TRACING PHOTOSYNTHATE CARBON FROM THE TREE CANOPY TO FOREST SOIL MICRO-ORGANISMS

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INTRODUCTION

The total respiration of forest soils comprises of that derived from the breakdown of soil organic matter and litter (heterotrophic respiration) and that derived from carbon recently fixed by plants (autotrophic respiration). In forest ecosystems, the detailed fate of recently fixed photosynthates transported down into tree roots and subsequently into mycorrhizal fungi and other soil micro-organisms is unknown. Neither do we know the rate at which carbon fixed by the trees reaches and supports the activity of the various soil microbe groups.

MATERIALS AND METHODS

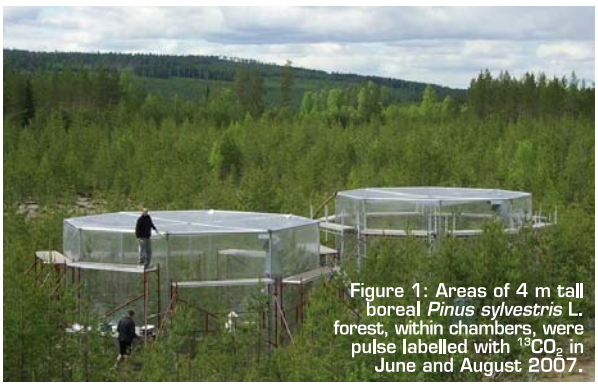

Figure 1: Areas of 4 m tall boreal *Pinus sylvestris* L. forest, within chambers, were pulse labelled with $^{13}CO_2$ in June and August 2007.

Figure 2: Soil beneath the trees was sampled prior to and on several occasions after pulse labelling.

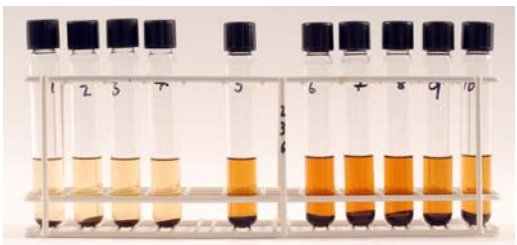

Figure 3: Phospholipid fatty acids (PLFAs) were extracted from the soil and derivatised to their fatty acid methyl esters (FAMES).

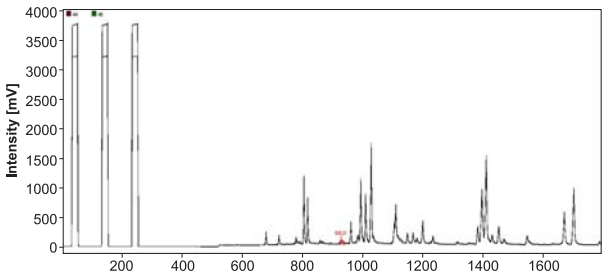

Figure 4: The $^{13}C/^{12}C$ ratios of the individual FAMES were determined using a GC Trace Ultra with combustion column attached via a GC Combustion II interface to a Delta^{Plus} XP isotope ratio mass spectrometer (All Thermo Finigan, Bremen, Germany).

RESULTS AND CONCLUSIONS

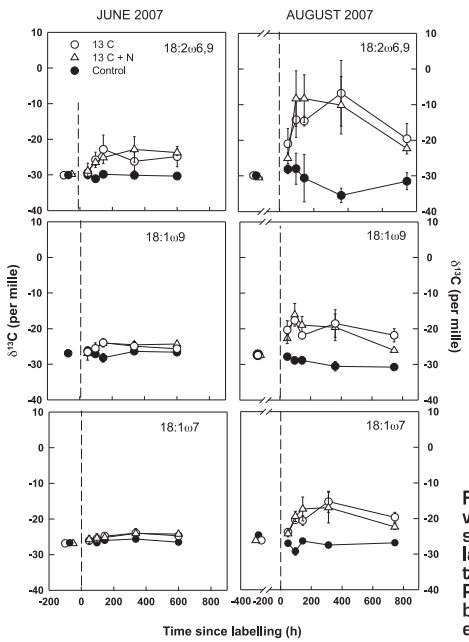

Figure 5: $\delta^{13}C$ values versus time since pulse labelling for the three individual PLFAs which became most enriched.

Two of the PLFAs which became enriched with ^{13}C, 18:2ω6,9 and 18:1ω9, were indicative of fungi. Of these fungal markers 18:2ω6,9 was the most strongly labelled and is thus a promising marker for ectomycorrhizae, the type of mycorrhizae associated with trees. Both 18:2ω6,9 and 18:1ω9 showed maximum ^{13}C enrichment 1-2 weeks after pulse labelling. In contrast, no PLFAs associated with gram positive bacteria and only one PLFA, 18:1ω7, associated with gram negative bacteria, became ^{13}C labelled. Generally the PLFAs became more enriched with ^{13}C following the labelling period in August compared with labelling in June, this suggests the pattern of allocation of recently fixed carbon in *P. sylvestris* is seasonal.

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