Carbon chasers

Last summer more than 40 researchers converged on a single Yorkshire hillside. Mathew Williams, Angela Gallego-Sala and Andreas Heinemeyer were there.

Last August, students from 23 European universities arrived at Malham Tarn. They were there to help scientists from the Centre for Terrestrial Carbon Dynamics (CTCD) measure how carbon moves through this beautiful North Yorkshire landscape.

Carbon is in every living cell; it fuels our civilisation and helps regulate our climate. But our massive consumption of fossil fuels is upsetting the natural balance. Northern hemisphere soils hold hundreds of billions of tonnes of organic carbon at high latitudes. If this decomposes, as might happen in a warmer world, the released carbon dioxide could accelerate climate change. We need to know more about whether and how this might happen.

The idea was simple—during a 'summer school', students would do some real science, helping with time-consuming data-gathering and analyses. They'd also learn to use the latest equipment, brought together in one place. We wanted to answer some complex questions: overall, did our study area store or release carbon? Could we be sure? Did the same thing happen everywhere within the site? What proportion of all the stored carbon moved about within the ecosystem during our study? Might carbon dioxide or methane make the biggest contribution to the greenhouse effect? It was an ambitious task for only a week!

We set up an eddy-flux tower, a system capable of continuously recording how carbon is exchanged between land and atmosphere over an area, or footprint, of a hectare or so of heather peatland. At various points, we measured continuously how much carbon dioxide came out of the soil. We also had a see-through chamber to record how much carbon dioxide the soil and plants released together. We used a laser to survey methane across the landscape. The beam was tuned so only methane absorbed its light, letting us calculate how much was in the air from how much light reached a receiver. We surveyed carbon in soils and vegetation with more traditional tools—spades, clippers, ovens and scales. But we also tested whether a ground-penetrating radar could determine peat depth and recorded vegetation cover in detail, to compare with satellite images. At the end, we had even more questions but also some clear answers.

Most of the carbon was stored in soils rather than plants, but the amount varied between heather moorland and rough grazing land, and plants dominated the exchanges between land and atmosphere. We saw how carbon regularly pulsed into living things by day, and out at night. Our measurements showed soils released carbon slowly but steadily, largely related to root activity. We also saw plants respond rapidly to changes in light levels, changing their carbon uptake as clouds scudded in front of the sun. Methane emissions were very patchy, mostly coming from stagnant boggy areas. We confirmed that processes in the landscape vary over a few metres, for example between areas burnt for grouse management, drainage ditches, and dips in the land. Satellite images usually have coarser scales, from 30m to 1km, so our research revealed what can be missed when using satellite data. We also used our data to test and refine the mathematical models that estimate carbon movements across regions and even the whole planet. But in the end, the best part of the summer school for some of us was being reminded why we devote so much time and effort to science, and how much fun it can be!

Tim Hill

Measuring methane.

Want to know more?
You can find out more about the Centre for Terrestrial Carbon Dynamics at: http://ctcd.nerc.ac.uk/

Mathew Williams is at the CTCD in the School of GeoSciences, University of Edinburgh, Crew Building, Kings Buildings, Edinburgh EH9 3JN, tel: 0131 650 7776, email: mat.williams@ed.ac.uk. Angela Gallego-Sala is at the Bristol Biogeochemistry Research Centre, Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queens Road, Bristol BS8 1RJ, tel: 0117 331 5037, email: Angela.Gallego-Sala@bristol.ac.uk. Andreas Heinemeyer is at the CTCD, University of York, Stockholm Environment Institute, Sally Baldwin Building D, Department of Biology, York YO10 5DD, tel: 01904 432991, email: ah126@york.ac.uk. *NERC, our Quantifying and Understanding the Earth System programme, and the European Science Foundation funded the summer school.*