

Interannual Variation of Yield and Phenology in Mongolian Grassland

Akihiko Kondoh[1]; Ichirow Kaihotsu[2]; Masahiro Hirata[3]

[1] CEReS, Chiba Univ.; [2] Natural Environ. Sci., Hiroshima Univ.; [3] Animal Husbandry, Agri., Kyoto Univ.

<http://dbx.cr.chiba-u.jp/>

Ecological zones in Mongolia ranges from forest in the northern part to southern desert region, and climatological gradient is very large. Kondoh et al.(2002) recognized water-limited and energy-limited vegetation types in the globe, and Mongolia located in the transition zone of both types. The boundary is the most vulnerable zone under changing environment expected during the 21st century. Kondoh and Kaihotsu(2003) showed that the Mongolian grassland is the water-limited type. This means the grassland suffers serious effects if climatological change accompany precipitation decrease. Yu et al.(2003) found that global warming promote the desiccation of ground surface and lead to the delay of germination of grass in eastern central Asia. The analyses on the phenology and plant yield and their causal analyses are the most important subject to enable the prediction of future environmental changes.

This paper attempts the description of phenology and yield in the Mongolian grassland. Interannual and spatial distribution of vegetation activity are revealed by biological data from Natural Environmental Monitoring Stations(NEMS), operated by Institute of Meteorology and Hydrology(IMH), Mongolia, and try to provide basic informations to understand the response of vegetation to climatic variation.

The following results are obtained from the analyses:

- There is large interannual changes in phenology. The amount of the variation reaches to 60 days, and it is different in grassland species.
- Spatial distribution of the timing of each phenological stage is various. There is no regular progress in the timing of germination(emergence), and interannual changes are also large.
- Plant yield also exhibits large interannual variation. Some locations show more than 90% of fluctuations to maximum yield.
- The spatial distribution of yield almost correspond to ecological zone, and large in northern and eastern part, and small in southern Gobi region. Interannual variation is also large, especially in southern desert steppe and desert region.
- There is a correlation between phenology and climate. Soil water content in early growing season determines the timing of emergence. Summer dryness and also over wetting may lower the plant production.
- Increase in growing season length is not simply connected to the increase in the yield. Yield receive various effect from the amount and the timing of weather events. This is the difference from forest.

Above results explain that the factors to affect Mongolian grassland phenology is various, and it leads to the instability of plant production. Essential nature of Mongolian grassland is water-limited one, and precipitation has wide variability in space and time compared with air temperature. On the other hand, forest has energy-limited growing type, and tend to synchronize to global climatic change. This explains the difference between forest and grassland as described in Kondoh and Kaihotsu(2003).