

Nitrogen -- the silent species eliminator

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Nitrogen pollution from agriculture and fossil fuels is known to be seriously damaging grasslands in the UK. A new European study is starting to show that the effect is Europe-wide, confirming that current policies to protect ecosystems may need a re-think.

When Carly Stevens finished her PhD in 2004, her findings were so significant they were published in *Science*. Not only that, they were selected as contributing to one of the top ten scientific breakthroughs of that year – quite something for a PhD student. Stevens had found the first evidence that nitrogen deposition from the atmosphere was depleting numbers of plant species in British grasslands. “There was experimental evidence that this could happen, but we were the first to show the effect is real and happening now,” says David Gowing, one of Stevens’ PhD supervisors at The Open University in the UK.

Stevens studied acid grasslands – upland pastures with relatively infertile soils. She found that in places where more nitrogen is deposited, there are fewer plant species. The gradient was so pronounced that one species has been lost for each additional 2.5 kg of nitrogen per hectare deposited every year. Nitrogen from man-made sources, like intensive farming and cars, causes significant air pollution in the UK, and some is deposited from the air on to the land. Deposition is highest in densely-populated areas, and in Britain ranges from about 5 to 35 kg of nitrogen per hectare per year.

The approach to protecting wildlife from nitrogen pollution is to calculate critical load values for different ecosystems – how much

nitrogen a system can accumulate every year before damage occurs. Infertile habitats, like heathlands and bogs, are the most vulnerable. But Stevens' research showed that species are being lost even where deposition is 'beneath' the critical load for grasslands.

"The species aren't going extinct," Stevens stresses, "but if this is happening everywhere, we are moving towards much more species-poor grasslands, and we have no idea what the knock-on effects of that will be."

So last year, Stevens, her UK colleagues David Gowing, Nancy Dise and Owen Mountford, and a team of experts from Germany, the Netherlands and France, embarked on a Europe wide project, part of the European Science Foundation (ESF) EuroDIVERSITY Programme. The project's aim is to see if the effects are the same on a wider range of grasslands, across the entire Atlantic side of Europe. "The low countries and northern Germany are the epicentre of European nitrogen deposition," says Gowing.

70 new grasslands in at least nine countries have been added to the picture, including different types of grassland. So far, the first year's field results seem to adhere to the pattern, showing that species loss is directly related to long term deposition of nitrogen. "The loss in Great Britain is much larger than people had imagined," says Dise. "It's almost 25% of species at the average deposition rate. If this is occurring across Europe, it will be a very important find." Wildflowers and other broad-leaved species, rather than grasses, are the hardest hit.

The team has started experiments to see if they can establish how extra nitrogen has these effects. They hope to predict what will happen in the future. "Nitrogen deposition in Europe probably peaked in the 1990s, and is coming down now in many places," says Gowing. But it may not be appropriate for policymakers to relax. "Having been accumulating

nitrogen for 40 years,” he continues, “we might be near the edge of the cliff where communities will suddenly change. Perhaps we’ll be able to say: you have another five years of accumulating at this rate, so now is the time to act.”

What should be done? “We are hoping for a clear signal that you can maintain species richness [under nitrogen deposition] by biomass stripping,” says Gowing. That means extra mowing and grazing. “If we find one, we can offer a management strategy for nature conservation.”

Source: European Science Foundation

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