

What Kind of Vegetation Exists in the Central Eurasian Steppe?

- Fundamental Information to Conserve the Vulnerable Steppe Vegetation -

Kohei SUZUKI*¹⁾, Abdisalam JALALDIN²⁾, Nurbay ABDUSALIK²⁾, Tsagaanbandi TSENDEEKHUU³⁾,
Takashi KAMIJO¹⁾ and Toru NAKAMURA¹⁾

Abstract: In this paper, we classify and describe plant communities of central Eurasian steppe and discuss about the position of central Eurasian steppe vegetation in the Eurasian steppe. Following phytosociological methods, vegetation survey was carried out in northern Xinjiang and western Mongolia. Plant communities were classified based on the species composition. The study areas of central Eurasian steppe is differentiated into six community groups; *Stipa capillata* community group, *Agropyron cristatum* community group, *Convolvulus lineatus* community group, *Elymus mutabilis* community group, *Anabasis brevifolia* community group and *Nanophyton erinaceum* community group. The results demonstrated that (1) *S. capillata* community group distributed northern Xinjiang and western Eurasian steppe have common differential species, and *A. cristatum* community group distributed western Mongolia and eastern Eurasian steppe have common differential species, though these community groups also have own species composition, (2) Species composition of *C. lineatus* community group, *E. mutabilis* community group, *A. brevifolia* community group and *N. erinaceum* community group are different from that of *S. capillata* community group, *A. cristatum* community group and other Eurasian steppe vegetation. These community groups considered to be more similar to desert steppe.

Key Words: Altay Mountains, Eurasian steppe, Mongolia, Phytosociology, Xinjiang

1. Introduction

Eurasian steppe extends as a broad belt across the continent from Hungary to Northeastern China (Archibold, 1995). Lavrenko and Karamysheva (1993) indicated that Eurasian steppe was divided into two subregions: Black Sea-Kazakhstan subregion and central Asian subregion due to the difference in degree of continentality of the climate. Black Sea-Kazakhstan subregion was contained up to the southern Altay. On the other hand, central Asian subregion extends from Gobi Altay to Inner Mongolia. Cheng (2008) also explained that along the lines of Altay Mountains, species composition of the Eurasian steppe is mainly divided into two groups including the western Eurasian steppe and the eastern Eurasian steppe.

In previous researches, Grubov (1999) conducted floristic classification in central Asia, and mentioned about the absence of information in floristic composition of Xinjiang. Lavrenko and Karamysheva (1993) also reported two steppe subregions are in contact at the southern Altay Mountains. This suggests that Eurasian steppe may not be completely divided there.

Some studies conducted in central Eurasian steppe, but survey and analysis methods were different among studies and research areas were not enough. Therefore, the vegetation information of central Eurasian steppe has not

gathered systematically. In addition, it is not clear that similarity among central Eurasian steppe and other steppe regions.

In this study, our aims are (1) to classify and describe plant communities of central Eurasian steppe; and (2) to discuss about the position of central Eurasian steppe vegetation in the Eurasian steppe.

2. Study Areas and Methods

The study was carried out in northern Xinjiang in July, 2009 and in western Mongolia in July, 2010 because most of plants were the flower season and identified relatively easily. Data were collected from a total of 129 stands (1 m²-16 m²) around Fukang city, Altay city and Barkol Kazak Autonomous County in northern Xinjiang, a total of 97 stands (1 m²-16 m²) around Ulaangom and Khovd in western Mongolia sampling from relatively homogeneous areas (**Figs. 1 and 2**). The average annual temperature is 7.0°C, 4.2°C and 9.4°C, while the annual precipitation is 249 mm, 195 mm and 57 mm in Fukang city, Altay city and Hami city which is located near Barkol Kazak Autonomous County, respectively (Statistics Bureau of Xinjiang Uygr Autonomous Region 2004). The average annual temperature is -1.5°C and 2.0°C, while the annual precipitation is 115 mm and 94 mm in Ulaangom and

* Corresponding Author: kohei0808@gmail.com

1-1-1 Temnodai, Tsukuba, Ibaraki, 305-8572, Japan

1) Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan

3) Department of Botany, School of Biology and Biotechnology, National University of Mongolia, Mongolia

2) Institute of Resource and Environmental Sciences, Xinjiang University, China



Fig. 1. Study areas.



Fig. 2. Landscape of western Mongolia.

Khovd, respectively (National Statistical Office of Mongolia, 2010). Typical steppe vegetation is focused in this research. However, the steppe vegetation around study areas is variable, with some of the features of desert steppe (Zhu, 1993). Therefore, vegetation survey may be conducted not only on typical steppe but also on desert steppe. The survey was followed by the phytosociological methods of Braun-Blanquet (1964). The species composition of each stand was recorded using the Braun-Blanquet cover-abundance scale. To decide sampling area, the minimal area was adopted. The minimal area is the way that enlarges area gradually up to stop new plant species appearance. The altitude of each stand was also recorded. Using the abundance data at each stand, plant community table was made and plant community was classified on the basis of their differential species in northern Xinjiang and western Mongolia respectively (Braun-Blanquet, 1964; Muller- Dombois, 1974). After that, plant community tables were unified. Taxonomic Nomenclature follows Mijit (2000) in northern Xinjiang and Grubov (2001) in western Mongolia.

3. Results and Discussion

The central Eurasian steppe is dominated by species belong to genus *Stipa* and genus *Artemisia*. And *Heteropappus altaicus* appeared in most of the community. After the unification of plant communities in the study areas in northern Xinjiang and western Mongolia, six community groups are differentiated. These community groups are *Stipa capillata* community group, *Agropyron cristatum* community group, *Convolvulus lineatus* community group, *Elymus mutabilis* community group, *Anabasis brevifolia* community group and *Nanophyton erinaceum* community group.

S. capillata community group is formed by the communities distributed in Fukang and Altay in northern Xinjiang. And this community group is characterized by *S. capillata* and *Festuca sulcata*. The distribution ranges of this community group are 912 m - 1830 m.

A. cristatum community group is formed by the communities distributed in Ulaangom and Khovd in western Mongolia. And this community group is characterized by *A. cristatum*, *Scorzonera ikonnikovii*, *Artemisia frigida*, *Gypsophila desertorum*, *Convolvulus ammannii* and *Cleistogenes songorica*. The distribution ranges of this community group are 1403 m - 1904 m.

C. lineatus community group is distributed in Barkol Kazak Autonomous County in northern Xinjiang. And this community group is characterized by *C. lineatus*, *Artemisia scoparia* and *Ephedra glauca*. The distribution ranges of this community group are around 2028 m.

E. mutabilis community group is distributed in Barkol Kazak Autonomous County in northern Xinjiang. And this community group is characterized by *E. mutabilis* and *Artemisia rutifolia*. The distribution ranges of this community group are around 2049 m.

A. brevifolia community group is distributed in Khovd in western Mongolia. And this community group is characterized by *A. brevifolia*. The distribution ranges of this community group are 860 m - 863 m.

N. erinaceum community group is distributed in Ulaangom in western Mongolia. And this community group is characterized by *N. erinaceum* and *Hordeum turkestanicum*. The distribution ranges of this community group are 1480 m - 1530 m.

S. capillata and *F. sulcata* which are differential species in *S. capillata* community group are also differential species in western Eurasian steppe which are classified in Kazakhstan and Ukraine by Cheng (2008). Therefore it is said that *S. capillata* community group and western Eurasian steppe have common differential species. However, species composition of *S. capillata* community group is different from that of

western Eurasian steppe. *S. capillata* community group has northern Xinjiang characteristics.

A. cristatum, *A. frigida* and *C. ammanii* which are differential species in *A. cristatum* community group are also differential species in eastern Eurasian steppe which are classified in mideastern Mongolia and Inner Mongolia by Cheng (2008). Therefore it is said that *A. cristatum* community group and eastern Eurasian steppe have common differential species. However, *S. ikonnikovii*, *G. desertorum* and *C. songorica* are not differential species in eastern Eurasian steppe. And species composition of *A. cristatum* community group is also different from that of eastern Eurasian steppe. *A. cristatum* community group has own characteristics.

The species compositions of other community groups are different from that of *S. capillata* community group, *A. cristatum* community group and other Eurasian steppe vegetation.

C. lineatus community group and *E. mutabilis* community group are distributed in Barkol Kazak Autonomous County. On the other hand, *S. capillata* community group is distributed in Fukang and Altay. Species composition is different between Barkol Kazak Autonomous County and others. This is likely because the aridness around Barkol Kazak Autonomous County. This area located in the eastern section of the Tianshan Mountains, and has the aridness due to its long distance from the oceans and the almost exhausted effect of western oceanic air masses (Zhang *et al.*, 2004).

A. brevifolia community group are distributed in Khovd, and *N. erinaceum* community group are distributed in Ulaangom. *A. cristatum* community group are equally distributed in Ulaangom and Khovd. However, the distribution ranges are lower in these community groups than *A. cristatum* community group. It is likely that these community groups and *A. cristatum* community group are divided by altitude. *A. brevifolia* and *N. erinaceum* which are differential species of these community groups respectively are the species mainly distributed in deserts and semi deserts in Mongolia (Hilbig, 1995). These community groups are characterized by drier species and absence of differential species of *A. cristatum* community group.

4. Conclusion

The species composition is quite different along the lines of Altay Mountains in central Eurasian steppe from a comprehensive standpoint. *S. capillata* community group which is located in west side of Altay Mountains has common differential species with western Eurasian steppe. On the

other hand, *A. cristatum* community group which is located in east of Altay Mountains has common differential species with eastern Eurasian steppe.

The species compositions of other community groups are different from that of *S. capillata* community group, *A. cristatum* community group and other Eurasian steppe vegetation. This is likely because the differences of geographical location and altitudinal distribution. Other community groups considered to be more similar to desert steppe than typical steppe. However, vegetation information is insufficient to make sure the position of these community groups. Therefore it is necessary to get more vegetation information in central Eurasian steppe.

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