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野外温暖化実験による森林生態系炭素循環の温暖化応答解明
Open field warming experiments for forest carbon cycling in Takayama, Japan

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Experimental evaluation of the effects of rising temperature on carbon cycling processes in forest ecosystems is one of the central interests in ecosystem science under climate change. We have established open field warming experiments in a cool-temperate deciduous broadleaf forest in Takayama site, central Japan, to investigate the responses of foliage photosynthesis in a canopy tree (*Quercus crispula*) and soil carbon dynamics to artificial warming treatment. Warming treatment for canopy tree (+5degreeC) was made by installing an Open-Top Canopy Chamber (OTCC) to three branches at the top of tree crown by an aid of canopy-access tower (18m height), and for soil (+3degreeC) it was made by installing heating cables to a depth of 3-5cm. Air temperature in the OTCC and soil temperature in the warming plots are monitored by temperature probes, respectively.

We monitored foliage phenology by automated digital camera system, and leaf-level ecophysiological characteristics by periodical measurements of chlorophyll content (biochemical assay and SPAD meter), photosynthetic and respiratory CO2 gas exchange (LI-6400, Li-Cor, Inc.) and leaf mass per area. Rising air temperature of the branches resulted in earlier leaf expansion (ca 5 days) and delayed leaf senescence (ca 5 days), and about 10% higher photosynthetic capacity in early summer, while leaf morphological characteristics were not influenced by the temperature treatments.

We examined the diurnal and seasonal patterns of soil respiration in warmed and control plots by using automatic measurement system (LI-8100, Li-Cor, Inc.) and portable non-dispersive infrared gas CO2 sensors (GMP343, Vaisala CARBOCAP, Finland). Soil warming treatment decreased soil moisture by about 6.4% and enhanced annual soil respiration by about 10% during growing season without snow cover. Temperature sensitivity (Q10) was different between control (3.06) and warmed (2.75) plots. The diurnal and seasonal variations in soil respiration might reflect the changes in physiological activities of plant roots and microbial organisms with increasing temperature.

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