

CARBON DYNAMICS IN HEATHER MOORLAND - IMPACT OF TREE ESTABLISHMENT

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INTRODUCTION

In some parts of Scotland, semi-natural woodland is increasing again through natural regeneration or planting. Organic moorland soils are an important store of C and so we need to understand the interactions between above and below-ground biodiversity during woodland establishment, and the consequences for ecosystem function.

Long-term experimental plots at three moorland sites; Invercauld, Glensaugh and Ballogie, were planted with birch and pine in 2005, paired with unplanted 'control' plots. A subset of plots is exposed to grazing, and another subset is fenced to prevent grazing.

At the Invercauld site, detailed measurements on C dynamics are being made.

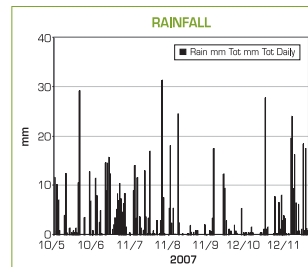
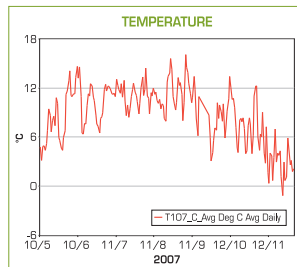
The soils are predominantly freely draining humus-iron podzols developed on glacial drift derived from schistose rocks generally having organic surface horizons to 15 cm depth, overlying characteristic podzolic E, Bh and Bs mineral horizons.



METHODS

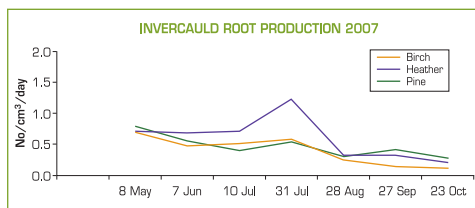
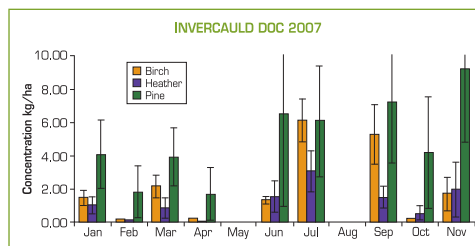
We are regularly monitoring C dynamics using continuous-flow soil respiration chambers attached to infrared gas analysers, zero-tension lysimeters to collect dissolved carbon and nitrogen exports and mini-rhizotron tubes to monitor root production and root disappearance. Above-ground traps are installed to capture and collect litter for litter quality analysis. An automatic weather station is installed at the site to measure incoming radiation, rainfall and soil temperature.

Isotope-labelled root and leaf litter is placed at the field-site at regular times to trace the fate of the material into and the turnover from selected soil pools.



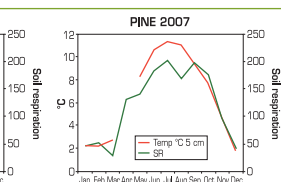
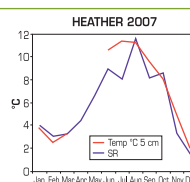
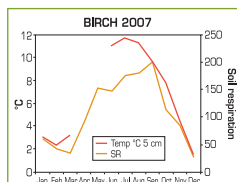
PRELIMINARY RESULTS 2005-07

- DOC concentrations show highest values in early winter (Sept-Nov) and midsummer (June and July) and relate to patterns of rainfall
- DOC concentrations are consistently higher under the planted pine treatments, while CO₂ soil respiration is unaffected by planting
- There is a trend for the presence of trees to reduce overall root production particularly in summer
- Patterns of root dynamics are consistent, with peaks in respiration occurring in the summer corresponding to times of maximal root growth and production, and closely related to soil temperature
- Stepwise regression will be used to model the effects of soil temperature and moisture on CO₂, DOC and DON. Lagged averages of temperature and moisture over different periods will be considered as possible explanatory variables



Summary data on soil C fluxes (kg ha⁻¹ yr⁻¹)

Land Use	CO ₂	DOC	Root C loss to soil
Heather	13965	10.66	14.61
Birch	12306	18.70	6.63
Pine	13324	44.02	16.40



CONCLUSIONS

Although results presented are preliminary, they are important to set a baseline of C storage pools and outputs and to suggest trends. Over the longer term we will analyse any trends in C dynamics to assess the importance of the different main drivers of these changes: tree establishment, grazing and N dynamics.