Evaluation of Carbon Sequestration for Different Land Covers in Mongolia

*Qinxue Wang[1], Tomohiro Okadera[1], Deni Eer[1], Ochirbat Batkhishig[2]

1. 国立研究開発法人　国立環境研究所、2. モンゴル科学院　地理・地球生態学研究所
1. National Institute for Environmental Studies, 2. The Institute of Geography and Geoecology, Mongolian Academy of Sciences

Land cover change can significantly affect the carbon sequestration potential in fragile ecosystems. Mongolia is experiencing climate change with associated land cover change including an increase in cultivation land, urban area and mining area, and decrease of grassland and forest. In order to estimate carbon sequestration by vegetation (NPP, net primary production) and by ecosystems (NEP, net ecosystem production) for different land covers under the influence of both climate change and livestock grazing intensity, we have developed an ecosystem-grazing model, which has coupled both natural factors to determine photosynthetic production (GPP), autotrophic respiration (Ra) and heterotrophic respiration (Rh), such as photosynthetically active radiation (PAR), air temperature (Ta), precipitation (P) and soil organic matter (SOM), and artificial factors such as grazing density (GD), grazing days (D) and grass intake (I). The model was validated by the observation data of carbon exchange from eddy covariance (EC) flux towers across a variety of ecosystem types.

We found that (1) carbon sequestration by both vegetation (NPP) and ecosystems (NEP) increased totally in whole country from 2000 to 2016. Water deficit index (WDI) was the most important driving factor in dry steppe and semi-desert steppe, however, land surface temperature (LST) was the most in forest and meadow steppe; (2) time series trend analysis indicated that areas showing positive trends are most widespread towards the northern and northeastern Mongolia, as well as in the Gobi desert in southern Mongolia. Negative trends are spread mainly in the central Mongolia, around the capital city, Ulaanbaatar, where grass land has seriously degraded due to heavy grazing, although these areas originally have a high capacity of carbon sequestration.

Overall, our results indicate that vegetation cover and carbon sequestration appear to be positively correlated with each other, which is highly sensitive to precipitation fluctuation in the arid area of southern Mongolia, but sensitive to grazing intensity in the semi-arid area of central Mongolia. Thus, we can come to a conclusion that the land cover in Mongolia are vulnerable to both climate change and intensive grazing, well management or strict-control of livestock numbers would be one of the most effective adaptation countermeasures for the resilience of ecosystem carbon sequestration.

This study was supported by the project “Development of Innovative Adaptation System and MRV Method for JCM in Mongolia" (2015-present), funded by Ministry of the Environment, Japan.

Keywords: Land Cover, Carbon Sequestration, Resilience of Ecosystem, Grazing Density

