



Clean Air Status and Trends Network (CASTNET, GTH161), National Atmospheric Deposition Program/National Trends Network (NTN, CO10), National Atmospheric Deposition Program/Ammonia Monitoring Network (AMoN, CO10) site in Gunnison County, CO.  
Photo courtesy of U.S. Environmental Protection Agency, CASTNET.

# Improving Nitrogen Deposition Budgets for Ecosystem Assessments in the United States

An overview of policy-relevant research needed to better understand emissions, air concentrations, and deposition of reactive nitrogen in the United States.

**Accurate and complete budgets of reactive nitrogen (Nr) deposition** are needed for ecosystem risk assessments, including the development of critical loads for nutrients and acidity and review of the secondary National Ambient Air Quality Standards. Members of the National Atmospheric Deposition Program Total Deposition Science Committee (NADP/TDep), along with collaborators from federal agencies and academia, recently completed a review of the state of the science of Nr deposition budgets in the United States. The report highlights that while much progress has been made in improving deposition budgets over the past decade, further improvements remain limited by important data and knowledge gaps. The report is categorized into specific areas of deposition research where these gaps are identified and briefly discussed in terms of their importance and, where applicable, potential research paths are identified.

In this issue of *EM*, we summarize several overarching examples of policy-relevant research needed to better understand emissions, air concentrations, and deposition of Nr, and to improve models and measurement-model fusion methods for estimating total and speciated Nr deposition for ecosystem assessments.

### Evolution of Nr Monitoring and Modeling

The first article by Walker and Beachley summarizes advancements in both measurements and models needed to further improve nitrogen deposition budgets in the United States. Examples include the continued evolution of monitoring to characterize concentrations and deposition of reduced forms of nitrogen (NHx = ammonia (NH<sub>3</sub>) and particulate ammonium (NH<sub>4</sub><sup>+</sup>)) and to better understand deposition in urban environments. An important advancement in chemical transport models is the estimation of land-use-specific deposition

for ecosystem assessments, which will help to reduce uncertainty in modeled dry deposition estimates.

### Long-Term Trends in Nr Deposition

The next article by Beachley, et al. describes trends in emissions, air concentrations, and deposition of Nr species across the United States. Trends in deposition of oxidized nitrogen are reflective of downward trends in emissions since 2000. Patterns of NH<sub>3</sub> emissions and NHx deposition are less consistent. Though NH<sub>3</sub> emission inventories suggest a slight decrease since 2000, measured wet deposition of NH<sub>4</sub><sup>+</sup> and modeled dry deposition of NH<sub>3</sub> have increased. Improved measurements, both for emissions and ambient concentrations, as well as the incorporation of satellite monitoring data, will help to reconcile differences in these trends.

### Need for Improved Monitoring of Spatial and Temporal Trends

The importance of NHx to total Nr deposition budgets has increased over time as emissions of oxidized nitrogen have declined. The third article by Puchalski, et al. explores needs and opportunities for expanding ground-based monitoring to better understand spatial gradients and processes of NHx deposition over local-to-regional scales. Integration of ground- and satellite-based NH<sub>3</sub> measurements, as well as improved agricultural emissions inventories, will be important for better resolving NHx trends.

This month's feature articles briefly summarize several important research needs in Nr deposition science. For more detailed information on these and other topics, including a summary of current regulations relevant to Nr deposition, we encourage readers to refer to the above-mentioned report available at the NADP website at <http://nadp.slh.wisc.edu/committees/tdep/reports/nrDepWhitePaper.aspx>. **em**

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### In Next Month's Issue...

#### NSR Reform 2.0

The U.S. Environmental Protection Agency's (EPA) New Source Review (NSR) program has been targeted for reform in the past, and additional changes are impending. Some NSR Reform programs were enacted in the early 2000s. The current round of "NSR Reform" seems focused on even broader changes to the program than previous reform efforts. The August issue will give multiple perspectives on the current NSR Reform efforts: from industry, environmental groups, to EPA, and states. How will these policies affect the permitting process, and what will be the aggregate effect on the environmental protection and economic priorities?