



## Short communication

## Plant species composition and vegetation cover of Kherlen Toono Mountain, Mongolia



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## ARTICLE INFO

## Article history:

Received 25 January 2016

Received in revised form

23 May 2016

Accepted 9 June 2016

Available online 23 June 2016

## Keywords:

Forb–kharvana community

Kherlen Toono Mountain

Mongolia

needle grass–forb community

## ABSTRACT

The Kherlen Toono Mountain Natural Reserve has a unique natural formation that makes its flora and vegetation cover unique. This study aimed to prepare a species inventory of flora and conduct make visual assessments of the vegetation cover of Kherlen Toono Mountain. A total of 202 species belonging to 115 genera, 46 families, and 4 phyla (Equisetophyta, Polypodiophyta, Pinophyta, and Magnoliophyta) were recorded. During this study, a species [*Vincetoxicum lanceolatum* (Grubov) Grubov] was newly recorded in the vegetation of the Dundad Khalkh district. An endemic species, 7 subendemic species (4.9%), and 10 rare species (3.9%) were recorded in the study area, which comprised 8.9% of the total species. These species recordings indicated the unique flora of the Kherlen Toono Mountain region. Forb–kharvana and needle grass–forb communities of 10 different communities were commonly recorded in the study area.

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## Introduction

Kherlen Toono Mountain (latitude: 47°01'32.58", longitude 109°16'04.96", elevation 1,578 m) is located 10 km southeast of the Avraga Toson resort in Khentii Province, Mongolia (Figure 1). This area is a natural reserve that belongs to the Great Dornod Steppe (National Atlas 2009) and the dry steppe of Dundad Khalkh district (Grubov 1982).

The vegetation of this area is mainly composed of mountain steppes and steppe vegetation associated with its geomorphology features. The plant species and their habitats recorded are very unique to this area.

Grubov (1955, 1982) and Ulziikhutag (1989) subdivided the region into 16 vegetation-geographic districts based on the geography of Mongolian territories and their vegetation cover characteristics. Based on this subdivision, the Kherlen Toono Mountain region is located in the Dundad Khalkh steppe (Figure 1).

Plant species and vegetation cover of Kherlen Toono Mountain are relatively less studied and there is no plant species inventory for this region. The general features of the vegetation cover of this area are covered by some studies on the vegetation of

Mongolia (Grubov 1955, 1982; Unatov 1950) and by the studies on the vegetation of Khentii, Mongol Daguur, Dundad Khalkh, and Dornod Mongol districts (Dashnyam 1974; Shagdar 2003). The Kherlen Toono Mountain region is included in the vegetation map of Mongolia (scales, 1:1,500,000 and 1:3,000,000; Dorjgotov 2009).

In recent years, there has been an increase in anthropogenic impacts such as livestock grazing and mining in this area. Therefore, it is important to create a species inventory of flora, in order to determine species composition and vegetation cover, so as to provide baseline information about vegetation pattern in this area for future research on changes in biological communities caused by land-use impacts and environmental management.

This study aimed to determine vascular plant species, major plant community and their vegetation cover, and rare species in this area.

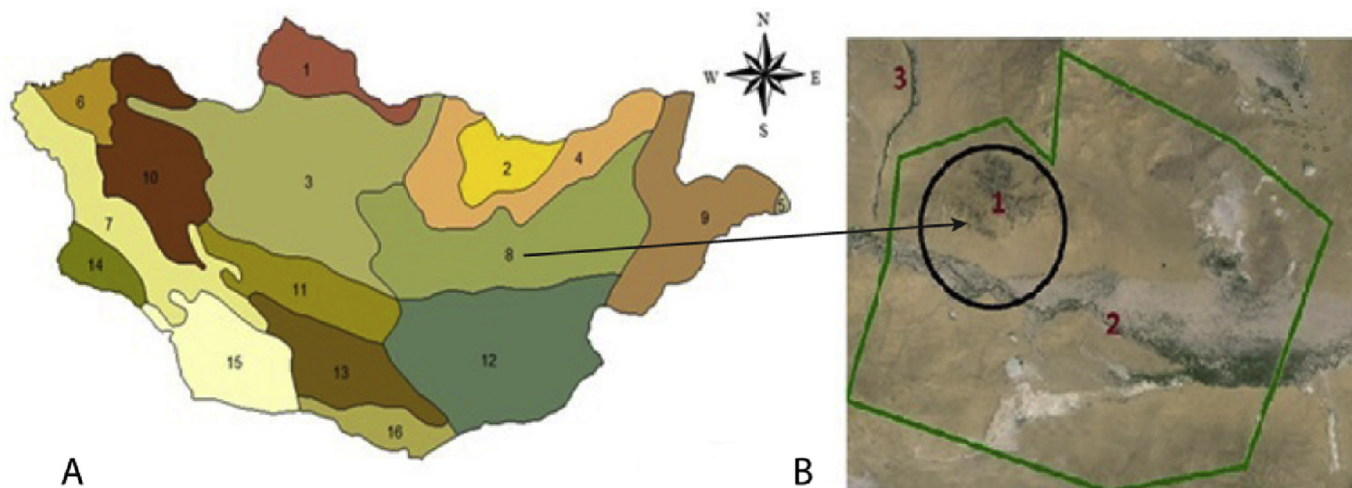
## Materials and methods

The research was performed on the Kherlen Toono Mountain region in Khentii Aimag, Mongolia, between July 4, 2015 and July 8, 2015 (Figure 1). Six sites and 20 plots in each site were chosen in the study area. Site 1: Southeast upper to lower slope of Kherlen Toono Mountain; Site 2: South upper slope to lower slope of Kherlen Toono Mountain; Site 3: Southwest upper slope to lower slope of Kherlen Toono Mountain; Site 4: Northwest upper slope to

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Peer review under responsibility of National Science Museum of Korea (NSMK) and Korea National Arboretum (KNA).



**Figure 1.** A, Vegetation-geographical districts of Mongolia. 1. Khövsgöl taiga mountain; 2. Khentii taiga mountain; 3. Khangai forest mountain; 4. Mongol Daguur forest steppe; 5. Khyangan meadow steppe; 6. Kovd mountain desert steppe; 7. Mongol-Altai mountain steppe; 8. Dundad Kalkh dry steppe; 9. Dornod Mongol steppe; 10. Great lakes depression desert steppe; 11. Valley of lakes desert steppe; 12. Dornogovi desert steppe; 13. Gobi Altai mountain desert steppe; 14. Dzungaria Gobi Desert; 15. Trans-Altai Gobi Desert; 16. Alasha Gobi Desert. B, Study area: 1. Kherlen Toono Mountain, 2. Kherlen River 3. Avraga stream. Green line is the border of Kherlen Toono Natural Reserve.

lower slope of Kherlen Toono Mountain; Site 5: Riparian zone of Avraga stream; and Site 6: Riparian zone of Kherlen River.

In this work, a general methodology of plant taxonomy and vegetation cover estimation based on ecological–geographical–morphological approaches was adopted (Buyan-Orshikh 2005; Kamelin 1998, 2004; Malyshev and Peshkova 1984; Peshkova 1972; Shennikov 1964; Ulziikhutag 1989). We recorded only the presence of species within the 20 plots using the qualitative sampling method. Geobotanical records were obtained using 1-m<sup>2</sup> net (100 cm × 100 cm grids) in each plot and 100 herbaria were made. Canopy cover was evaluated by visual assessment (calculated as percentage) within each site.

## Results

In this work, a total of 202 species belonging to 115 genera, 46 families, and four phyla (Equisetophyta, Polypodiophyta, Pinales, and Magnoliophyta) were recorded (Table 1). The following six families were more diverse and accounted for 52.5% of the total flora recorded (Table 1): Asteraceae (28 species), Poaceae (21 species), Rosaceae (17 species), Fabaceae (15 species), Ranunculaceae (14 species), and Caryophyllaceae (10 species).

These aforementioned families were more diverse families of the Mongolian flora and were recorded from the mountain steppe and steppe regions. One to thirteen species were recorded within a genus. The most diverse genera were *Artemisia* (13 species) and *Potentilla* (6 species; Table 1). During the study period, *Vincetoxicum lanceolatum* (Grubov) Grub was newly recorded in the vegetation district of Dundad Khalkh.

An endemic species (*V. lanceolatum*), eight subendemic species (*Stipa klemenzi*, *Cotoneaster mongolicus*, *Astragalus galactites*, *Oxytropis lasiopoda*, *Oxytropis salina*, *Caryopteris mongolica*, *Thymus gobicus*, and *Pedicularis flava*), 10 rare species (*Ephedra sinica*, *Juniperus pseudosabina*, *Allium anisopodium*, *Allium ramosum*, *Iris humilis*, *Chelidonium majus*, *Bistorta alopecoroides*, *Stellaria dichotoma*, *V. lanceolatum*, and *Artemisia rutifolia*), were included in the rare species list of Mongolia. These species indicate the unique flora of Kherlen Toono Mountain.

### Distribution by vegetation-geographic district

The Kherlen Toono Mountain is located in the Dundad Khalkh dry steppe (Figure 1). Of note, plants of all 16 vegetation districts were recorded in the Kherlen Toono Mountain, but their percentages were different depending on the district's ecological and geographical differences. Plants of neighboring vegetation district were also commonly recorded in the study area.

### Ecological groups

Plant species were divided into 8 ecological groups and the number of species recorded varied between the groups (Figure 2). Xerophytes and xero-lithophytes comprised 40% of total plants, meso-xerophytes and meso-lithophytes 29.7%, mesophytes 16.3%, halophytes 6.5%, hygrophytes 4.5%, and hydrophytes 3% (Figure 2).

### Vegetation cover and its characteristics

Mountain steppe, steppe shrubs, and annual grasses were predominant in the vegetation cover of Kherlen Toono Mountain. Forb, khargana, and needle grass–forb communities of 10 different communities were commonly recorded in the study area.

### Forb community

This community was relatively diverse, with canopy cover of approximately 45–65% and distributed on the lower slope and lower part of the mountain. The commonly recorded species included *Artemisia dracunculus*, *Galium verum*, *Aconogonon divaricatum*, *Aconogonum angustifolium*, *Thalictrum minus*, *Rheum undulatum*, *Phlomis tuberosa*, and *Sanguisorba officinalis*. Some communities also include *Potentilla fruticosa*, *Spiraea aquilegifolia*, *Cotoneaster melanocarpa*, and *Artemisia gmelinii*.

### Shrub community

This community was reported from the mountain side hill, trench, and at river banks. *S. aquilegifolia* and *Amygdalus pedunculata* were predominant and *Ulmus pumila*, *P. fruticosa*, and

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