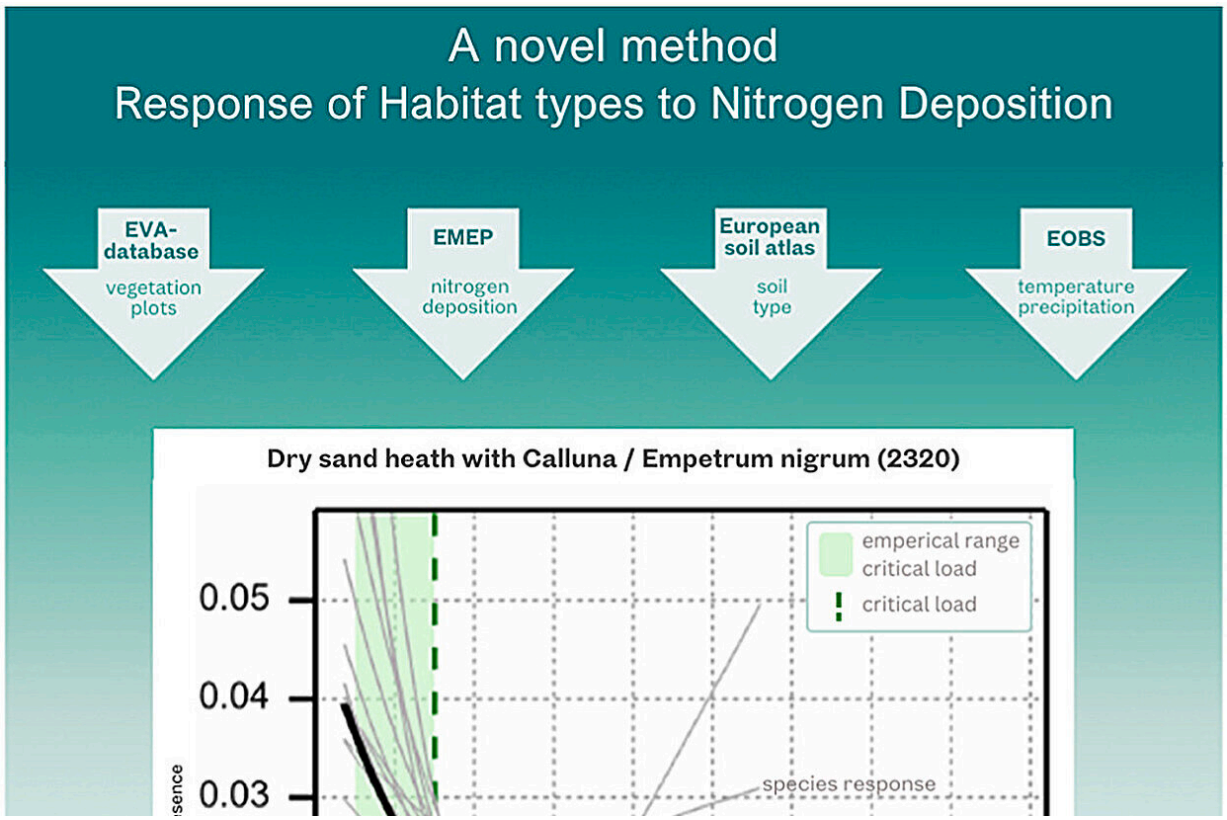
Habitats much more vulnerable for nitrogen deposition than previously thought

April 30 2024



Graphical abstract. Credit: *Environmental Pollution* (2024). DOI: 10.1016/j.envpol.2024.123844

Nitrogen deposition is one of the four main pressures on nature in Europe. Many of the Natura 2000 sites suffer from an excessive input of

ammonium and nitrate from farming, industry, traffic and households, leading to the disappearance of many plant species and consequently dependent animal species.

A group of researchers, led by Wageningen University & Research (WUR), show the decrease of habitat quality in relation to an increasing nitrogen deposition. In an article in *Environmental Pollution*, they claim the critical load for nitrogen depositions is too high.

The researchers calculated response curves for 60 terrestrial habitat types in the Netherlands to the estimated nitrogen deposition. The curves for habitat types are based on the occurrence of their characteristic plant species in the Atlantic region in Europe, from Portugal and Spain till Norway and Sweden. Results can be applied in the whole Atlantic region and with some adjustments for the whole of Europe.

"We already knew the critical loads for nitrogen deposition for habitat types," principal investigator Wieger Wamelink explains, "but we did not know what happens with the vegetation beyond that critical load. Would the decline be quick or more gradually?"

As it turns out it depends on the habitat type how quick the decline of specific plant species is, some have a very rapid decline, while others have a more gradual decline. "But they all have in common that the number of species do decline, leading to a lower quality. They are all losing species," according to Dr. Wamelink.

Critical load too high

The most remarkable result was not the decline due to nitrogen deposition. Wamelink said, "We observed that even at nitrogen depositions lower than the critical load the habitats were already suffering from nitrogen deposition, implying that the critical load is too

high. For a significant number of habitats, the decline in quality already starts at the lowest deposition levels.

"For instance, Dunes with sea-buckthorn has a critical load of 28 kg N ha/y where the descent of the response curve already starts at 7 kg N ha/y; for dry sand heath this is 15 kg N ha/y and 4 kg N ha/y.

"This would mean that if we want to protect all species, the critical loads for nitrogen should go down. This could have a significant impact on the measures that are needed to protect nature. Nitrogen deposition and thus emissions from farmers, industry and so on should go down even further than now already is needed."

Not only nitrogen deposition is affecting plant species occurrence. Climate change, habitat loss due to land use change and invasive species also have a negative effect. This is partly incorporated in the response curves, effects of climate change via precipitation and average annual temperature are incorporated in the response curves, as well as the influence of soil type.

Targets for the other pressures should also be met otherwise even when the nitrogen target is met habitat quality may not or only partly improve.

What effect does nitrogen deposition have on plants?

The effect of nitrogen deposition on plant species is two-fold, via a manuring effect and an acidification effect. Ammonium and nitrate stimulate plant growth, all plants grow faster and higher. However, some plants like sting nettle, bramble or some grass species grow much faster that other often already rare smaller species like the marsh grass of Parnassus, marsh gentian or many orchid species.

The smaller plants will get overgrown and do not receive enough light

and eventually die. Acidification results in a lower soil acidity, which many species can't cope with due to aluminum toxicity or the disappearance of calcium and magnesium, essential for plant growth.

More information: G.W.W. Wamelink et al, A novel method to estimate the response of habitat types to nitrogen deposition, *Environmental Pollution* (2024). DOI: 10.1016/j.envpol.2024.123844

Provided by Wageningen University