Assessment of Long-term Monitoring of Nitrogen, Sulfur, and Mercury Deposition and Environmental Effects in New York State

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Air pollutants such as nitrogen oxides, sulfur dioxide, and mercury have had significant impacts on lakes, rivers, soils, fauna, and tree health throughout the northeastern US. Some areas of New York State are particularly susceptible to environmental degradation, such as the Adirondack and Catskill regions, which receive some of the highest rates of acid and mercury deposition in the country. Long-term monitoring (LTM) efforts in New York State have produced data sets that have been extremely valuable for evaluating changes over time in air pollution loads and effects on the environment. It is important to evaluate LTM programs periodically to ensure that these programs remain efficient and effective. To our knowledge, a comprehensive evaluation of long-term environmental monitoring has never been undertaken in New York State. Such an analysis is necessary to identify possible improvements in sampling designs to maximize information gained relative to the resources required for data collection.

We performed a comprehensive analysis of acid and mercury atmospheric deposition and environmental effects in New York. We used a variety of statistical approaches to assess current sampling schemes in six topic areas: atmospheric deposition, lakes, streams, vegetation, soils, and fauna. Using this information, we were able to assess whether current monitoring efforts are sufficient to identify long-term recovery trends, and also to assess whether some monitoring programs may be able to reduce current sampling efforts and apply these efforts to additional monitoring projects. In general, we found that state-wide coverage of wet deposition monitoring is sufficient for measuring long-term trends in acid deposition, but that records of wet mercury deposition were often not long enough to reflect any significant trends. We found that statewide stream chemistry sampling is sufficient, but that there is little information in the state on small, acid sensitive streams or on stream export. We suggest ways that lake sampling might be redistributed to better identify trends in lake chemistry and biota for the same amount of effort expended. We also used a power analysis to assess the change needed to detect a significant difference in a variety of environmental variables such as loon and fish mercury, lake water and sediment mercury concentrations, soil nutrient concentrations, and stream concentrations based on a variety of one-time surveys. We hope that the methods used in this assessment will be widely applicable to researchers interested in evaluating long-term monitoring programs throughout the country.

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