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Investigating the Impacts of a Wind Farm Induced Microclimate on Peatland Carbon Cycling

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Peatlands play a fundamental role in the terrestrial carbon cycle by storing 1/3 of the world's soil carbon (Limpens et al. 2008). Concerns have been raised over the stability of these carbon stocks when large scale wind developments are sited upon them. This project aims to deliver underpinning data in order to improve estimates of the impact of wind farms on carbon sequestration in peatlands. This will enable more robust predictions of carbon payback times for wind farms.

Wind turbine 'wake-effects' can alter microclimatic conditions, as a result of significant differences in air temperature, humidity, wind speed and turbulence (Baidya Roy and Traiteur 2010). These changes are likely to have a significant impact on above and below ground processes involved in peatland carbon cycling, but effects are currently unquantified.

We are using a microclimatic gradient across an area of blanket bog at Black Law wind farm (Lanarkshire, Scotland) to examine the impacts of microclimatic changes on carbon sequestration processes. In particular we are focusing on the functioning of microbial communities, as they regulate carbon sequestration in peatlands by dictating rates of decomposition and greenhouse gas (GHG) production (Artz 2009). Analysis of total carbon, nitrogen and microbial community composition (phospholipid fatty acid (PLFA) analysis) in peat, litter and vegetation will enable the impacts of microclimatic changes on above and belowground processes to be identified. In addition, multi-factorial mesocosm experiments are being conducted to determine how abiotic changes caused by a wind farm microclimate could destablise peatland carbon stocks. These experiments are using intact peat cores to assess the interacting effects of temperature and water table on GHG fluxes and litter decomposition.

Initial findings show that sites most affected by the wind farm microclimate have an increase of total carbon in peat, and increases in total PLFAs under certain vegetation types. Further investigation of the impacts of wind farms on microbial communities will lead to a greater understanding of the implications of wind farm development for carbon sequestration in these ecosystems.