Case study

The role of natural and artificial pools in northern peatland carbon cycling

Dr Ed Turner
t.e.turner@leeds.ac.uk
http://www.geog.leeds.ac.uk/people/e.turner
+44(0)113 343 1593

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Natural peatland pool in the Flow Country, northern Scotland

The research question

What role do pools play in the carbon cycle in northern peatlands?

Background

Peatlands are important ecosystems in terms of biodiversity, nature conservation and the hydrological cycle. They are also one of the world's most significant carbon (C) stores, containing 20 - 30% of all terrestrial carbon. Peatlands can act as both a sink and a source of atmospheric carbon depending on their condition, which has serious implications for global warming.

This project examines the role of natural and artificial pools in the peatland carbon cycle. Pools are known 'hotspots' of methane (CH4) emissions, a potent greenhouse gas, but the reasons for this are unknown. Many new pools are being created artificially as degraded peatlands are restored by blocking man-made drainage ditches. Therefore, understanding the processes operating within and around peatland pools is a key research question.

This project will measure flows of water and carbon into and out of pools in order to understand whether the pools play an important role in processing the carbon. Additionally it is known that many peatlands contain connected cavities within them known as soil pipes. These are not artificial pipes, but natural connected holes within the peat. Some peatland pools which are connected to pipes may therefore be connected to large carbon sources from some distance away.

The aim of this project is to quantify carbon budgets for natural and artificial pools.

Methods

Our research site is within the RSPB Forsinard Reserve in the Flow Country, northern Scotland.

Monitoring and sampling the water going into and out from the pools, and gases emitted at the pool surface will allow the influx and efflux of carbon to be quantified over an 18 month period. A dual isotope approach (13C and 14C) will establish the source of C (C from mineral sources, old C from deeper peat reserves, or younger C from plant decay) in dissolved organic carbon (DOC), particulate organic carbon (POC), carbon dioxide (CO2) and CH4.

We will also conduct manipulative experiments to quantify the role of temperature and solar radiation in processing DOC and POC ('mineralisation') into CO2 and CH4 which is then able to escape to the atmosphere.

Logging equipment recording water level and temperature

Sampling for analysis of dissolved carbon dioxide in the pool water

Results

We expect to find that natural pools have greater connectivity to pipe networks, and thus release more gaseous carbon than artificial pools with little or no connectivity.

Conclusions and impact

This work is fundamental to our understanding of the role of peatlands in the global carbon cycle. Without this research we will be unable to properly predict carbon fluxes from peatlands under climate change scenarios because we will not understand what drives carbon cycling in peatland pools.

The work is urgent: without it we will be unable to explain how the large number of pools currently being created by practitioners via drain blocking is affecting carbon cycling within, and carbon release from, peatlands.

The results from this project are also vital to informing the future management and restoration of peatlands in order to optimise their potential to mitigate global warming.

Floating chamber measuring greenhouse gas fluxes from a pool surface

Please contact us for further information:
Email water@leeds.ac.uk **Telephone** 44(0)113 343 3373 **Twitter** @wateratleeds