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# Peatland $CO_2$ emissions: Using $^{13}C$ to quantify responses to land use change

Helen Snell (1), David Robinson (1), and Andrew J. Midwood (2)

(1) Institute of Biological and Environmental Sciences, University of Aberdeen, Scotland, UK, (2) James Hutton Institute, Aberdeen, Scotland, UK

Soil is the largest terrestrial carbon reservoir and annually soils emit about 98 billion tonnes of $CO_2$which is derived from plant root and rhizosphere respiration (autotrophically fuelled by photosynthesis) and microbial degradation of soil organic carbon (heterotrophic respiration). These two processes are intrinsically linked by complex physical and biochemical interactions.

In order to meet its GHG reductions targets the Scottish Government plans to increase woodland cover from 17 to 25% by the second half of this century which will inevitably lead to significant tree planting on peatland soils. Tree roots and associated mycorrhiza will alter physical and biological conditions in the soil which may affect the heterotrophic contribution to $CO_2$ emissions and consequently the long term landscape-scale carbon balance since the difference between net primary productivity and heterotrophic respiration defines the terrestrial $CO_2$ sink. Significant uncertainties surround the response of peatlands to tree planting and predicted climate changes.

At a field site in eastern Scotland we used natural abundance stable isotopes of carbon to partition soil $CO_2$ efflux into its heterotrophic and autotrophic components to determine whether young Scots pine plantations affect heterotrophic respiration rates in peatland soil. Rate and isotopic composition of soil $CO_2$ efflux was measured in plantation areas and in unforested heather moorland; soil and roots were then excavated and separately incubated to establish the isotopic end members of a simple linear mixing model.

Isotopic composition of soil efflux varies temporally and spatially across the site; young Scots pine trees do not increase the heterotrophic flux from soil and therefore do not lead to a net loss of soil carbon from these landscapes.