AIR POLLUTION

Is the air in the countryside cleaner than in our cities and how clean is the air where I live? Is our air cleaner than it was in the past? Is it just an issue for human health or are ecosystems at risk too?

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Air pollution has been termed the invisible killer. However, this was not always the case – it used to be much more visible and palpable. The London smogs of the 1950s (and similar situations in some industrial towns of the north) were caused by foggy conditions combined with extremely high levels of particulate matter and soot from open fires and industrial emissions. The Clean Air Act in 1956 in the UK paved the way towards atmospheric emissions reductions, from industry, domestic burning and eventually from vehicles. Cars have had successively stricter emission standards over the last few decades[1]. Another success story is the gradual removal of toxic lead from petrol in most countries by 1995.

Air pollutants vs. greenhouse gases

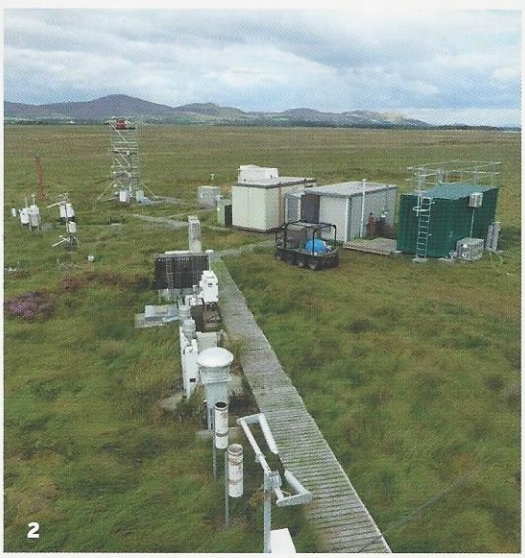
Some people are confused between which gases affect our health and which ones have an effect on our climate. Greenhouse gases like carbon dioxide and methane (CO_2, CH_4) are released from fossil fuel burning and this same burning (including from a vehicle's engine) will also release air pollutants like nitrogen oxide and dioxide (NO and NO_2), carbon monoxide (CO) and hydrocarbons (ethane, benzene, propane etc.) as well as black carbon (tiny soot particles) and aerosols[2] (tiny suspended particles in the atmosphere) and these are what are bad for human health. Carbon dioxide levels are rising globally at 406 parts per million (ppm) but at these levels it is not having an adverse effect on human health but, for example, a nitrogen oxide level of 20 parts per billion (ppb) – a 1000 times lower – is harmful for human health.

Human health

It is estimated that 40,000 deaths a year in the UK are attributable to exposure to outdoor air pollution[3]. In rural areas of developing countries with clean mountain air such as Nepal, women in particular are exposed to extremely high indoor pollution levels from cooking on open fires indoors. Many lifestyle factors affect one's health and the effect of long term exposure to air pollution is difficult to study in isolation.

Air pollution in the UK

So, how can I find out about air pollution where I live and the mountains where I work? DEFRA is responsible for the air quality monitoring stations and reporting levels and their data is publicly available[4 5 6]. The chart (top right) shows the NO_2 levels during the last month of 2017 at the contrasting measurement stations of Fort William and Marylebone road, London. The EU limit[7] for



NO_2 is an annual average of 40 µg/m³ (20 ppb) so you can see that Fort William is well below that, while London is breaching the air quality limit.

Effects on ecosystems

Acid rain used to be a huge problem in the 1970s and 80s, hitting Scandinavia even harder than the UK. Increased levels of sulphur dioxide (SO_2) from industrial emissions would be carried northwards and react in clouds to form sulfuric acid that would fall in the rain. Vast areas of forest and lakes were acidified, harming trees and killing fish. The moorlands of the Peak district, subjected to the westerly winds passing over the industrial powerhouse of Manchester, have suffered acidification over many years since the industrial revolution, affecting the sphagnum mosses and the soil fertility[8]. Nowadays coal-burning power stations that would be huge emitters of SO_2 barely emit any as their emission scrubbing devices are so efficient. However, nitrogen deposition from NO_2 and also from fertilisers is still seen to affect sensitive moorlands. Lichens are often a sign of clean air but learn to identify[9] them as are nitrogen-loving and nitrogen-sensitive ones.

Seasonal and meteorological effects will also vary the air quality. The Chamonix valley has suffered from very polluted winters due to the temperature inversions that trap the air low in the valley bottom, stagnating the traffic and household wood-burning fumes. Santiago, a city of 7 million inhabitants at the foot of the Andes and trapped on the other side by the coastal mountains has to announce many emergency pollution days. The Po valley in northern Italy is the region with the worst air quality in Europe; the Alps traps air from this industrial area, causing it to stagnate. On the contrary, when there is more atmospheric mixing of the lower layers in summer, there is another issue that crops up: ozone. Los Angeles and Mexico are cases in point. A build-up of pollutants, heat (which also stresses the vegetation to release more hydrocrabons) and lots of sunlight create high levels of ozone which can be harmful for human health and vegetation. Many of the National Parks in the western US suffer from high ozone, many blaming it on Asian pollution transport.

MAIN PHOTO Smog in the valley above Sallanches on the way to Chamonix.
1. Healthy lichens in clean air.
2. Auchencorth Moss Atmospheric station, CEH Edinburgh (Pentland hills in background). © CEH. 3. The red of a sunset and sunrise is due to the reflection of light through the longer path through the atmosphere when it is near the horizon. If there are more particles (aerosols, sea spray, volcanic ash, Saharan dust) in the atmosphere it will be more red.

References

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