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Soil fauna contribution to the decomposition of recalcitrant organic matter in response to warming

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The past century has seen a marked increase in atmospheric carbon dioxide concentrations and a concomitant 'greenhouse warming' that has drawn scientific attention to the link between global carbon stocks and climate change. In particular, the temperature dependency of soil decomposition is crucial to the stability of terrestrial organic matter stocks with recent debates focussing on the dynamic behaviour of two hypothetical carbon (C) pools (i.e. a young, rapidly turned over labile pool and an older, longer lived non labile pool) in response to warming. To understand how much and how long C can be stored in soils, there is a critical need to determine the residence time and effluxes of soil organic matter (SOM) carbon and identify the regulatory processes involved.
In this study we used a 'bomb' radiocarbon approach (14C) to determine the roles of temperature and soil fauna activity in the turnover of 'old' non labile carbon in a peatland ecosystem. We investigated the impacts of enchytraeid worms on carbon turnover in two different soil layers, with different incorporation of the 'bomb' peak, when incubated at two different temperatures.
Our results suggest that the combined effect of temperature and enchytraeids has a strong influence on the decomposition rate of this recalcitrant organic matter and thus, at 20oC when the worms were present, there was a strong contribution of pre-bomb C in the release of CO2 and DOC from the deeper layer, with some of this C likely to be hundreds, and possibly >1000 years old. Interestingly, a significant positive and approximately 1:1 relationship was observed between the 14C signatures of both forms of C release suggesting that the treatments superimposed in this experiment affected both forms of C turnover in a similar way.
The fact that there was also a positive, and nearly 1:1 link between the 14C content (i.e. age) of the enchytraeids tissues and that of the respired CO2 and leached DOC suggests that these organisms play an important role in the mobilisation of the older C pools enabling older C to be respired, leached into the soil solution and assimilated by soil organisms in response to warming. This suggests that either the enchytraeids were directly metabolising older C sources or that they were indirectly favouring the turnover of this older carbon through grazing on microbial populations.
Consequently, if we are to understand and model the temperature dependency of SOM decomposition we feel that it is necessary to include the responses and potential interactions with components of the soil faunal community which may affect the turnover of the 'stable' C fractions.