sediments.

The richness and diversity of the plant world of Transbaikal and neighboring Mongolia is due to the presence in these territories of the unique species and communities, i.e., the vegetation elements of the oldest flora-genotypes [6]. These include not only the Paleogene-Neogene shrubland (elm forests) shibliaks (apricots, amygdalins), large-grains (*Achnatherum*) ephemerophytes savannoide types, but Neogene types e.g., halogeton (nitrarias with *Limonium gmelinii* (Willd) Kuntze), desert-steppe petrophyton (wormwood with *Artemisia rutifolia* Stephan ex Spreng.), as well as types of Pleistocene cryophiton (cushion plants), etc.

The Republic of Buryatia, most of its territory belongs to Western Transbaikal, covers 351.3 thousand sq. m., where 2161 species and subspecies of vascular plants belonging to 591 genus types and 131 families are registered. Only 48 endemic species are known in the flora of the steppes of the Baikal Siberia. It is 7.0% of the total structure of the flora. Moreover, the relicts are typical for steppe ecosystems; 27 species are of the oldest tertiary.

It is necessary to consider their holistic treatment in the plant world when characterizing rare species in accordance with the concept of biodiversity. The disclosure of this phenomenon not only on the species, but also on the cenotic and landscape, means a systematic representation of the noted phenomenon on three mutually conjugate levels:

- Characteristics of a unique species as a system of individuals of different ages,
- Analysis of the community with the dominance or participation of the investigated species,
- Description of the original landscape with the development of rare phytocenosis.

It should be noted that relict plant species, communities and landscape systems should be differentiated into temporary categories: 1 - tertiary (Paleogen-Neogene); 2 - quaternary (Pleistocene, Holocene). Endemic plants are divided into two categories: 1 - ancient Endemics, Cretaceous-Paleogene, Neogene; 2 - Young endemics, Pleistocene-Holocene. The boundary populations of rare plants are divided into three categories: 1 - border populations of species with a wide (global - continental and planetary) range; 2 - boundary populations of species with a regional (inland) range; 3 - local populations at the boundaries of species with an intermittent (disjunctive) range. In conclusion, from the diversity of rare plants of Transbaikal, as an example, we consider a relict species - desert feather grass (*Stipa desertorum*). Such a holistic disclosure of the biology and ecology of endemic,

relict and boundary populations of plant species will be considered as the basis for developing a valuable scientific synthesis, the Atlas of the unique gene pool of natural flora.

2. Relic species

Stipa desertorum (Roshev.) Ikonn. – Desert feather grass. Relict xerothermic Holocene.

Family: (lat.) Poaceae, (Eng.) Bluegrass. The feather grass desert is a species from the family of S. caucasica s.l., it has small low turfs and small spikelets, with smooth leaves on the outside. This species was described by P.N. Ikonnikov in "Flora Badakhshan" on the basis of a new combination of the subspecies taxon of the Caucasian feather grass, Stipa caucasica ssp. desertorum (Roshev.) Tzvelev. Local protection The Red Book of the Irkutsk Region: 2 (V) - Vulnerable (2001)

Characteristics of the geographic range. Chorological group (area) - Central Asian belt-zonal - desert-steppe. Distribution in Siberia. Republic of Tuva, Irkutsk Region, Republic of Buryatia (figure 1).

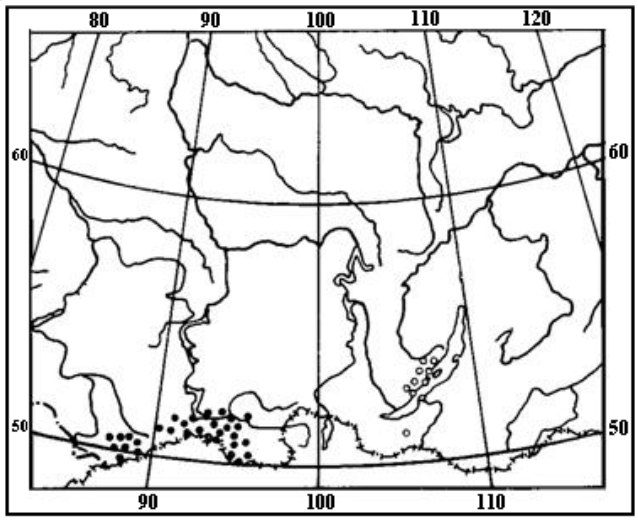

Figure 1. Locations of Stipa desertorum (Roshev.) Ikonn. and S. glareosa P. Smirn. in the territory of Southern Siberia (by: [5.8] and our data). Reference designation:
• - Stipa glareosa ° - S. desertorum.

Habitat, ecological status. In the mountain-steppe and forest-steppe zones, on open rocky slopes, in the steppes. Xeropetrophyte, autotroph. Morphology. Perennial plant 5 (7) -17 height. Bristle leaves long (up to 10-12 cm), straight 0.5-0.7 mm. in diam., longer than stem, bare or covered with rare and short spines. Stems are often longer than leaves, often articulated, a cluster of the upper bracts, and the spikelets have a violet color, swollen and completely conceal the panicles, elongated at the apex in the posterior pointed. Panicles are firm with crowded tiny spikes and often completely hidden in the cluster of the leaf. Barbs are 5–9 cm long, genuflexuous, pinnate-pubescent along the entire length, often almost bare or slightly pubescent in the lower part before the elbow bend. Life form. Perennial grassy tussock grass (figure 2).

Figure 2. Desert Feather Grass Stipa desertorum (Roshev.) Ikonn. in spurs of the ridge Malyi Khamar-Daban.

3. Relic community

Deserted mountain stony steppes. Description of the specific phytocenosis is Western Transbaikal. Foothills of the ridge Malyi Khamar-Daban, southeastern spurs of the Barun-Burin-Khan mountain massif, valley of the river Inzagatuy. The republic of Buryatia, Dzhidinsky district, region of village Inzagatui 6.0 km to the north.

The community area is small, within 25 x 12 m, occupies the slopes of the southern, south-western exposure of the rocky slope along the top of the ridge. On the surface there is an abundance of fine crushed stone of whitish hue. The territory has an oval elongated shape along the ridge line. Height is 1037.0 m above sea level. Geographical coordinates: N50°88'12" E105°70'13". The community develops on the slopes of the southwest exposure, the angle of inclination is from 5 to 15 ^{0}.

Geographic range. The desert-steppe territories of Central Asia, Kazakhstan, Mongolia, the south of Eastern Siberia (Priolkhonye, Western Transbaikal)

Habitat ecology. Communities are widespread along plumes, sloping piedmont plains, dry depressions, and southern gravelly slopes of the ridges of the ridges. Humidification is uneven over the seasons (up to 80% falls in July-August), insufficient. Spring and early summer periods are almost no precipitation. The snow cover is blown away by the wind, the soils are deep freezing.

Major destabilizing factors and protection motives. Intensive pasture use. The standard of the zonal desert steppes of Central Asia, the location of the Stipa desertorum in the Baikal region are more than 5,0^{0} in latitude north. t rare plant species are habited.

Protection causes. Organization of a botanical nature monument. Organization of monitoring for the state of the population. To include in the new edition of the Red Book of the Republic of Buryatia, Siberia, Russia.

Phytocenotic characteristics

Phytocenosis is petrophyte of grass-pop-and-feather grass (Stipa desertorum + Carex kirilowii Turcz). The total projective cover of the grass stand is 30–40%. The layering is not identified; spatial heterogeneity is characteristic in the horizontal structure of the community.

Floristic structure of the community is 36 species of higher vascular plants. In the species structure of the community, a group of species of different ecology and phytogeographic orientation is distinguished. They include xerophytes of the Eurasian steppes (Koeleria cristata (L.) Pers., Potentilla acaulis L.), South Siberian-Mongolian (Polygala tenuifolia Willd., Silene jenisseensis Willd.), xeropetrophites, indicator species of the Dauro-Manchurian steppe Filifolium sibiricum (L.) Kitam., Stellera chamaejasme L., Cymbaria daurica L.

There are also species typical for the high steppes. They are actually cryophyte species: Patrinia sibirica (L.) Juss., Kobresia filifolia (Turcz.). C.B. Clarke, as well as the cryoxerophytes of the mountain steppes of Southern Siberia and Mongolia (Festuca lenensis Drobow, Androsace incana Lam., Amblynotus rupestris (Pall. Ex Georgi) Popov ex Serg., Potentilla sericea L., Stellaria petraea Bunge, Chamaerhodos altaica (Laxm.) Bunge,, Artemisia dolosa Krasch., etc.).

It becomes obvious that the character of the desert-dusting community is cryoxerophytic-mountain-steppe but not the dry steppe according to the analysis of the Khamar-Daban population of the species.

Syntaxonomy. Formation Stipa desertorum, florocenotype desert steppes, a group of semi-arid types of Boreal vegetation in the understanding of R.V. Camelina [6].

Modern protection. A botanical monument in Priolkhonye on the western coast of the lake Baikal is announced. In the future, it is assumed to substantiate the new plant key area in the vicinity of village Inzagatui of Dzhidinsky district of Republic of Buryatia.

4. Relic landscape

The landscape surrounding the desert-dusting community in the spurs of the ridge of Malyi Khamar-Daban, on a slope in the near-tip part of one of the regional ridges of the Barun Burin Khan mountains in the valley of the r. Inzagatuy is interesting. The mountain-forest-steppe landscapes are typical along the southern macroslope of Khamar-Daban in the strip of the advanced ridges of the range, at altitudes of 900–1400 m above sea level. m. The desert-pollen community in the vegetation of the ridge is

combined with herbal steppe larch forests and dry turf-grass steppes on the slopes of various exposures (figure 3).

A unique phytocenosis is developing on a flat hill at the summit part along the ridgeline. It stands out noticeably against the surrounding rocky low-grass steppe with its shiny whitish bracts of feather grass, giving the community a view completely unusual for the Transbaikal steppes (figure 3).

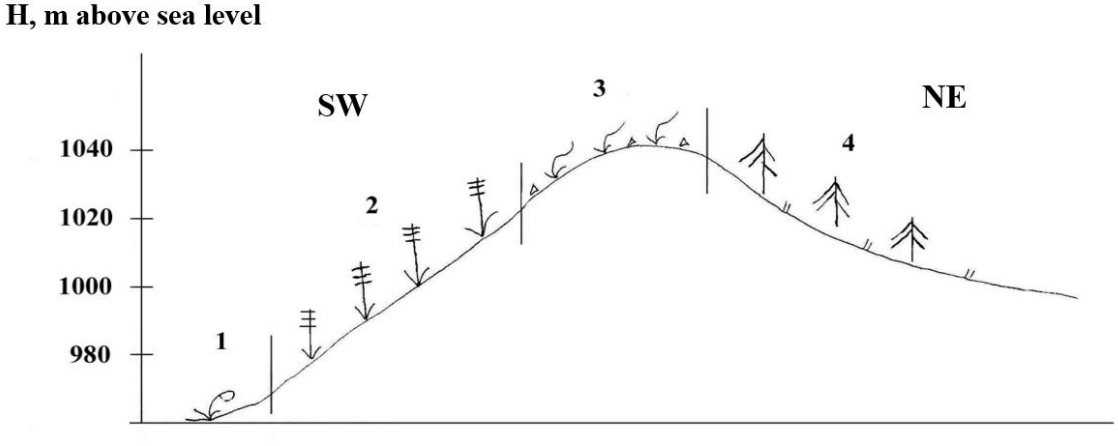

Figure 3. Schematic profile of the distribution of vegetation in the mountain larch forest steppe in the valley of river Inzagatuy (foothills of the southern macroslope of the Malyi Khamar-Daban ridge).

Reference designation: 1 - forb-grass (Helictotrichon schellianum (Hack.) Kitag., Bromopsis inermis (Leyss.) Holub, Stipa baicalensis Roshev., Phlomis tuberosa L., Aconitum barbatum Pers.) steppe in a hollow; 2 - Gypsophila -small tussock - grass (Agropyron cristatum (L.) Gaertn., Koeleria cristata, Stipa krylovii Roshev.) rocky mountain steppe; 3 – petrophyte forb – sludge – desert feather grass (Stipa desertorum, Carex kirilowii, Androsace incana, Chamaerhodos altaica, Potentilla sericea) mountainous cryoxerophytic steppe; 4 – larch forest with stoplike sludge and siberian fescue (Festuca sibirica Hack. Ex Boiss., Carex pediformis C. A. Mey., Helictotrichon altaicum Tzvelev, Artemisia commutata Besser), steppe.

The vegetation complex of a grassy larch forest with the participation of Altai oyster (Helictotrichon altaicum), Siberian fescue (Festuca sibirica) and replacement wormwood (Artemisia commutata) confirm the relict nature of the landscape of larch forest steppe in the foothills of the ridge Malyi Khamar-Daban of Western Transbaikal (figure 4). The cenofloristic complex of a grassy larch forest with the participation of Altai oyster (Helictotrichon altaicum), Siberian fescue (Festuca sibirica) and replacement wormwood (Artemisia commutata) confirm the relict nature of the landscape of larch forest steppe in the foothills of the ridge Malyi Khamar-Daban of Western Transbaikal (figure 4).

Figure 4. Relict larch forest with stoplike sludge and fescue on the northern exposure slope in the mountain forest steppe of the Malyi Khamar-Daban ridge (Western Transbaikal).

5. Conclusion

The main focus of the development of cold continental steppes and light coniferous forests of the Pleistocene forest-steppe, he considered the geographic range between Viluy in the north and Khangai (Northern Mongolia) in the south. It is precisely in the south of Eastern Siberia in the area of the Baikal-Khangai mountain structure that landscape analogues of the Pleistocene forest-steppe have been preserved According to Ippolit Mikhailovich point of view [1].

Herbarium specimens of *Stipa desertorum* are stored in the herbarium of the Buryat State University UUDE (Ulan-Ude); duplicate specimens are transferred to LE (desert feather grass, St. Petersburg).

Acknowledgements

Research is supported by the grant of the Banzarov Buryat State University № 19-10-0502.

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