Geophysical Research Abstracts
Vol. 19, EGU2017-8652, 2017
EGU General Assembly 2017

Short-term dynamics and partitioning of newly assimilated carbon in the foliage of adult beech and pine are driven by seasonal variations

Dorine Desalme (1), Pierrick Priault (1), Dominique Gérant (1), Masako Dannoura (2), Pascale Maillard (1), Caroline Plain (1), and Daniel Epron (1)

(1) UMR 1137 Ecologie et Ecophysiologie Forestières, Université de Lorraine, INRA, Vandoeuvre-lès-Nancy, F-54500, France (dorine.desalme@univ-lorraine.fr), (2) Laboratory of Forest Utilization, Kyoto University, Kyoto 606-8502, Japan

Carbon (C) allocation is a key process determining C cycling in forest ecosystems. However, the mechanisms underlying the annual patterns of C partitioning in trees, influenced by tree phenology and environmental conditions, are not well identified yet.

This study aimed to characterize the short-term dynamics and partitioning of newly assimilated carbon in the foliage of adult European beeches (*Fagus sylvatica*) and maritime pines (*Pinus pinaster*) across the seasons. We hypothesized that residence times of recently assimilated C in C compounds should change according to the seasons and that seasonal pattern should differ between deciduous and evergreen tree species, since they have different phenology. $^{13}CO_2$ pulse-labelling experiments were performed *in situ* at different dates corresponding to different phenological stages. In beech leaves and pine needles, C contents, isotopic compositions, and ^{13}C dynamics parameters were determined in total organic matter (bulk foliage), in polar fraction (PF, including soluble sugars, amino acids, organic acids) and in starch.

For both species and at each phenological stage, ^{13}C amount in bulk foliage decreased following a two-pool exponential model, highlighting the partitioning of newly assimilated C between 'mobile' and 'stable' pools. The relative proportion of the stable pool was maximal in beech leaves in May, when leaves were still growing and could incorporate newly assimilated C in structural C compounds. Young pine needles were still receiving C from previous-year needles in June (two months after budburst) although they are already photosynthesizing, acting as a strong C sink. In summer, short mean residence times of ^{13}C (MRT) in foliage of both tree species reflected the fast respiration and exportation of recent photosynthates to support the whole tree C demand (e.g., supplying perennial organ growth). At the end of the growing season, pre-senescing beech leaves were supplying ^{13}C to perennial organs, whereas overwintering pine needles accumulated labelled PF, probably to acclimate to colder winter temperatures.

Results of this experiment revealed that the dynamics and the in-leaf partitioning of newly assimilated C varied seasonally according to the phenology of the two species. In the future, coupling ^{13}C pulse labelling with compound-specific isotope analysis will be promising for tracing the allocation of newly assimilated C to various physiological functions such as growth, export, osmoregulation and defence in trees submitted to global changes.