Geophysical Research Abstracts
Vol. 16, EGU2014-6686, 2014
EGU General Assembly 2014

The short-term effects of ecological restoration on carbon dioxide fluxes from a *Molinia caerulea* dominated marginal upland blanket bog.

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Peat soils in the UK represent a significant long-term carbon store. Despite this the annual imbalance between uptake and release is small and susceptible to change in response to land management, atmospheric deposition and climate change. The shallow marginal peatlands of Exmoor, southwest England, have historically been subject to extensive drainage and are known to be vulnerable to future changes in climate as they lie at the southern edge of the ombrotrophic peatland climatic envelope. However little is known about the processes that drive CO_2 fluxes from degraded *Molinia caerulea* dominated upland mires or the potential effect that restoration through drainage blocking will have. The Mires-on-the-Moors project (www.upstreamthinking.org), funded by South West Water aims to restore the eco-hydrological functionality to over 2000 hectares of drained mire by April 2015. We hypothesised that such mire restoration will return these upland mires to peat forming/carbon sequestering systems.

Partitioned below-ground respiration fluxes as well as biotic and abiotic variables, were collected on various dates in 2012 and 2013 along six transects adjacent to three pairs of drainage ditches. One of each pair was restored by blocking with peat dams in spring 2013 whilst the other remained unrestored to act as a control. Monitoring locations were arranged along transects to investigate the spatial variation in gas fluxes with respect to the drainage ditches. By partitioning below-ground fluxes it was possible to monitor root-derived (autotrophic) and more importantly soil-derived (heterotrophic) respiration providing an insight to the effects of ditch blocking on the long term carbon store.

Here we present CO_2 fluxes for the growing seasons at two critical stages in the restoration process: (a) immediately pre-restoration and (b) immediately post- restoration, and discuss the temporally and spatially variable processes driving below-ground CO_2 fluxes. Respiration rates were comparatively low in these shallow humified peats, with daily mean total, heterotrophic and autotrophic respiration reached 1.34, 0.60 and 0.23 μmolCm^{-2}s^{-1} respectively. As expected soil temperature had a significant control on respiration rates, once this was accounted for water level showed a weak effect on total and heterotrophic respiration. Distinguishing the effects of ecological restoration between a wetter baseline period and a drier post-restoration period had its challenges. However, by expressing the respiration rates in the restored sites as a proportion of that observed in the control sites, the confounding effect of climate variability could be accounted for. This allowed us to determine that heterotrophic respiration decreased at the restored sites comparative to the control sites following restoration, indicating the immediate effect of restoration was to reduce decomposition of the peat store, with implications for carbon sequestration rates.