Response of moss tissue and foliar nitrogen to a nitrogen deposition (or ammonia concentration) gradient in Ireland

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Deposition of ammonia and nitrogen oxides can have detrimental effects on ecosystems. Mosses accumulate nitrogen in their tissues so tissue nitrogen is used as an indicator of air pollution pressure. In order to co-locate moss tissue collection with habitat monitoring plots, a wider pool of moss species is required than previously tested. Nitrogen deposition increases foliar nitrogen in some vascular plant species, mediated through soil processes. This can influence plant health and herbivores but also could be an early indicator of slower vegetation changes.

Moss tissue was collected at 291 plots across a deposition gradient in Ireland, including 20 plots where more than one species was sampled. Vascular plant leaves were collected at 86 of the semi-natural grassland plots. Tissue nitrogen differed significantly among moss species. A Moss Enrichment Index (MEI) was calculated to calibrate between moss species. The best regression model explained only 13.77% of variation in the data. MEI did not work well to remove the effect of species in this study, which is likely because MEI is calculated from a small range of tissue N values. A solution is proposed where external values are used to calculate the MEI, but this will require international research to sample each moss species at a greater range of measured deposition.

Vascular plant C:N was better predicted by moss C:N than by modelled nitrogen deposition, which could be partly due to a disparity between modelled deposition for 5km squares and local conditions at plots of 50m radius. Precipitation and latitude were statistically significant predictors of C:N but are also both strongly correlated with nitrogen deposition in Ireland, which means some uncertainty remains as to their relative importance.

This research contributes to improvements in monitoring of nitrogen deposition effects, helping Ireland meet requirements of the EU National Emission reduction Commitments Directive (2016/2284/EU).