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Effects of the expansion of vascular plants in Sphagnum-dominated bog on carbon balance

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Peatland ecosystems have accumulated a huge amount of soil organic carbon for millennia. However, it is reported that the soil carbon has become vulnerable because of global warming and land-use change. Such disturbances potentially enhance oxidative peat decomposition, and consequently a large amount of CO_2 is emitted into the atmosphere. In Sarobetsu Mire in northern Hokkaido, which has the largest *Sphagnum*-dominated bog in Japan, vascular plants, *Sasa*, have invaded into *Sphagnum* bog because of the change of the hydrological environment, which was due to drainage for agriculture. To understand the effects of the expansion of *Sasa*-dominated area in *Sphagnum* bog on carbon balance, we measured CO_2 flux using the eddy covariance technique at a *Sphagnum*-dominated area (B site) and a *Sasa*-dominated area (T site) and compared CO_2 balance between the two sites.

Flux measurement was conducted during the four snow-free seasons from mid-April through early November in 2007 to 2010. Eddy sensors of CO_2 (LI7500, Licor) and wind speed (CSAT3, Campbell) were installed at the heights of 2.0 and 2.3 m, respectively, at B and T sites. The outputs from the sensors were recorded with a datalogger (CR1000, Campbell) at 10 Hz. Net ecosystem CO_2 exchange (NEE) was calculated on a half-hourly basis as a sum of eddy CO_2 flux and CO_2 storage change calculated from CO_2 concentration measured by LI7500. NEE was partitioned into gross primary production (GPP) and ecosystem respiration (RE) using an empirical conventional method.

Both GPP (gross ecosystem photosynthesis) and RE were larger at T site than B site. In 2008 with dry summer, cumulative NEE for 6.5 months of the snow-free season was -129 and -179 gC m^{-2}, respectively, at T site and B site. The negative NEE values indicate that the two peatland ecosystems functioned as CO_2 sinks in the season. In addition, sink strength was higher at T site. In 2010 with hot, wet summer, however, cumulative NEE was -238 and -159 gC m^{-2}, respectively, at T site and B site. Although NEE increased largely at B site, it decreased at T site. *Sphagnum* moss grew more under the hot and moist environment, which increased GPP more than RE. In contrast, although growth and resultant GPP also increased at T site, RE increased more than GPP because of high temperature. This result suggests that net CO_2 uptake will decrease by the invasion of *Sasa* plants under the warming environment in the near future.

Keywords: Peatland, CO2 flux, Eddy covariance technique, Global warming