Carbon dioxide flux and its environmental controls in Mongolian semiarid grassland

Tomoko Nakano[1]

[1] Dept. Geography, Tokyo Metro. Univ.

The Mongolian steppe zone is one of the main components of central-Asian grasslands. Carbon dioxide exchange rates between the atmosphere and the steppe ecosystem were measured in a Mongolian semi-arid grassland in July 2004, May 2005, July 2005, September 2005, and June 2006 by using a closed-chamber technique. The study area is dominated by Poaceous grasses and was enclosed by a fence (300 m x 300 m) in June 2004 to prevent livestock from grazing. We used transparent and opaque chambers to separately evaluate net ecosystem exchange (NEE), ecosystem respiration (R_{eco}), and gross primary production (GPP). Along with the flux measurements, air and soil temperatures, relative humidity, precipitation, photosynthetically active radiation (PAR), and soil volumetric water content were continuously measured. Aboveground plant biomass was also determined by clipping vegetation for each observation period. From the measured data of CO_2 fluxes and environmental variables, their quantitative relationships were examined. GPP was highly correlated with the aboveground biomass, hence we normalized GPP values by the amount of aboveground biomass. Photosynthetic light-response curves for the normalized GPP did not differ among the observation periods (i.e., growth stages of the grasses). However, the curves differed significantly among different soil moisture conditions, suggesting that the light-response of grasses declined as soil dried. In addition, reduced GPP was observed under extremely hot and dry atmospheric conditions. We found significant relationships between R_{eco} and both of the soil temperature and moisture. Our results also indicated that the temperature sensitivity of R_{eco} increased with the increased soil moisture.