

Impact of Nitrogen Deposition to Conifer Forest Plots in Ireland

Globally, deposition of bioavailable nitrogen (N) over the past two centuries has resulted in profound changes in terrestrial N cycling. Many forest ecosystems that are normally nitrogen limited are showing signs of receiving excess inputs leading, in some cases, to nitrate losses.



Forest plot with PRS probes
(photo courtesy of J. Johnson)

[Johnson et al. \(2016\)](#) conducted a study to determine the availability of nitrogen in conifer forest plots distributed across Ireland and the potential influence of deposition on nitrogen cycling in these plots. Over the long-term, nitrogen deposition exceeded removal in harvesting suggesting that nitrogen will accumulate in these systems. Nitrogen availability was determined using needle N concentrations, forest floor C:N ratio, and Plant Root Simulator (PRS[®]) probes. PRS probes were deployed at six sites, both with and without root competition, over one year with four burial periods from April 2009 to May 2010. Nitrogen availability was generally quite low, suggesting that the effect of deposition will take some time to become apparent.

There was quite a marked difference in nitrogen availability between mineral and organic soil types. Consistent with observations of forest floor C:N and needle N concentration, PRS N supply rates were higher on mineral soils than peat soils and increased with N deposition rate within each soil type. At two sites, soil nitrate supply was elevated even with root competition, indicating that N deposition exceeded the capacity of trees to utilize this N.

The researchers concluded that bioavailable nitrogen in conifer forests of Ireland will accumulate over the long term because nitrogen deposition rates exceed critical loads, although nitrogen status indicators (forest floor C:N ratio, needle N concentration, PRS N supply rate) were currently low to intermediate at most monitored plots. Harvest practices may be useful to mitigate the effects of nitrogen deposition. Further work is required to evaluate nitrogen cycling controls and mitigation strategies in these forests.

Adapted from [Johnson, J., Cummins, T., and Aherne, J. 2016. Critical loads and nitrogen availability under deposition and harvest scenarios for conifer forests in Ireland. *Science of the Total Environment*, 541, 319-328.](#)

<http://dx.doi.org/10.1016/j.scitotenv.2015.08.140>.