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冷温帯落葉広葉樹林におけるアロケーションの年次変化解析
Interannual variation of carbon allocation in a cool-temperate deciduous forest from 1999 to 2006

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Carbon allocation is the key factor controlling the dynamics of carbon cycle. It determines partitioning of assimilated carbohydrate to components of vegetation, leaves, woody organs, and fine roots. To analyze seasonal and annual scale carbon allocation of forest ecosystems, it is conventional to use the mass-balance approach, which combine individual estimations of flux and biometric observations such as gross primary production, ecosystem respiration, soil respiration, net ecosystem production, leaf and tree biomass, litterfall, and soil organic carbon considering appropriate balances with each components. However, it is often the case that an attribution of fine roots was not fully assessed because it is required significant effort to monitor its dynamics in a long term. Pulse labelling technique allows directly measure allocation of assimilated carbon from foliage to belowground in various tree species. This approach provides detailed aspects of allocation dynamics, but assessing labelled carbohydrate allocated to fine roots is still challenging. Absence of allocation to fine roots limits our knowledge about mechanism of carbon allocation because net primary productivity of fine root (frNPP) potentially account for one-third of the annual total NPP. To compensate limited observation, a model-data integration technique would be a useful tool, in which a process-based biosphere model combined with multi-year biometric observations to inversely estimate plausible allocation to fine roots.

This study investigated the interannual variability of carbon allocation of a cool-temperate forest in the Takayama Forest Research Site, Japan. The multi-year biometric observations are available for most of carbon cycle components at the Takayama site (e.g., woody tissue net primary productivity (wNPP), foliage NPP (fNPP), aboveground and belowground woody biomasses, litterfall, recruitment, and mortality) except fine root NPP (frNPP); only one year data of frNPP is available for 2000?2001. To compensate the limited frNPP measurement, we calculated frNPP from 1999-2006 by a model-data integration technique. In the process of calculation, unnecessary freedom in the simulation of a process-based ecosystem model, Biome-BGC, was constrained as much as possible with multiple biometric observations at the Takayama site. With the observed components of allocation (fNPP and wNPP) in conjunction with the modeled frNPP, we characterized the internnual variability of carbon allocation at the Takayama site by focusing two aspects: (1) allocation priority among leaves, woody components, and fine roots, and (2) controlling climate factors for these allocation components.

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