

Where does bad air come from?

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Credit: PlanetEarth Online

Auchencorth Moss is one of Scotland's distinctive moorlands, which for generations have provided people with a lifesaving source of peat to burn to keep warm.

While modern alternative fuels have dramatically reduced communities' need for fires and peats, this precious habitat is now providing valuable information for scientists working to combat [air pollution](#) in cities and towns across the country.

As a pristine environment that produces no pollutants, it seems a world away from the traffic-clogged streets of Glasgow or nearby Edinburgh and from the serious health risks which affect large numbers of residents there. Yet it is this background air quality that makes this peatland so valuable scientifically, because experts know that any pollution detected here must have come from somewhere else.

That helps researchers to work out how much of the pollution blighting Scottish cities comes from the traffic and industry within those cities. Importantly, it also helps show how much comes from outside - such as from traffic or industry elsewhere in the UK and across Europe, or from rural sources such as agriculture.

Air pollution doesn't obey borders

Dr Marsailidh Twigg, specialist in air pollution at the Centre for Ecology & Hydrology in Edinburgh, which has a monitoring station at Auchencorth, explained:

"At times of peak air pollution, monitoring at Auchencorth gives us real-time baseline information about conditions. High air pollution is often driven by weather (as wind and rain bring pollution through the air) coming from the rest of the UK or from other parts of Europe. In turn, pollution produced in our cities gets transported to the rest of the UK and Europe, so it goes both ways."

Spring is in the air

In spring, traditionally a busy period in farming, raised levels of a chemical called [ammonium nitrate](#) are sometimes detected in the fine particles analysed at Auchencorth. Experts have linked this ammonia both to fertilisers used on the land to grow crops and to dung produced

by livestock such as cattle. When it's warm, ammonium nitrate evaporates, but cooler spring temperatures allow this pollutant to accumulate.

One of the lasting mysteries that scientists like Dr Twigg hope to answer by monitoring changing conditions more closely is where a specific pollutant called [nitrous acid](#) comes from. This compound occupies a key role in atmospheric chemistry and, until recently, it was thought to be produced mainly at night. But improvements in measurement technology have revealed a plethora of unexpected sources during the day.

Emissions from soils and chemical reactions with organic soil material present a poorly understood source, but it also appears to be emitted directly as pollution from vehicles, along with nitrogen oxide.

As Dr Twigg said:



Marsailidh at the Auchencorth monitoring site. Credit: PlanetEarth Online

"How big are these emissions and what makes them happen? These are the questions at the moment."

Improving understanding and awareness of the causes and consequences of man-made pollution in the atmosphere will help to find solutions to problems that can save lives both locally and globally.

Ozone hole

Arguably the most famous and significant work related to air pollution, after the identification of acid rain in the 1970s, was the 1985 discovery by scientists at NERC's British Antarctic Survey of a vast hole in the ozone layer above the remote continent. That discovery, along with [atmospheric chemistry](#) work by Professor John Pyle, found that a group of chemicals known as chlorofluorocarbons (CFCs) - then used in a wide range of products from fridges to aerosol cans - were destroying the ozone.

The revelation was a crucial early warning that dangerous thinning of the ozone layer was happening worldwide, putting people at growing risk globally of developing deadly skin cancers because we were losing UV protection offered by the ozone. This groundbreaking environmental science drove an unprecedented worldwide political consensus between governments to phase out CFCs, under the landmark Montreal protocol, which was signed 30 years ago in 1987.

Tackling traffic

Now a major focus of work, concern and political action is traffic fumes, with vehicles still a major source of air pollution that experts continue to research to help ensure that government policy is targeting man-made sources in the most appropriate way.

The Scottish Government has just pledged (September 2017) to phase out new diesel and petrol cars and vans by 2032 - eight years ahead of the UK government's latest target.

Beyond cars

Work funded by NERC is vital to understand the complex way in which such [pollution](#) is created, and spread, to ensure that policies now and in future do what they are intended to do.

As Dr Twigg warned:

Nitrous acid is so interesting because it produces something called hydroxyl radicals. These radicals are useful because they react with other pollutants and reduce the amount of time they're in the atmosphere. But they're also an issue because those reactions create new pollutants that cause smog.

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