
New England Governors & Eastern Canadian Premiers Acid Rain Action Plan, 1998

Forest Sensitivity Mapping Project

Effects of acid deposition on forest ecosystems

The New England Governors and Eastern Canadian Premiers have given priority to addressing acid deposition impacts on ecosystems through implementation of their Acid Rain Action Plan of 1998. The action plan identifies mapping forest sensitivity to acid deposition as one of its priority action items. Through coordinated international efforts, this project will provide critical data on forest productivity and health effects of acid deposition on forest ecosystems, enhancing policy level dialogues on emissions reductions.

Forest resilience to acid deposition depends largely on the ability of soils to buffer the acid inputs, thereby keeping soil nutrition stable for tree growth. Once the buffering capacity of a soil is "used up" through acid neutralization, the soil becomes acidic, nutrient availability is diminished, and problems of calcium depletion and nitrogen saturation are developed. Watersheds and forests, particularly high elevation forests, in the northeastern United States and Eastern Canada are especially sensitive to the effects of acid deposition due to the predominance of thin and poorly buffered soils through out the region. While reductions of sulfur emissions have been accomplished in the region and across North America, resulting in significant reductions in wet sulfate deposition levels, persisting emissions of both sulfur and nitrogen compounds, particularly those generated in the midwestern U.S. and central Canada, continue to negatively impact the resources of this region.

The NEG/ECP Forest Mapping Work Group proposal outlines a plan to generate maps of Eastern Canada and Northeastern United States that identify the forest areas most sensitive to damage from acid deposition. The results will provide scientific data to support decisions on setting emission levels of sulfur dioxide and nitrogen oxides to satisfy forest sustainability goals. This scientific approach has been used successfully in Europe, where much of the conceptual work has been completed and can be applied to the North American situation, reducing the time and cost required for this project.

Forest sensitivity to acid deposition is a complex question. Assessing forest sensitivity requires information on:

- * pollution deposition to the forest landscapes,
- * the interaction of the pollutants with the forest canopy,
- * the ability of soils and their underlying bedrock to buffer acid inputs, and
- * plant uptake of available nutrients.

Recent advances in our ability to measure each of these factors now makes it feasible to produce maps of forest sensitivity to atmospheric inputs of sulfate and nitrate. Once areas of sensitivity are identified, forest health and productivity data will be used to evaluate current and future effects of acid deposition on forest ecosystems.

This project relies on many partnerships to share data and draw from local scientific expertise. Most of the data requirements are satisfied using existing data, but some specific data collection may be needed for standardization across borders. The project calls for a two phased implementation. Phase I (Set up phase) consists of developing maps for one state (Vermont) and one province (Newfoundland) as a test of the process, models and data availability. This phase is due for completion by

the end of 2001. Phase II (Operational phase) applies the methodology across the Northeastern United States and Eastern Canada to develop regional maps of forest sensitivity to acid deposition, and report on the impact of acid deposition to forest productivity and health. This phase is due for completion by the end of 2004.

During Phase I of the project, data requirements and standards will be established. Spatial data layers will be compiled for the test state and province, formatted and analyzed by ecological units to determine current critical loads and exceedances of nitrogen and sulfur. Maps of forest sensitivity will be generated. A regional database of high quality, site-specific data will be compiled, analyzed, and compared to the spatial data results to verify that the spatial data approach yields accurate results.

Phase II of the project includes filling data gaps, compiling region-wide spatial and site-specific databases, analyzing data, and producing maps of regional sensitivity to acid deposition. Regional maps of forest productivity and health will then be compiled to compare with results of the forest sensitivity maps. A final step will be to predict forest sustainability given different scenarios of future sulfur and nitrogen deposition.

While Phase I will ultimately determine what data gaps are critical to this project, it is anticipated that some data collection will be required to satisfy data requirements for the model at certain sites. Soil information is crucial to the process. It is possible that limited soil sampling for soil chemical and weathering data may be required. Existing data will be used where available, and existing networks and data collection infrastructure will be utilized where data collection is needed.

Development of regional databases are essential to this project and account for a major investment in time and effort. Existing data from many different sources will form the foundation of these databases, but will need to be reformatted to meet project requirements. Much effort will be focused on the creation of these databases so they can serve the needs of all aspects of this project, and any future efforts to assess air pollution effects on forest ecosystems. Spatial and site-specific databases will include data on atmospheric deposition; climate; soil characteristics and chemistry; forest diversity, nutrition and productivity; geology; topography; and ecological units.

Refinements of existing models appropriate to the Northeast will require cooperation from many different groups working independently on specific aspects of forest ecosystem modeling. This project will integrate these various models into the forest mapping project and produce products that are based on the best "collective" understanding of forest ecosystem functioning at this point in time. Development of spatial databases of regional forest productivity and health will entail cooperation among state, provincial and federal partners who are each responsible for data collection of different aspects of the forest resource. Measurements of growth, biomass, susceptibility to insects and diseases, crown condition and vigor will be incorporated into a spatial and site-specific database.

Maps of forest sensitivity and maps illustrating current productivity and health effects can serve an additional function as a guide to locating monitoring and research sites for state and federal programs intent on addressing forest sustainability issues. Additionally, maps can direct state resource managers to areas needing special management considerations to ensure sustainability.

Anticipated Products

Recommendations to policy makers on the current and future forest effects of nitrogen and sulfur emissions.

Report on the relationship between forest sensitivity to acid deposition and forest sustainability.

Maps of forest sensitivity to acid deposition in Northeastern United States and Eastern Canada.

Maps of forest productivity and health in Northeastern United States and Eastern Canada.

Internationally standardized databases containing:

- * acid deposition
- * climate
- * evapotranspiration
- * soils
- * forest inventory
- * geology
- * topography
- * ecological units
- * forest nutrition

Identification of target areas sensitive to acid deposition for long-term monitoring.
