25. THE PEAT BENEATH OUR FEET

Cold Fell

Somewhere south of Cold Fell I became intimately acquainted with a bog. One moment I was striding along, talking to the friend I was with, and enjoying the countryside. The next I was up to my waist in gloopy water.

I extracted myself, damp and a little dirty with little pieces of sphagnum moss clinging to my clothes. No harm done. We carried on. And, once I'd had the time to dry off a little and I'd thought about it, in a way I was pleased that the bog was there. Compared with the dry peat deserts I had traversed on my first few days on the Pennine watershed, this was an altogether different, and much better, example of a peatland habitat. I'd encountered a blanket bog in pretty rude health.

If you've read this far, you'll know that there are a number of reasons why it's considered important that our Pennine peat moorlands are in good condition. One is because a healthy blanket bog leads to greater biodiversity of plant and animal life. A second reason is because a large percentage of the population of northern England gets its drinking water from off the peat moors, and peat erosion leads to both discolouration and an increase in the presence of particles in the water.

But there's another reason, arguably even more important, which I briefly mentioned a few chapters back. Peat bogs act as a superb store for carbon which could otherwise escape into the atmosphere as carbon dioxide or methane, fuelling the greenhouse effect. If we lose our peat bogs, we risk increasing still further the problems we face of global warming.

School children learn the basic principle of photosynthesis, whereby plants convert carbon dioxide and water into oxygen and glucose. When plants die and decay, under normal circumstances, the carbon held by the plant is released back into the atmosphere. In certain circumstances, however, especially where the ground is very waterlogged, lack of oxygen prevents micro-organisms from getting to work and the process of decomposition doesn't take place. Dead plants are instead slowly turned into peat, with the carbon safely retained in the soil. Peat, in other words, is what's known as a carbon sink.

This is the reason, of course, why peat has over the centuries been dug, dried and used as a fuel. As with coal, the carbon it contains is combustible and can be used to provide heat and light. This is also why, when peat-covered moorland catches fire, environmentalists are concerned: carbon dioxide is escaping into the atmosphere in much the same way it does from coal-fired power stations.

Peat formation is a slow process – perhaps a centimetre of peat each ten years – but Britain's peat has been building up for several millennia which means that the amount of carbon trapped within peat bogs has become quite significant. An academic at Durham

An isolated farmstead, backed by the bulk of Cold Fell.

University, Dr Fred Worrall, has come up with a striking way of looking at this, so striking that you can now find his phrase quoted again and again in publications. I'm happy to repeat it one more time: there is more carbon held in British bogs, Dr Worrall says, than in the forests of Britain and France added together. In his own words, 'peat is much more vital in terms of carbon storage than forests'.

The Pennine moors make up a small part of what are called the northern peatlands, which stretch around the world from Siberia through Scandinavia to northern Canada and Alaska. It's been estimated that the land masses of the planet hold three times the amount of carbon currently in the atmosphere, with much of this carbon held within the soil itself; and of this, the northern lands hold at least 20–30 per cent of the total. This is one reason why recent reports from Siberia and elsewhere of the rapid melting of the permafrost and the apparent destruction of peatland habitats has been causing concern to scientists worldwide.

What about our own bogs? For peat to be accumulated in the Pennines, the right sort of climate conditions have to be in place. When I'd talked to John Adamson of the Centre for Ecology and Hydrology about his work at Moor House, he'd told me that there were four key criteria for successful peat formation. The first is that there has to be plenty of rain: about a thousand millimetres a year as a minimum. (At present, Moor House with about 2,000 mm

easily meets this; the Peak District moors do too, with average annual rainfall of 1,200–1,500 mm). Secondly, there has to be a minimum of 160 wet days. Thirdly, the average temperatures in the warmest summer months shouldn't be too hot: a mean of less than 15°C is required. And finally, there needs to be relatively minor seasonal fluctuations in the climate. Meet all these conditions and you will have the right sort of waterlogged conditions to prevent vegetation from decomposing.

When everything is working well, I'd gathered, a healthy peat bog can fix about 50 grams of carbon per square metre each year – about 50 metric tonnes per square kilometre. (This by itself is not an enormous quantity: it equates very roughly with the amount of extra carbon released into the atmosphere from air travel if twenty-five people make a holiday trip to the Caribbean and back. Fortunately, as anyone walking the watershed will testify, there are many thousands of square kilometres of Pennine peat moorland to take into account.) However, what's not clear is the extent to which peat is still being accumulated; are our peat bogs still acting as carbon sinks?

All of the country's soil was carefully assessed and measured for its carbon content as part of the National Soil Inventory which took place in the late 1970s, and it was recently sampled again in a study by the National Soil Resources Institute to check whether carbon levels had increased or decreased since then. The findings, reported in 2005, were that the soils of England and Wales, taken together, were losing carbon each year at an average rate of 0.6 per cent, a rate of loss which equates to around four million tonnes of carbon a year. If true (and it should be added that the study has since come in for some criticism from other academics) this would be unexpectedly grim news: the apparent loss of carbon from the soil would be cancelling out any successes which Britain has been having in reducing greenhouse gas emissions.

The question that's relevant to us is what's happening specifically with peat. Because of its significance as a carbon sink, researchers have been paying particular attention in recent years to upland peat and the land around the Moor House reserve has been a major focus for their work. There's a sense, perhaps, of academics today building on the past generations of researchers going right back to the time of Gordon Manley. Durham University, for example, has had sophisticated measuring devices up on the Moor House reserve trying to trap and measure the gases which are leaving the peat to enter into the atmosphere. This is the most direct way in which carbon dioxide (and other greenhouse gases such as methane) escape, but it is not the only route. Carbon can also be taken away through the streams and rivers which drain the land, either dissolved in the water (dissolved organic carbon, DOC) or in particulate form (particulate organic carbon, POC). To measure levels of DOC and POC you need some of the hydrologists' toolkit of equipment which I saw in place out on the moors near Bleaklow, though I was intrigued to discover that it's not only high-tech kit which gets used: a good way to measure levels of particulates, I learned, is to put a small mat of Astroturf down in a stream and wait to see what gets caught on it.

Trout Beck, a stream south-east of Great Dun Fell which flows into the Tees has been especially targeted by researchers, including the man-with-the-quote Dr Fred Worrall himself. In a 2003 study he and a number of colleagues carefully measured the levels of DOC and POC escaping down the stream, looked also at levels of methane and inorganic carbon coming from the peat, and concluded that here, at least, the peat moor was functioning adequately as a carbon sink. Their research suggested that each year on average about thirteen

tonnes of carbon per square kilometre were becoming stored within the Pennine peat – rather less than the target of fifty tonnes, perhaps, but still on the right side of the balance sheet.

What worries soil scientists and hydrologists however is that, increasingly, peatlands will start giving out more carbon than they take in: that they will become carbon sources, not carbon sinks. There are a number of reasons for this, but climate change is the key factor. The two particular dangers are hot dry summers with drought-like conditions and very wet winters. Dry summers bake the peat, cause it to crack open and allow oxygen in through these fissures to oxidise the carbon below. Wet winters make the rivers and streams 'flashy', eroding peat banks and carrying the peat away down the hillside. Unfortunately, as you may recall, computer modelling of Britain's future climate carried out by the UK Climate Impacts Programme suggest that both these eventualities will become increasingly likely. The worst case for the North Pennines saw a significant increase in average temperatures by the 2080s, a decline in summer rainfall and an increase in rain in winter (to refresh your memory, see page 172).

The really frightening scenario is not just that global warming will stop new peat from forming, it is that the carbon already stored in existing peat will increasingly start to be unlocked allowing it to enter the atmosphere. What could happen, in other words, is a climatic equivalent of the sort of screeching feedback you can get when a microphone is placed too near a speaker. The world gets hotter. Result: peat bogs start giving up their carbon stores. Carbon dioxide (and, worse, methane) enters the atmosphere. Result: the world gets hotter still. The cycle speeds up, and gets faster and faster. This is why journalists have started using terms like the 'carbon time bomb'. What should give pause for thought is that the fuse on this bomb is short.

I recalled one conversation I'd had as I'd progressed my way along the watershed. I'd been talking to an ecologist working for Natural England who had responsibility for one of the Pennines moors' Sites of Special Scientific Interest. Our conversation had moved from the work he was doing to encourage biodiversity on his moorlands on to the subject of climate change. 'The people who are doing the research work tell us we have only about a decade's breathing space,' he told me. 'Climate change is irreversible, and our peat bogs could become a source, rather than a sink, of carbon in a decade's time.'

It's true that, as a society, we are becoming increasingly conscious of the risk of carbon emissions. But the importance of the Pennine bogs, and those of Scotland, Wales and Ireland too, is not yet widely understood. 'You can plant a tree to salve your conscience. But what you should really be doing is looking after the peat bogs,' he said. 'If we act now, we can at least ensure that the impact is less severe.'

So how do we do this? It comes back to a theme which this book has focused on several times already, good moorland management and moorland restoration work. It means many things. It means trying to prevent peat from becoming eroded. When erosion has occurred, it means trying to bring back vegetation. It means in some places trying to lessen the impact brought about by visitors to the countryside. It means avoiding overgrazing, and being sensitive to the effects which can come from heather and grass burning.

It particularly means trying to avoid the peat drying out. Maintaining a high water table in blanket bog land is critical and sphagnum moss, because it acts like a sponge, is one of the key species which help to achieve this. Where peat has already become dry, as in the Peak District and the South Pennine moors, the strategy has to be to take steps to rewet the moor. Ironically,

Between Cold Fell and Hadrian's Wall, the moors give way to a more benign, farming landscape.

government grants were widely available in the 1980s to dig drainage channels in moorland, to reduce the water level and to make the land more productive agriculturally (and incidentally more productive for grouse shooting). Now, only a generation on, it's become clear just what a disaster this policy has been. Moorland grips (drainage ditches) began as narrow channels but have become eroded so that in some places they are as wide as roads. Today government funding is available not for creating grips but for blocking them, so that the moors have a chance to become waterlogged once again. And some ecologists are suggesting that companies should join in the funding of this work too, supporting grip blocking programmes and bog management systems as a way of offsetting their CO_2 emissions. Plant a tree if you like. Protect a bog as well.

There are grounds for some optimism. Manchester University's Martin Evans has, like Fred Worrall, undertaken research on the land drained by Trout Beck, and his findings support the suggestion that this area could be working better as a store of carbon than it was a generation ago. Of course, this may yet be reversed again as we suffer from climate change. But Martin points out that the northern Pennine moors seem to be healthier now than they were in the second half of the twentieth century. Eroded areas have disappeared and vegetation has come back. If this can happen in the North Pennines, perhaps it can happen further south as well.

As I'd found out at first hand, there are areas of the Pennine moors which today are very healthily boggy and wet. That's the way they need to be. We need to learn to love our peat bogs.