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温暖化による生育期間延長を考慮した落葉広葉樹林における炭素収支
Carbon budget in a deciduous broad-leaved forest considering the expanded growing season length by global warming

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The growing season length of plants is one of the major interests in studying the current and future carbon cycles in terrestrial ecosystems, since it would directly affect the photosynthetic CO_2 uptake and respiratory CO_2 release in those ecosystems. In this study, we examined the possible effects of growing season length under current climate and in future climate on forest ecosystem CO_2 budget, by combining in-situ observation of canopy phenology and ecosystem carbon cycling model.. First, by using daily canopy surface images and air temperature data at the Takayama deciduous broad-leaved forest site (TKY) from 2004 to 2009, we examined the dates of the beginning of leaf expansion, the beginning of autumn leaf color development, and the end of leaf-fall, and their relationships with air temperature. We found that (1) leaf expansion began when the accumulated effective air temperature from the first day of the year (based on a 5 deg C threshold) exceeded 140.0 +/- 13.5 deg C (average +/- standard deviation) during spring; (2) leaf color development began when the 5-day moving-average daily temperature fell below 10.8 +/- 1.3 deg C during autumn; and (3) the leaf-fall period, which was defined as the period between the beginning of autumn leaf color development and the end of leaf-fall, was 30.7 +/- 4.0 days. Second, we adapted these relationships between leaf phenology and air temperature to account for the seasonal variation of leaf area index (LAI) under future climatic conditions referring to the projection data of climatic conditions based on several scenarios from CMIP3 Multi-Climate Models. As a result, the growing season length was expected to expand in future climate than present. Finally, we introduced thus simulated phenology of LAI into NCAR/LSM model to examine its possible effects on canopy photosynthesis, ecosystem respiration and resulting net ecosystem CO_2 budget in the future climate. Our analysis could provide the importance of phenological field observation and the consideration of phenological impact for future climate studies.

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