HOW PASTORALISTS IN MONGOLIA PERCEIVE VEGETATION CHANGES CAUSED BY GRAZING

Kaoru Kakinuma, Takahiro Ozaki, Seiki Takatsuki and Jonjin Chuluun

Abstract

It is widely recognized that changes in livestock grazing in Mongolia after the early 1990s has increased concerns regarding land management and a need for better management strategies. Traditional knowledge and experiences of the Mongolian pastoralists should be used for such strategies. If pastoralists recognize the seriousness of 'overgrazing' or signs of overgrazing, management can be guided to use this traditional ecological knowledge to develop more effective strategies. This paper describes vegetation changes caused by grazing and how pastoralists assess these changes. We have found that pastoralists use certain types of plants as indicators to assess vegetation changes. They consider '*nariin*' (narrow) plants, which often include short grasses and sedges, as good because livestock prefer them. However, most of the interviewed pastoralists thought that the main reason for vegetation degradation is temperature increase, not overgrazing. This case study suggests the usefulness of such interviews together with vegetation surveys.
Keywords: Mongolia, ecological knowledge, mobile pastoralists, grazing management, overgrazing, vegetation change

Introduction

With the collapse of the Soviet Union in 1991, the Mongolian political economic system was completed altered, leading to many livelihood changes including changes in the livestock production systems (e.g. Okayasu et al. 2007). Livestock populations grew in the mid-1990s and grazing, especially around towns and cities, increased dramatically. The altered livestock grazing patterns certainly led to increased land degradation, and there is thus an urgent need to develop better strategies for sustainable land use.

In attempts to assure sustainable land use, biological and ecological studies have studied the relationships between vegetation and grazing intensity (Fernandez-Gimenez and Allen-Diaz 2001, Sasaki et al. 2005). These studies have shown a decrease of biomass and increase of unpalatable plants due to increase of grazing intensity. These findings are important for understanding the basic mechanisms of vegetation changes. At the same time, it is also important to document how Mongolian pastoralists view the present grasslands associated with different values and uses. Much of this knowledge is likely based on

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traditional knowledge, being learned from others. Previous studies on pastoralists have shown that they use ecological knowledge, which suggests the possibility of new types of grazing management for sustainable land use (Fernandez-Gimenez 2000, Oba and Kaitira 2006, Allsopp et al. 2007, Muller et al. 2007). For example, Fernandez-Gimenez (2000) has shown that Mongolian pastoralists recognize suitable plants for different livestock, appropriate slopes for different livestock species and appropriate season of use. Muller et al. (2007) has shown that pastoralists' traditional knowledge is useful for sustainable range management. We need to investigate whether their knowledge regarding rangeland degradation and overgrazing seems to correspond with current ecological theory and if their views would be similar to our findings on plant responses to livestock grazing in their local area. Our study focuses on Mongolian pastoralists' perception of vegetation changes and grazing intensity. A case study was done in the northern part of Mongolia. We suggest that an effective management system should synthesize and use both known biological information and pastoralists' knowledge.

Study Area

The study area is located in Bulgan Aimag (*aimag* is synonymous with an administrative province or prefecture) (48°57′N, 103°21′E) in the north-central part of Mongolia. Bulgan is located in forest-steppe ecological zones. The annual average temperature of the *aimag* is –1.0°C and annual precipitation is 332 mm (Institute of Meteorology and Hydrology of Mongolia).

Grazing Intensity Classification and Vegetation Monitoring Methods

In order to determine differences in vegetation associated with different grazing intensities, we categorized three levels of grazing intensity according to distance from *gers* (traditional Mongolian circular felt tent-houses) and livestock numbers. The types of animals raised in the area are sheep, goats, cattle and horses. The number of livestock were converted to sheep units (Bedunah and Schmidt 2004). Sheep units calculations were cattle = 6 sheep, horse = 7 sheep and goat = 0.9 sheep.

We categorized the level of grazing intensity according to sheep unit and distance from *ger*: heavy grazing (> 2,000 head) and within 2 km of the *ger*, moderate grazing (< 2,000 head) and within 2 km, and light grazing categorized as > 2 km from the herder *ger*. We used five 1m × 1m plots to record species numbers and estimate cover (per cent) and height (cm) of all plant species rooted in the plots for each grazing intensity. We also clipped, dried and weighed plants from each plot to determine biomass (g/m^2). Sample size was 15 plots each on the moderate and heavy grazed classified sites and 26 for the lightly grazed classified sites.

Interviews

In order to understand the evaluation and recognition of the grassland characteristics by local pastoralists, we visited with the pastoralists at the three sites (light, moderate and heavy grazing sites) where we had conducted the vegetation surveys. We used a semi-structured interview process. We asked three pastoralists individually to evaluate whether the sites were suitable for grazing or not, and asked them about the reasons for the evaluation. They lived close to the study sites during summer. They were 40- to 50-year-old men. Additionally we interviewed 37 pastoralists on vegetation changes during the last 10 years. Okayasu et al. (2007) have shown the recent vegetation changes are marked.

Results

Vegetation Change by Grazing Intensity

Total numbers, height and biomass of plants decreased as grazing pressure increased (Figure 1). Cover (per cent) of perennial forbs such as *Geranium spp.* and *Galium verum* greatly decreased with more grazing intensity. On the contrary, graminoids remained similar in coverage, species and biomass regardless of grazing pressure (Figure 2). Cover of *Carex duriuscula.* and *Festuca rubra* increased as grazing pressure increased. On the other hand, cover of *Poa sp.* decreased as grazing pressure increased.

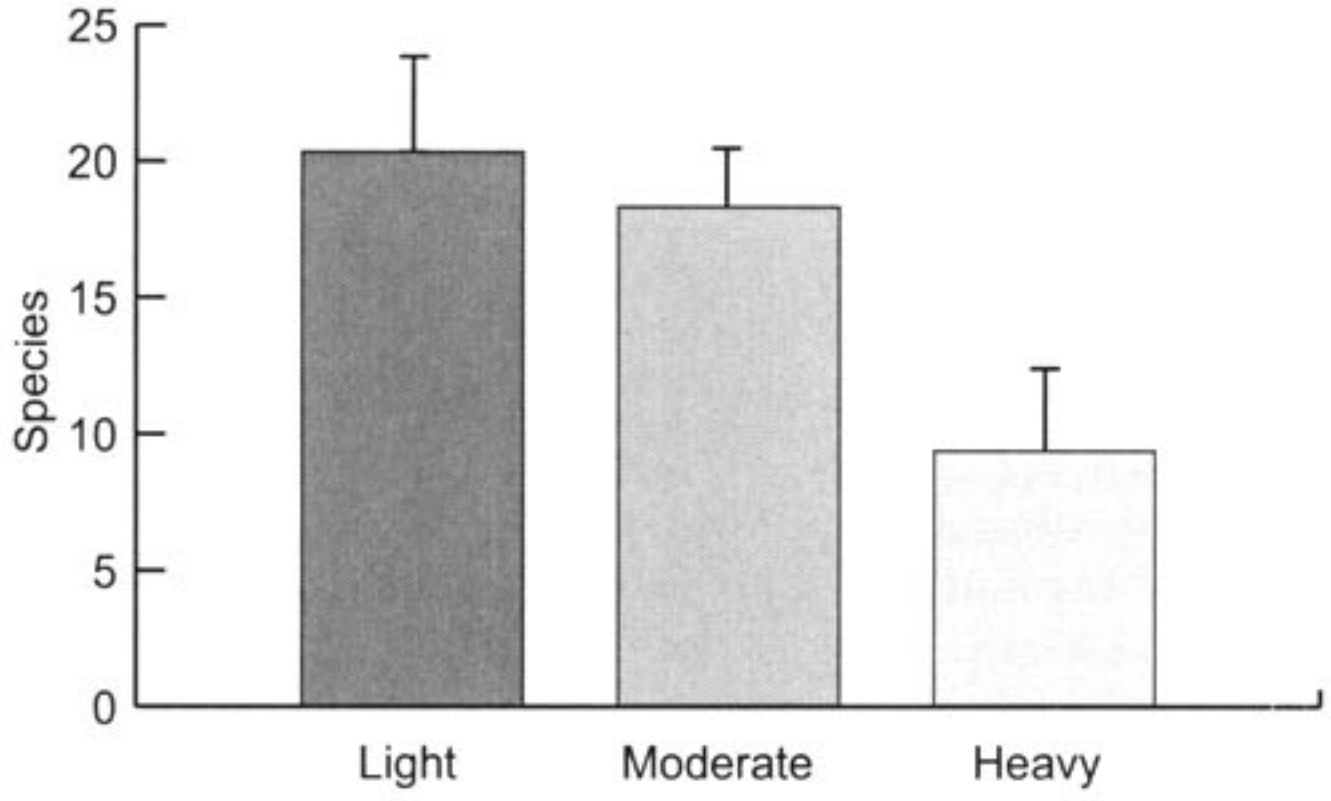
Perceptions of Vegetation Change by Grazing Intensity

The informants used specific plants for assessment of the grasslands. They termed as '*nariin ovs*' (Mongolian) the graminoids such as *Carex duriuscula* and *Festuca rubra*, which they described as narrow plants, and regarded them as good forage for livestock, particularly sheep and goats. These plants frequently appeared even in heavy grazing places. In spite of apparent 'overgrazing', the pastoralists seemed to consider heavy grazing sites as relatively 'good' because such places are vegetated by *nariin* plants. One of the *nariin* plants, *Carex duriuscula*, had greatest coverage in heavy grazing sites (Figure 3).

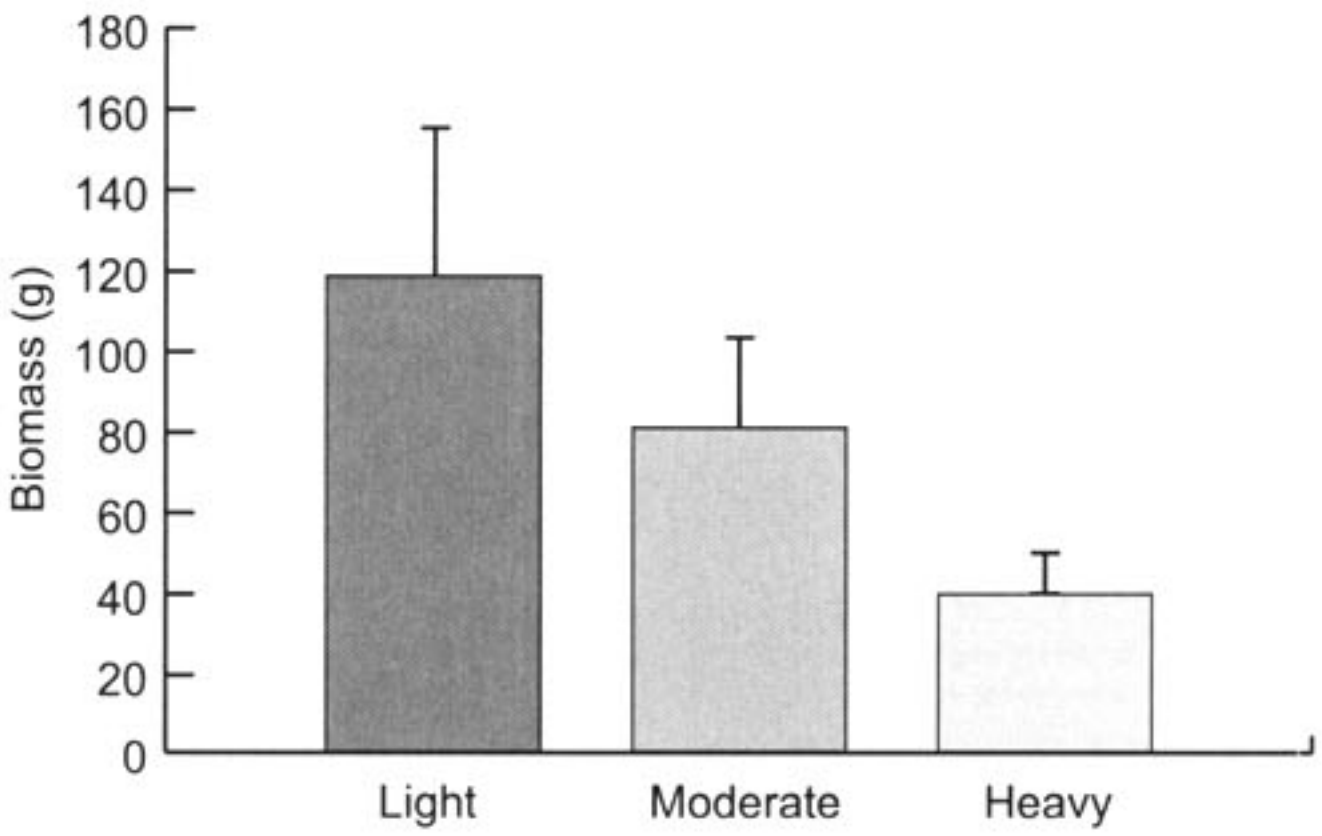
Perceptions of Long-term Vegetation Change

Twenty-eight of the 37 pastoralists answered that vegetation has worsened in the last 10 years. They mentioned as some of the evidence for the decrease: biomass decrease, plant height lowering, disappearance of plants and increase of undesirable plants such as *Iris spp.* and *Stellera chamaijasme* (but we observed little coverage of these plants in this vegetation survey). Nineteen out of 28 pastoralists who pointed to the decrease supposed that it was due to the decrease in precipitation. No one mentioned heavy grazing as the cause.

(a) Species



(b) Biomass (g)



(c) Height

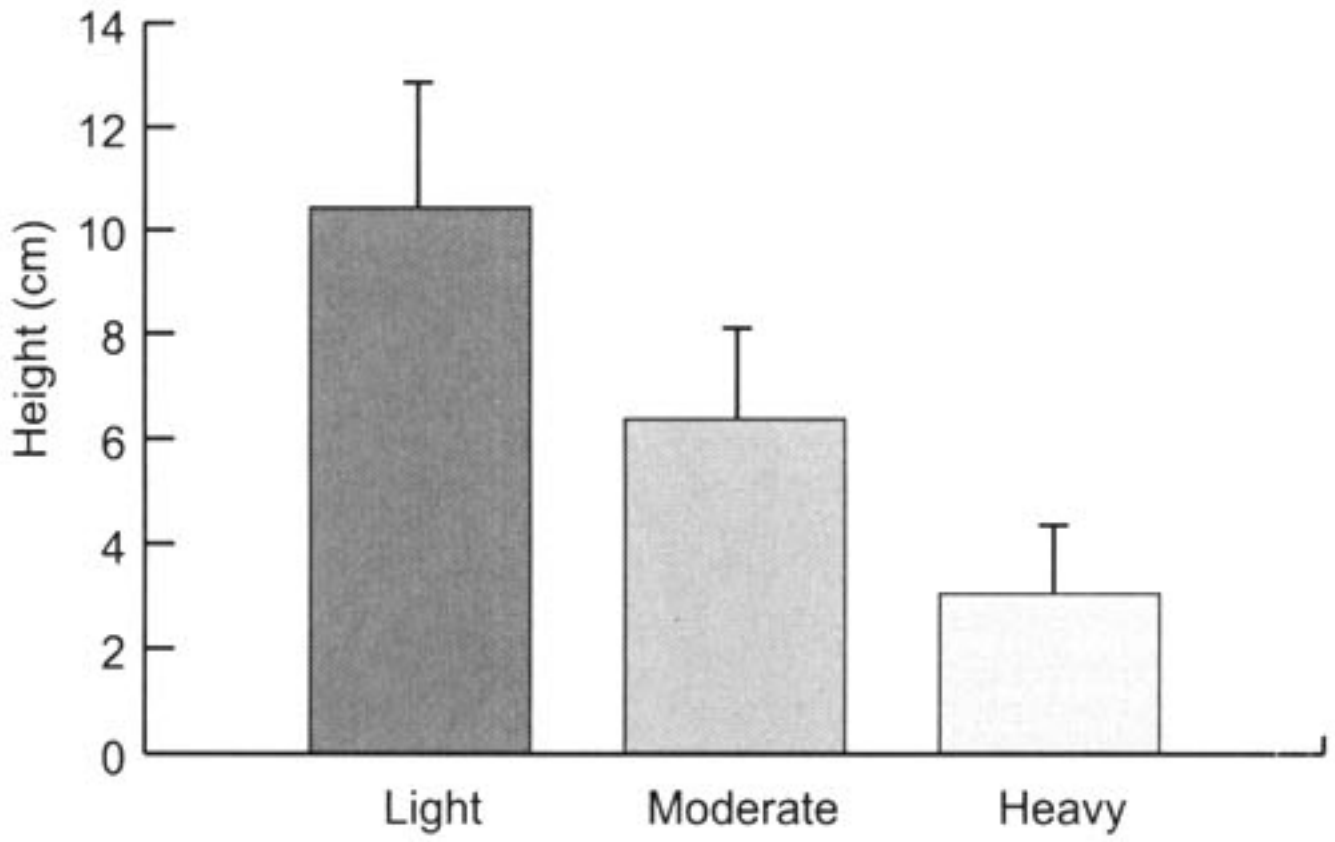


Figure 1: *Total Coverage, Biomass, and Number of Species at Different Level of Grazing Intensity at Bolgan Aimag, Northern Mongolia.*
Each bar represents the mean +SD. We use pairwise t-test with bonferroni correction. Different letters above bars mean statistical significance ($p<0.05$)

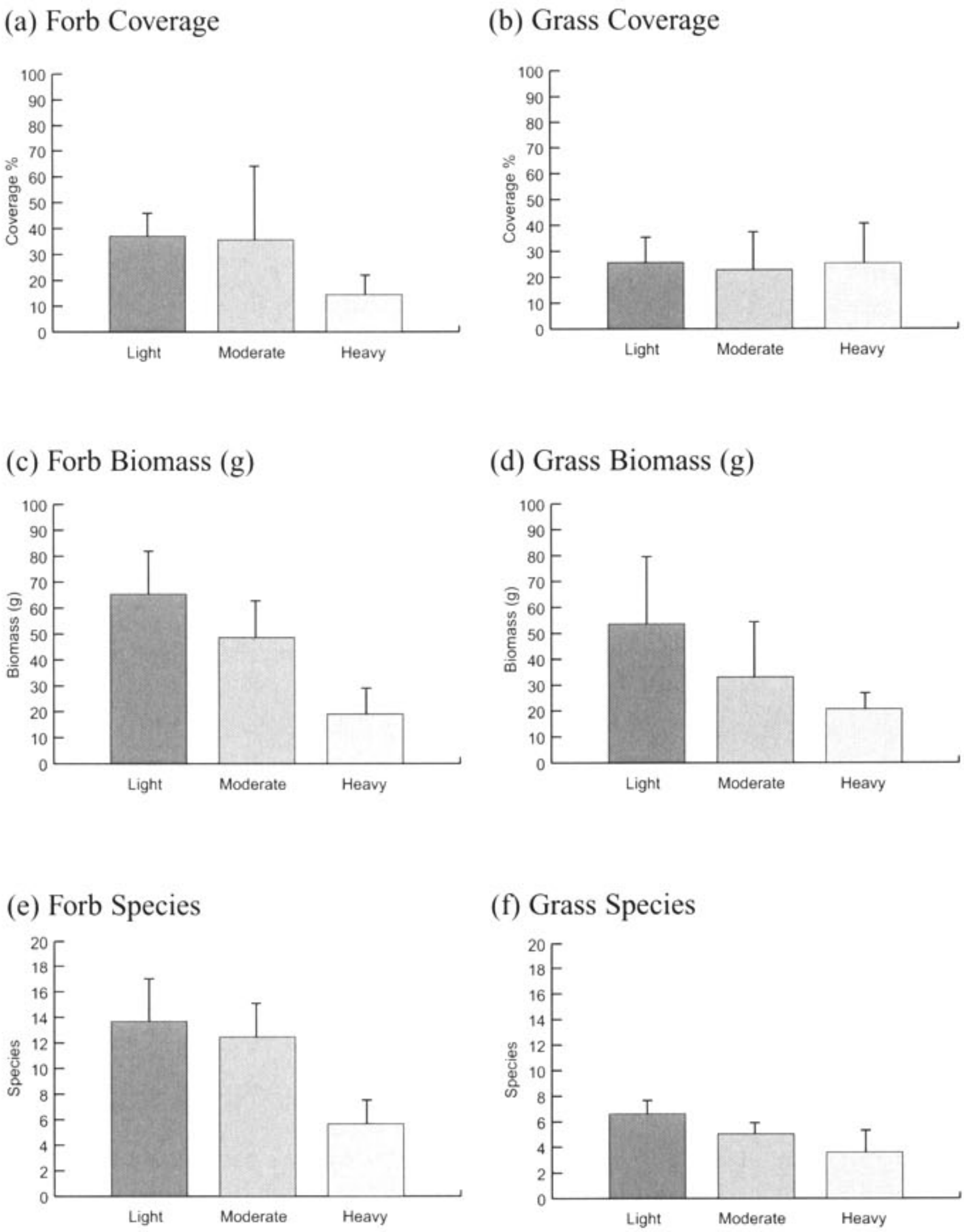


Figure 2: *Coverage, Biomass, and Number of Species of Forbs and Grasses at Different Level of Grazing Intensity at Bolgan Aimag, Northern Mongolia intensity.*
Each bar represents the mean +SD. We use pairwise t-test with bonferroni correction. Different letters above bars mean statistical significance ($p<0.05$

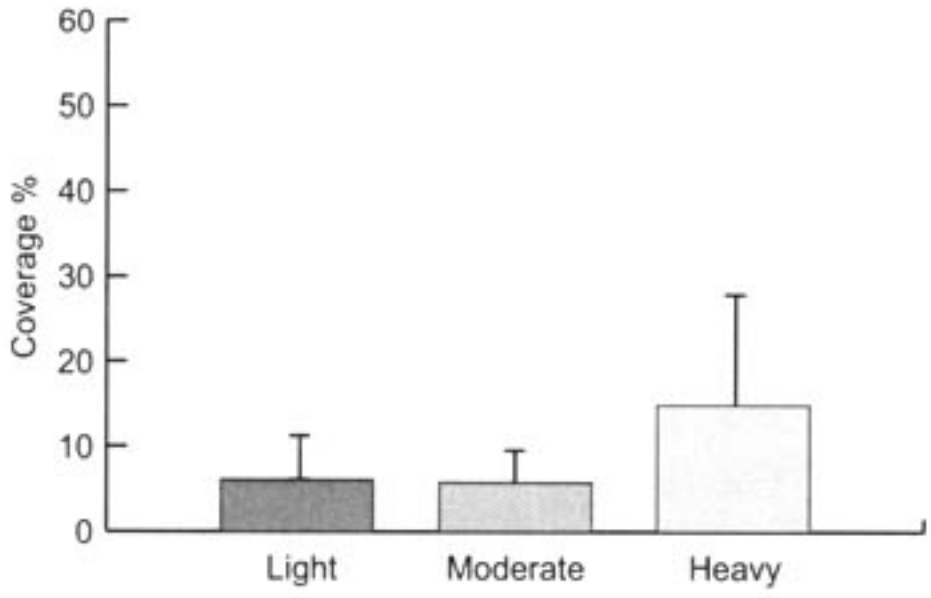


Figure 3: *Coverage of Carex duriuscula at Different Levels of Grazing Intensity at Bilgan Aimag, Northern Mongolia*

Discussion

From the point of plant ecology, it is apparent that intensification of grazing reduces plant biomass and height, and changes the vegetation compositions, and this seems to be common in Mongolia (Fernandez-Gimenez and Allen-Diaz 1999). The interviewed pastoralists of Bulgan Aimag also recognized that changes or degradation of the grassland happened through the last decade. Nevertheless, no informant considered that such changes were caused by heavy grazing; rather, they thought the reason was climate change, particularly a decrease in rainfall.

The pastoralists considered *nariin* or narrow plants as indicators of good sites for grazing of sheep and goats, as the livestock preferred *nariin* plants. Our vegetation survey also showed that *nariin* plants appeared in heavy grazing sites. Therefore, it is possible that the pastoralists do not recognize the more intensive grazing as a negative factor and a detriment for sustainable productivity of this grassland.

Although we have shown compositional changes and reduction of biomass of the grassland due to overgrazing, these changes do not always directly mean degradation of the grassland. It is therefore necessary to show the evidence of degradation such as lower forage nutrient value or lower plant productivity. It is also necessary to show whether *nariin* plants are really preferred by livestock. Nevertheless, our study has shown that a synthetic approach of both plant ecology and interviews with local pastoralists is useful and can contribute to better grassland management of Mongolia.

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Kaoru Kakinuma, Graduate School of Agricultural and Life Sciences, University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113–8657, Japan.
Email: aa076294@mail.ecc.u-tokyo.ac.jp

Takahiro Ozaki, Faculty of Law, Economics and Humanities, Kagoshima University, Japan.

Seiki Takatsuki, Laboratory of Wildlife Ecology and Conservation, School of Veterinary Medicine, Azabu University, Japan.

Jonjin Chuluun, pastoralist and ex-chief of the meteorological station in Bulgan Prefecture, Mongolia.