

Plant Phytomass Changes in a Larch Forest of the Lake Hövsgöl Area, Northern Mongolia

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Abstract

In the present study we related the decrease of the vegetation productivity in a larch forest with an increase of the air temperature over a 20-year period (1987-2007). During the years of the study the data from nearby weather stations showed warming and drying trends in climatic conditions: a 1.6°C increase of mean annual temperature, increase in maximum and minimum temperature extremes, and delay of summer rains. Plant community changes include the shift in species dominance from mesophytes to xerophytes, decrease in vegetation cover and plant height, and transformation of a single July blooming peak to the more diffuse blooming season. We also showed the plant phytomass of the larch forest of the Hövsgöl region is decreasing in response to the climate changes.

Key words: Phytomass dynamics, air temperature, precipitation, Lake Hövsgöl, vegetation cover

Introduction

The Lake Hövsgöl National Park is located in the northern part of Mongolia at 50°-51°N, 98°-101°E. This protected area surrounds Lake Hövsgöl, which is reported to contain the world's freshest water. The area includes two distinct vegetation landscape types: alpine and mountain taiga forest to the west of the lake, and forest-steppe to the east. The forests consist predominantly of coniferous trees, constituting a boreal, typical Siberian taiga. They are subdivided into the dark colored pine forest (*Pinus sibirica* and *Picea obovata*) and the light colored coniferous larch forest (*Larix sibirica*). The larch forest is predominant across the forest-steppe area on the east of the lake. Its vegetation cover includes diverse forbs and shrubs (*Betula humilis*, *Rhododendron parvifolium*, *Vaccinium vitisi-daea* and *V. uliginosum*) (Batraeva *et al.*, 1982).

The Hövsgöl region experiences a harsh continental climate with four sharply defined seasons and large diurnal temperature fluctuations. Winter season is long, cold and dry; summer is short, hot and dry. Average monthly temperatures range from +12°C in July to -21°C in January. Mean yearly temperature is equal to -4.5°C, absolute maximum of +35°C, and absolute minimum of -49°C (Nandintsetseg *et al.*, 2007). Average annual precipitation ranges from 250 to 450 mm with a mean of 300 mm. Precipitation peaks in the

summer months, averaging 22.4 mm for May, 52.6 mm for June, 87.6 mm for July, and 77.1 mm for August. Wind direction is predominantly from the northwest and south and its speed averages 2-3 m/sec (Bufal *et al.*, 1989).

The protected area is underlain by continuous permafrost, which keeps the soils of the forests cool and wet in summer months. As the Arctic or boreal regions, permafrost and its associated plant communities are threatened by global climate change and warming. The effects of these warming patterns on different landscapes can be diverse, changing plant development, reproduction, vegetation type, cover and phytomass (IGBP, 1999).

Since 1963, a weather station has been maintained in the village Hatgal at the southern end of Lake Hövsgöl, providing excellent local weather records. Statistical analysis of the weather data for 1963-2002 revealed a clear record of a regional warming trend (1.6°C increase in average annual air temperature for the period) (Nandintsetseg *et al.*, 2007).

In 1987, we established a new geobotanical research plot near the weather station at the southern end of the lake to monitor plant phenology and phytomass, successional changes in the plant community and anthropogenic influences from tourism and livestock grazing in the national park (Oyumaa & Erdenetsetseg, 2004, 2008).

Recent environmental conditions have