Refining empirical critical loads for nutrient nitrogen: Northeastern pilot study

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The most serious threats to forest ecosystems in the U.S. include climate change, pest disturbance and nitrogen (N) deposition. Previous forest ecosystem research has typically focused on the impacts of individual stresses. In order to effectively assess the susceptibility of forests, it is necessary to evaluate the interaction of the effects of these three stressors. One approach for assessing the risk to forest ecosystems from air pollution is the critical load (CL). The CL is the level of deposition below which no harmful ecological effect occurs. The objective of this project was to refine the current estimates of empirical CL for N at the ecoregion scale for the U.S. to a finer spatial scale and by incorporating interactions with climate change and pest disturbance.

In order to refine CL estimates to a 4 km2 grid scale within our Northeastern pilot study area, we identified abiotic modifying factors and biotic characteristics which can affect CLs. Abiotic modifying factors include elevation, precipitation, and topographic and edaphic factors. For biotic characteristics, we focused on species and habitats of concern to local resource managers. Different species and receptors can have different empirical critical loads. We evaluated available land cover data to best estimate species composition on the ground. We developed a protocol to refine the CL for each grid cell based on abiotic modifying factors and biotic characteristics, and assessed the costs and benefits of making these refinements at different resolutions.

These refinements in CL will make them more accurate and useful to policymakers and resource managers who use critical loads as a scientific basis to assess the impact of N deposition on forests including evaluating the potential impact of new pollutant sources on forest ecosystems. These CL refinements will be incorporated into the CLAD FOCUS database and will be reported to the UNECE in future submissions. In addition, these refinements will be incorporated into a US Forest Service repository to be used for forest management.

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