Taking the environment's pulse

Long-term observation of our ecosystems is critical for us to understand environmental change. Andy Sier looks back on the contribution of 20 years of observation and research by the Environmental Change Network.

Natural Resources Wales

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Andy Sier, ECN science liaison officer.

'The only thing constant in life is change,' wrote French author François de la Rochefoucauld. This is certainly true of the environment, which is in a continual state of flux. But that change may be so slow as to be almost undetectable, so we need long-term monitoring and research programmes to gather rigorous data on our ecosystems. This is exactly what the UK's Environmental Change Network (ECN) has been doing for the last 20 years.

These data are a unique resource for understanding patterns and causes of environmental change. They support a wealth of environmental research and policy decisions in areas such as climate change adaptation, air and water quality and biodiversity loss.

ECN was established in 1992 in response to calls for more long-term, quantitative information about the state of the environment and how it was changing. Initially set up with 12 terrestrial sites, ranging from lowland farms and woodlands to upland moors and mountains, since 1994 we have also taken data from a network of lakes, rivers and streams.

At each site, scientists make a wide range of high frequency, closely located environmental measurements, using standard protocols that let us compare trends at different sites.

We manage all these data – as well as data from four other monitoring networks – in a central database containing millions of records. Since the earliest days of ECN, the data have been freely available for non-commercial use including research and teaching, with a helpful data portal that enables users to explore, and plot summary data or access datasets.

So what have we learned about how the environment has changed in the last two decades? Perhaps the most significant change has been a marked reduction in the deposition of sulphur compounds – so-called 'acid rain' – primarily because of changes in energy policy and greater international regulation of emissions from power stations. This is reflected in large reductions in sulphate concentrations in rainfall at ECN sites and corresponding reductions in the acidity of water in our soils, although so far we've not seen any clear responses in vegetation.

These aren't just interesting observations – they have real-world impact through their contribution to policy and regulation. Our acid rain observations, for example, were used in the recent Defra-funded UK Review of Transboundary Air Pollution, which was led by NERC's Centre for Ecology & Hydrology and informs the development of UK air quality strategies.

Defra has long used ECN data on populations of invertebrates like beetles, moths and butterflies as indicators of how ecosystems are responding to climate change. For example, we've seen large changes in the abundance of ground beetles at ECN sites, as reported previously in Planet Earth Online*. These changes may be linked to the climate but differ in strength and direction between habitats. So we're doing more work to understand why species respond differently to environmental change, which could benefit local habitat management practices.

One of our sites, Moor House-Upper Teesdale, is a nature reserve in the Pennine hills of northern England. Large parts of it are upland blanket peatland which are important sources of drinking water in the UK. But the water is typically coloured brown by dissolved organic matter (DOM) from the peaty soils and this is a real headache for the water industry – drinking water must be chlorinated by law but chlorinating water with a high DOM concentration can produce potentially harmful bi-products such as trichloromethanes. So DOM has to be removed before chlorination, and this is expensive.

Working with colleagues at the Upland Waters Monitoring Network, we've seen DOM concentrations in upland streams across the UK double over the last few decades, leading to a substantial rise in water treatment costs. This has triggered great interest in the likely causes of change and whether the scale of the problem can be reduced by altering upland management practices such as heather burning or soil drainage. Researchers are turning to ECN soil and water data from peaty sites like Moor House, Glensaugh and Sourhope to help understand peatland processes, including the factors controlling DOM concentration – critical knowledge for developing appropriate strategies to protect water quality and human health.

Looking to the future

Although ECN's 20-year datasets support a wide range of research, we need to be pragmatic. To continuously monitor environmental change at a single place in detail is a major commitment. If we had more sites, took more types of measurement, or made measurements more frequently, we would undoubtedly improve our understanding of these environments, but this is unrealistic in the present economic climate.

The answer is greater integration, and for ECN this means linking up more effectively with other environmental recording programmes, including amateur enthusiasts, citizen science initiatives and socio-ecological studies.

We are therefore looking for better ways to integrate with other national datasets and to share new measurement technologies. It is critical that we work together to develop shared tools so users can easily find, combine and use the data they need.

ECN has come a long way in the last two decades and is making significant contributions to our understanding of how and why our ecosystems are changing. Our challenge now is to ensure we get as much scientific benefit as possible from all this information in the decades to come.

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ECN is coordinated by the NERC Centre for Ecology & Hydrology. It is supported by a consortium of partners responsible for site-based monitoring, research and analysis. For full details and to access data see www.ecn.ac.uk

* http://planetearth.nerc.ac.uk/news/story.aspx?id=1310