SAES-422 Multistate Research Activity Accomplishments Report

Project No. and Title:	NRSP-3, The National Atmospheric Deposition Program – A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition
Period Covered:	10-2009 through 9-2010
Date of Report:	December 15, 2010
Meeting Dates:	October 6–8, 2009
Participants:	
Meeting Minutes:	http://nadp.isws.illinois.edu/committees/minutes.aspx

Participants

A list of meeting participants from our Fall Meeting and Scientific Symposium can be downloaded from our website (http://nadp.isws.illinois.edu/committees/minutes.aspx).

Meeting Minutes

All meeting minutes from our Spring Meeting (Business Meeting) and our Fall Meeting and Scientific Symposium (2009 and now 2010 minutes) can be downloaded from our website (http://nadp.isws.illinois.edu/committees/minutes.aspx).

Accomplishments

The NRSP-3 provides a framework for cooperation among State Agricultural Experiment Stations (SAES), the U.S. Department of Agriculture, and other governmental and nongovernmental organizations that support the National Atmospheric Deposition Program (NADP). The NADP provides quality-assured data and information on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, base cations, and mercury in precipitation and through dry deposition of these same compounds. NADP data support informed decisions on air quality issues related to precipitation chemistry.

Specifically, researchers use NADP data to investigate the impacts of atmospheric deposition on the productivity of managed and natural ecosystems; the chemistry of estuarine, surface, and ground waters; and the biodiversity in forests, shrubs, grasslands, deserts, and alpine vegetation. These research activities address "environmental stewardship," one of the Experiment Station Section's research challenges. Researchers also use NADP Mercury Deposition Network data to examine the role of atmospheric deposition in affecting the mercury content of fish, and to better

understand the link between environmental and dietary mercury and human health. This fits with another research priority of "relationship of food to human health."

The NADP operates three precipitation chemistry networks: the National Trends Network (NTN), the Atmospheric Integrated Research Monitoring Network (AIRMoN), and the Mercury Deposition Network (MDN). At the end of September, 2010, 244 NTN stations were collecting one-week precipitation samples in 48 states, Puerto Rico, the Virgin Islands, and Quebec Province, Canada. The NTN provides the only long-term nationwide record of basic ion wet deposition in the United States. Complementing the NTN are the 7-site AIRMoN and the 116-site MDN. Data from daily precipitation samples collected at AIRMoN sites support continued research of atmospheric transport and removal of air pollutants and development of computer simulations of these processes. The MDN offers the only long-term and routine measurements of mercury in North American precipitation. These data are used to quantify mercury deposition to water bodies that have fish and wildlife consumption advisories due to this toxic chemical. In 2008, every state and 10 Canadian provinces listed advisories warning people to limit fish consumption due to high mercury levels. Coastal advisories are also in place for Atlantic waters from Maine to Rhode Island, from North Carolina to Florida, for the entire U.S. Gulf Coast, and for coastal Hawaii and Alaska.

Short-term Outcomes and Outputs.

Samples Collected. Our principal objective and accomplishment/outcome for this project is the collection and analysis of samples for precipitation chemistry. Briefly, the NADP processed a total of 13,075 weekly precipitation samples from the NTN. These include 12,694 samples and 381 quality assurance samples. The chemical analyses include observations of 10 different analyte concentrations and precipitation volume, which allow for calculation of deposition flux for each analyte. These same data are collected daily (i.e., every day with measurable precipitation) from the 7-site AIRMoN network. For the year, AIRMoN collected and processed 1,059 precipitation samples, including 146 quality assurance samples. The MDN collected and processed 7,199 weekly mercury-in-precipitation samples during the year, including approximately 300 quality assurance samples.

NADP Data. Our second most important accomplishment or outcome is making data available to all for the support of continued research. Scientists, policymakers, educators, students, and others are encouraged to access data at no charge from the NADP website (http://nadp.isws.illinois.edu). This site offers online retrieval of individual data points, seasonal and annual averages, trend plots, concentration and deposition maps, reports, manuals, and other data and information about the program.

As of today, 2009 calendar year data are complete and online, with data through June of 2010 available within weeks. Website usage statistics provide evidence that our data are being used. During FY2010, website usage continued to grow. There are now more than 39,000 registered users with over 356,000 independent user sessions. There were almost 27,000 data downloads from the site (specifically, 26,938). The site received more than 1.505 million webpage "hits," and our data maps were viewed approximately 124,000 times. Information about users is collected, and the user types include about 33 percent from federal and state agencies, 33 percent from universities, 20 percent from K-to-12 schools, and 14 percent from other organizations. The NADP website has registered users from more than 150 countries over the globe. These statistics demonstrate that NADP continues to be relevant to both the scientific and educational communities, and to attract new users.

Map Summary. During FY10, annual maps of atmospheric pollutants, concentrations, and depositions were developed for 2009 calendar year measurements. These maps are used widely for a number of reasons, and constitute one of the major products of the network. Individual maps are filed by network, year, and constituent (see examples at http://nadp.isws.illinois.edu/data/annualiso.aspx). Individual maps are compiled into annual Map Summary reports (http://nadp.isws.illinois.edu/lib/dataReports.aspx). We also completed the distribution of approximately 1,800 printed FY08 Map Summaries, and printed and began distributing 2000 of the 2009 Map Summaries in August. The Summary is available for all to download.

Scientific Meeting (Fall 2009). At the end of each federal year, a scientific meeting is held that showcases some of the latest deposition research that occurred during the year. During FY2010 (Saratoga Springs, NY, Oct. 6–8), the meeting focused on "Bridging Air and Ecosystems." The meeting attracted more than 175 registered participants (our largest ever), and provided more than 40 speakers (two keynotes) organized into 7 sessions, which included, "Are Ecosystems Responding to Emission Reductions?" and "Agricultural Emissions and Ecosystem Effects." All presentations, posters, and meeting proceedings are available on the NADP website (http://nadp.isws.illinois.edu/meetings/fall2009/post/).

Scientific Meeting (Fall 2010). The latest meeting, the Fall 2010 Meeting and Scientific Symposium, was held in October 2010 (after these report dates) in Truckee, CA. It was focused on "Networking the Networks" and was meant to foster collaboration between networks, produce more information with the same effort, and so forth. There were 152 participants, 2 keynote addresses, 35 speakers, and 31 poster presentations in 6 sessions focusing on networks monitoring in the environment. These sessions included "Climate

Change" and "Soil Networks." Committee minutes, proceedings, and scientific presentations are available on the website.

Preparations are well underway for our next Fall Technical and Scientific Symposium in Providence, Rhode Island on October 25 to 28, 2011. All meeting information, registration, payment, and other details will be made available online soon.

These basic activities fulfilled the project objectives: (1) coordination of three networks; (2) quality assurance to ensure consistency; and (3) analytical, site support, and data validation services for the sites supported directly through this agreement.

Network Operation Notes. The NADP continues to convert our precipitation gages to an all-digital network, originating with a Technical Committee decision in 2006 (http://nadp.isws.illinois.edu/newissues/newgages/newequip.aspx). Currently, the network is well on its way to completing this goal. In mid- FY10, 50 percent of our sites (approximately 150 sites) were using and reporting digital precipitation data (15-minute observations).

Updated versions of the following quality assurance documents were produced and approved at the Fall 2009 meeting: 1) Quality Management Plan; 2) Quality Assurance Plan; 3) Guidelines for NADP Laboratory Quality Assurance Reports; 4) Guidelines for NADP Laboratory Reviews; 5) Guidelines for NADP Quality Management System Review; 6) NADP Site Information Worksheet; 7) NADP Site Selection and Installation Manual; and 8) Guide for New NADP Initiatives. These documents were all in use during the year (http://nadp.sws.uiuc.edu/lib/qaPlans.aspx).

Further, the U.S. Geological Survey conducted an external review of our laboratories, with 360 performance evaluation samples for the NTN, 216 performance evaluation samples for the MDN, 100 field audit samples to NTN site operators and 115 system blank samples to MDN site operators, and 20 blind Audit Program samples to MDN site operators.

Other Notes. In November 2004, the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service issued the first report of Phakopsora pachyrhizi, commonly known as Asian Soybean Rust (ASR), in the continental U.S. ASR is an obligate fungal parasite that can cause significant losses in soybean and other leguminous crops. From infected plants, ASR spreads through the aerial release and dispersal of spores. These airborne spores can be scavenged in and below clouds and deposited by rain on uninfected host plants hundreds of kilometers from an existing infection. During the 2010 growing season, NADP again partnered with the USDA

Cereal Disease Laboratory (CDL) to look for ASR spores in NTN samples (5th year). With partial support from the Agricultural Research Service, weekly samples from 80 eastern U.S. NTN sites were selected and are undergoing study. Additionally, a new wheat rust investigation, also with CDL, began in November 2009. This initiative will investigate 44 Southern U.S. sites and weekly precipitation samples for several strains of winter wheat rust. Results should be available for the FY11 report.

The presence of ammonia gas in the atmosphere and its association with agricultural operations has become a very important topic of discussion, and NADP is continuing with an ammonia monitoring network across the central part of the U.S. and Canada. The goal is to develop, deploy, and operate a cost-efficient *passive* sampling network for basic ammonia gas concentrations. During FY2010, the network's 21 sites collected 2,051 observations of ammonia in the atmosphere, principally across the U.S. Midwest. These two-week integrated values will be used to quantify the spatial and temporal differences in atmospheric ammonia concentrations and estimate dry deposition of ammonia nitrogen. The network includes a quality assurance program to document the accuracy of passive samplers. Following NADP methods, the resulting quality-assured concentrations will be reported and made available for use by all data users. (At the FY10 Fall Meeting, this new network was added.) More information can be found at http://nadp.isws.illinois.edu/nh3net/. This network has numerous implications for agriculture, including directly addressing Challenge Area #2 in The Science Roadmap for Agriculture.

The NADP, with support from USGS, worked on its ability to capture the analyte bromine in its NTN samples. Bromide is released into the environment via natural and anthropogenic processes, including agricultural fumigants and flame-retardants. Methyl bromide is classified as an ozone-depleting substance, and its use is strictly regulated and monitored by the U.S. EPA. Although there are regulations in place, there is still a concern about the amount of bromide present in the atmosphere. During FY11, regular collection and reporting of this analyte is planned.

Scientists at the U.S. Environmental Protection Agency supported research at the NADP's Central Analytical Laboratory to determine whether organic nitrogen deposition can be measured reliably and accurately in weekly NTN samples. Preliminary results from these tests indicate a seasonal trend in organic nitrogen concentrations. Furthermore, these concentrations may account for as much as one-third of total nitrogen deposition. This added information contributes to the understanding of our current inorganic nitrogen measurements and deposition patterns. Results are forthcoming in the FY11 year.

The NRSP-3 has enhanced our website to better serve our members and data users.

During the 2010 calendar year, 145 journal articles and reports were generated using the NADP data in some form. These are listed in the Publications section. This is again evidence that NADP is producing data that are both valuable and useful.

Milestones

1. To date, nearly *400,000 observations of precipitation chemistry* are archived by the NADP (NTN and AIRMoN). More importantly, all of these remain available in our database, and are comparable over the years for research.

2. At the NADP Fall 2009 Meeting and Scientific Symposium, the technical sub-committees voted to approve the Atmospheric Mercury Network (AMNet) as an official NADP network. This is the fourth network of the NADP in our 32-year history. This network has operated as an NADP special study since 2008. The focus of AMNet is the measurement of atmospheric mercury concentrations across North America. These data will be used to model dry deposition of mercury to the environment. Currently, AMNet has 21 sites. On-site analyzers measure atmospheric mercury concentrations on a continuous (15 minute) basis. More information about AMNet can be found at http://nadp.isws.illinois.edu/amn/. During this next federal year, quality-assured data will be moved to the web to support future research.

Impacts

As a National Research Support Project, the NADP's most important impacts are the research reports and journal articles that are produced using our data and products. Here, several articles are summarized that are most useful for agriculture and to the USDA.

From January through December 2010, we identified 145 journal articles and reports that used NADP data or maps specifically in their research, modeling applications, or for comparison. These articles are included in our online database of NADP-supported publications. Brief summaries of several articles are given as specific examples of the research supported by the NRSP-3.

1. Skogen et al. investigated the impact that anthropogenic and agricultural nitrogen deposition could have on mid-latitude forests and native species (e.g., legumes). They estimated that N deposition is having a detrimental effect on these legumes through increased biomass in other species that out-compete them. As other species

more strongly assimilate N, legumes become more dependent on other limited nitrogen sources.

2. Van Riper et al. investigated the potential for much higher nitrogen fixation rates in prairie soils with the presence of non-native sweetclover, another legume now common in the upper Midwest. Increased species' presence should increase nitrogen fixation and force species changes. Increases in *Halogeton glomeratus* (a restricted noxious weed) abundance was noted. NADP data were used to estimate nitrogen addition at multiple field sites.

3. Van Diepen et al. simulated long-term nitrogen deposition into northern forests and investigated ecosystem changes in the in situ fungi and the microbial community, finding serious decreases in biomass with increased deposition. NADP information provided typical deposition at all their field sites in upper and lower Michigan.

4. Stevens and Tillman investigated the impact on native prairie grasses of point source ammonia emissions from Midwest animal operations. Among their findings was that soil pH, ammonium, and nitrate concentration gradients were present with distance, species richness decreased toward the sites, and above ground biomass was higher with increased NH4 deposition. NADP data provided baseline values for deposition at the several animal feedlots used for the study.

5. Di Vittorio et al. developed and optimized the agricultural and ecosystem numerical model Agro-BGC (Biogeochemical Cycles) to now include C4 perennial grass function, along with fruit growth, optional annual seeding, N fertilization, harvest, fire, and different irrigation strategies. Results were compared to crop data from IL SAES. For the model, NADP data are used as input of nitrogen deposition to all agricultural lands.

6. Li et al. built a numerical model describing the coupled water runoff and chemical movement from a tile-drained agricultural region of Illinois. The model suggests that annual runoff volume and nitrogen discharge are principally from tile, with a net loss of nitrogen during wet years (and vice versa). Phosphorus storage is not affected by wet and dry years. NADP Nitrogen and Phosphorus information was used as inputs to the model and to check model performance.

7. Vidon and Cuadra also investigated the hydrology of tiled agriculture systems. They investigated and modeled different types of flow through soil and drainage characteristics, along with chemical composition in drainage waters. NADP data were used to define the problem and provide the chemical composition of

deposition water.

8. This same type of model building and analysis was conducted by Dayyani et al. in Eastern Canada with the DRAIN-WARMF model. They were able to adequately model hydraulic response and nitrate losses. The authors used NADP data as chemical and hydraulic inputs to the model.

9. Reese used passive and active techniques to determine ammonia emissions from a variety of agriculture areas sources, including overall dairy emission rates and a comparison of measurement techniques. He used NAPD data to look for spatial correlations between ammonia wet deposition and animal operations.

10. Beavers et al. investigated the burden and loss rates of phosphorus (P) from poultry-litter amended soils in the Southeast, finding increasing P levels over time, with the majority of the P still in place after three years. NADP phosphorus information and observations were used in their model to estimate atmospheric input of P to the soils over the study period.

11. Bormann et al. studied the effect of ion losses in cropping systems (corn and alfalfa), specifically studying the method of using "simulated" rainfall versus actual rainfall (as provided by NADP) to determine leaching. They concluded that simulated rainfall does have significant differences from real rainfall. Here, NADP provided regional values of Na, K, Mg, Ca deposition, rainfall samples, and information on orthophosphate ions.

12. Grenon et al. used NAPD data extensively to look for deposition trends in the Bridger-Teton National Forest, finding decreasing deposition of sulfate, Na, Mg, and Cl, while finding increasing trends in ammonium and inorganic nitrogen. These trends should have an impact on the forest ecosystem and surrounding areas.

13. The USDA Forest Service produced a report that reviewed the scientific resources at the 77 experimental forests and ranges of the U.S. This document describes each research site, its history, climate, vegetation, soils, databases, and research products. NADP is represented at several forests, including Marcell in Minnesota where several of the Network's oldest NADP sites are located.

14. Greenquist et al. published work in the *Journal of Animal Science* concerning nitrogen use efficiency in steers with substitute feeds. They found some improvements in efficiency using dried distillers grain as feed. NAPD information on deposition rates and nitrogen amounts was used as input to their models.

Publications

Approximately 145 publications used NADP data or resulted from NRSP-3 activities in 2010 (January to December 15). A publically available online database that lists citations using NADP data is accessible at: http://nadp.isws.illinois.edu/lib/bibsearch.asp.

1. Adams, M.B., Loughry, L., and Plaugher, L. (cpl.) 2010. Experimental Forests and Ranges of the USDA Forest Service. USDA Forest Service Publication, http://hdl.handle.net/1957/17290.

2. Allen, D.J. and Brent, G.F. 2010. Sequestering CO2 by mineral carbonation: Stability against acid rain exposure. Environmental Science & Technology 44(7): 2735–2739.

3. Ashton, I.W., Miller, A.E., Bowman, W.D., and Suding, K.N. 2010. Niche complementarity due to plasticity in resource use: Plant partitioning of chemical N forms. Ecology 91: 3252–3260, doi:10.1890/09-1849.1.

4. Bash, J.O. 2010. Description and initial simulation of a dynamic bidirectional air-surface exchange model for mercury in Community Multiscale Air Quality (CMAQ) model. Journal of Geophysical Research 115: D06305, doi:10.1029/2009JD012834.

5. Batson, J.A. 2010. Denitrification and a nitrogen budget of created riparian wetlands. Master's thesis in partial fulfillment for the Degree Master of Science, Ohio State University.

6. Beavers, B.W., Liu, Z., Cox, M.S., Kingery, W.L., Brink, G.E., Gerard, P.D., and McGregor, K.C. 2010. Phosphorus dynamics in two poultry-litter amended soils of Mississippi under three management systems. Pedosphere 20(2): 217–228.

7. Beem, K.B., Raja, S., Schwandner, F.M., Taylor, C., Lee, T., Sullivan, A.P., Carrico, C.M., McMeeking, G.R., Day, D., Levin, E., Hand, J., Kreidenweis, S.M., Schichtel, B., Malm, W.C., and Collett, J.L., Jr. 2010. Deposition of reactive nitrogen during the Rocky Mountain Airborne Nitrogen and Sulfur (RoMANS) study. Environmental Pollution 158(3): 862–872, doi: 10.1016/j.envpol.2009.09.023.

8. Beltran, B.J., Amatya, D.M., Youssef, M., Jones, M., Callahan, T.J., Skaggs, R.W., and Nettles, J.E. 2010. Impacts of fertilization on water quality of a drained pine plantation: A worst case scenario. Journal of Environmental Quality 39: 293–303.

9. Bohl , N.L., Baxter, C.A., Adraski, T.W., Good, L.W., and Bundy, L.G. 2010. Source water effects on runoff amount and phosphorus concentration under simulated rainfall. Soil Science Society of America Journal 74: 612–618.

10. Burkle, L.A. and Irwin, R.E. 2010. Beyond biomass: Measuring the effects of community-level nitrogen enrichment on floral traits, pollinator visitation and plant reproduction. Journal of Ecology 98: 705–717, doi: 10.1111/j.1365-2745.2010.01648.x.

11. Caffrey, J.M., Landing, W.M., Nolek, S.D., Gosnell, K., Bagui, S.S., and Badui, S.C. 2010. Atmospheric deposition of mercury and major ions to the Pensacola Bay (Florida) watershed:

Spatial, seasonal, and inter-annual variability. Atmospheric Chemistry and Physics Discussion 10: 4593–4616, www.atmos-chem-phys-discuss.net/10/4593/2010/.

12. Cai, M., Schwartz, J., Robinson, R., Moore, S., and Kulp, M. 2010. Long-term effects of acidic deposition on water quality in a high-elevation Great Smoky Mountains National Park watershed: Use of an ion input–output budget. Water, Air & Soil Pollution 209(1): 143–156, doi: 10.1007/s11270-009-0187-5.

13. Chang, Y.-M., Hsu, N.-J., and Huang, H.-C. 2010. Semiparametric estimation and selection for nonstationary spatial covariance functions. Journal of Computational and Graphical Statistics 19(1): 117–139, doi:10.1198/jcgs.2010.07157.

14. Civerolo, K., Hogrefe, C., Zalewsky, E., Hao, W., Sistla, G., Lynn, B., Rosenzweig, C., and Kinney, P.L. 2010. Evaluation of an 18-year CMAQ simulation: Seasonal variations and long-term temporal changes in sulfate and nitrate. Atmospheric Environment 44(31): 3745–3752, doi: 10.1016/j.atmosenv.2010.06.056.

15. Clow, D.W. and Mast, M.A. 2010. Mechanisms for chemostatic behavior in catchments: Implications for CO2 consumption by mineral weathering. Chemical Geology 269: 40–51.

16. Clow, D.W., Nanus, L., and Huggett, B. 2010. Use of regression-based models to map sensitivity of aquatic resources to atmospheric deposition in Yosemite National Park, USA. Water Resources Research 46: W09529, doi:10.1029/2009WR008316.

17. Coconino County. 2010. Lake Mary Regional TMDL For Mercury in Fish Tissue: Upper Lake Mary, Lower Lake Mary, Soldiers Lake, Soldiers Annex Lake, and Lower Long Lake Little Colorado River Watershed., State of Arizona, Department of Environmental Quality, Open File Report #OFR 10-02, http://www.azdeq.gov/environ/water/assessment/download/Lake_Mary_Region_Draft-6-16-2010.pdf.

18. Converse, A.D., Riscassi, A.L., and Scanlon, T.M. 2010. Seasonal variability in gaseous mercury fluxes measured in a high-elevation meadow. Atmospheric Environment 44(18): 2176–2185, doi 10.1016/j.atmosenv.2010.03.024.

19. Corvo, F., Reyes, J., Valdes, C., Villasenor, F., Cuesta, O., Aguilar, D., and Quintana, P. 2010. Influence of air pollution and humidity on limestone materials degradation in historical buildings located in cities under tropical coastal climates. Water, Air & Soil Pollution 205: 359–375, doi 10.1007/s11270-009-0081-1.

20. Croft, B., Lohmann, U., Martin, R.V., Stier, P., Wurzler, S., Feichter, J., Hoose, C., Heikkil, U., van Donkelaar, A., and Ferrachat, S. 2010. Influences of in-cloud aerosol scavenging parameterizations on aerosol concentrations and wet deposition in ECHAM5-HAM. Atmospheric Chemistry and Physics 10: 1511–1543.

21. Cusack, D.F., Torn, M.S., McDowell, W.H., and Silver, W.L. 2010. The response of heterotrophic activity and carbon cycling to nitrogen additions and warming in two tropical soils. Global Change Biology 16: 2555–2572, doi: 10.1111/j.1365-2486.2009.02131.x.

22. Daley, M., Potter, J., Difranco, E., and McDowell, W.H. 2010. Nitrogen Assessment for the Lamprey River Watershed, New Hampshire Water Resources Research Center (NH WRRC), Department of Natural Resources, The State of New Hampshire, http://des.nh.gov/organization/divisions/water/wmb/coastal/documents/unh_nitrogenassessment.pdf.

23. David, M.B., Drinkwater, L.E., and McIsaac, G.F. 2010. Sources of nitrate yields in the Mississippi River Basin. Journal of Environmental Quality 39: 1657–1667, doi:10.2134/jeq2010.0115.

24. Dayyania, S., Prasherb, S.O., Madanic, A., and Madramootoob, C.A. 2010. Development of DRAIN–WARMF model to simulate flow and nitrogen transport in a tile-drained agricultural watershed in Eastern Canada. Agricultural Water Management 98: 55–68.

25. Dennis, R.L., Mathur, R., Pleim, J.E., and Walker, J.T. 2010. Fate of ammonia emissions at the local to regional scale as simulated by the Community Multiscale Air Quality model. Atmospheric Pollution Research 1: 207–214.

26. Di Vittorio, A.V., Anderson, R.S., White, J.D., Miller, N.L., and Running, S.W. 2010. Development and optimization of an Agro-BGC ecosystem model for C_4 perennial grasses. Ecological Modeling 221(17): 2038–2053, doi:10.1016/j.ecolmodel.2010.05.013.

27. Drevnick, P.E., Shinneman, A.L.C., Lamborg, C.H., Engstrom, D.R., Bothner, M.H., and Oris, J.T. 2010. Mercury flux to sediments of Lake Tahoe, California–Nevada. Water, Air, and Soil Pollution 210(1-4): 399–407, doi 10.1007/s11270-009-0262-y.

28. Engle, M.A., Tate, M.T., Krabbenhoft, D.P., Schauer, J.J., Kolker, A., Shanley, J.B., and Bothner, M.H. 2010. Comparison of atmospheric mercury speciation and deposition at nine sites across central and eastern North America. Journal of Geophysical Research 115: D18306, doi: 10.1029/2010JD014064.

29. Ewing, H.A., Groffman, P.M., and Frank, D.A. 2010. Grazers and soil moisture determine the fate of added $^{15}NH_{4+}$ in Yellowstone grasslands. Plant Soil 328: 337–351, doi: 10.1007/s11104-009-0113-z.

30. Fang, Y., Fiore, A.M., Horowitz, L.W., Levy, H., Hu, Y., and Russell, A.G. 2010. Sensitivity of the NOy budget over the United States to anthropogenic and lightning NOx in summer. Journal of Geophysical Research 115: D18312, doi:10.1029/2010JD014079.

31. Fenn, M.E., Allen, E.B., Weiss, S.B., Jovan, S., Geiser, L.H., Tonnesen, G.S., Johnson, R.F., Rao, L.E., Gimeno, B.S., Yuan, F., Meixner, T., and Bytnerowicz, A. 2010. Nitrogen critical loads and management alternatives for N-impacted ecosystems in California. Journal of Environmental Management 91: 2404–2423.

32. Filippa, G., Freppaz, M., Williams, M.W., and Zanini, E. 2010. Major element chemistry in inner alpine snowpacks (Aosta Valley Region, NW Italy). Cold Regions Science and Technology 64(2): 158–166, doi:10.1016/j.coldregions.2010.07.005.

33. Florida, State of. 2010. Site-Specific Information in Support of Establishing Numeric Nutrient Criteria for Choctawhatchee Bay. Florida Department of Environmental Protection, Tallahassee, FL 32399.

34. Florida, State of. 2010. Site-Specific Information in Support of Establishing Numeric Nutrient Criteria in Ochlockonee Bay. Division of Environmental Assessment and Restoration, Florida Department of Environmental Protection, Tallahassee, FL 32399.

35. Florida, State of. 2010. Site-Specific Information in Support of Establishing Numeric Nutrient Criteria for the Springs Coast, Florida. Department of Environmental Protection, Tallahassee, FL 32399, http://www.dep.state.fl.us/water/wqssp/nutrients/docs/estuarine/pinellaspark/springs_coast_082010.pdf.

36. Florida, State of. 2010. Site-Specific Information in Support of Establishing Numeric Nutrient Criteria for St. Joseph Bay. Division of Environmental Assessment and Restoration, Florida Department of Environmental Protection, Tallahassee, FL 32399, http://www.dep.state.fl.us/water/wqssp/nutrients/docs/estuarine/tallahassee/st_joe_bay_081310.pdf.

37. Follstad Shaw, J.J., Harner, M.J., and Tibbets, T.M. 2010. Elaeagnus angustifolia elevates soil inorganic nitrogen pools in riparian ecosystems. Ecosystems 13: 46–61, doi: 10.1007/s10021-009-9299-4.

38. Fu, X., Feng, X., Zhu, W., Rothenberg, S., Yao, H., and Zhang, H. 2010. Elevated atmospheric deposition and dynamics of mercury in a remote upland forest of southwestern China. Environmental Pollution 158(6): 2324–2333, doi: 10.1016/j.envpol.2010.01.032.

39. Gaddis, E. and Voinov, A. 2010. Spatially explicit modeling of land use specific phosphorus transport pathways to improve TMDL load estimates and implementation planning. Water Resources Management 24: 1621–1644, doi: 10.1007/s11269-009-9517-z.

40. Gahl, M.K. and Calhoun, A.J.K. 2010. The role of multiple stressors in ranavirus-caused amphibian mortalities in Acadia National Park wetlands. Canadian Journal of Zoology 88: 108–121.

41. Garvey, J., Ickes, B., and Zigler, S. 2010. Challenges in merging fisheries research and management: The Upper Mississippi River experience. Hydrobiologia 640: 125–144, doi: 10.1007/s10750-009-0061-x.

42. Geiser, L.H., Jovan, S.E., Glavich, D.A., and Porter, M.K. 2010. Lichen-based critical loads for atmospheric nitrogen deposition in Western Oregon and Washington Forests, USA. Environmental Pollution 158(7): 2412–2421, doi: 10.1016/j.envpol.2010.04.001.

43. Gil, I.S., White, M., Melendez, E., and Vanderbilt, K. 2010. Case studies of ecological integrative information systems: The Luquillo and Sevilleta Information Management Systems. Communications in Computer and Information Science 108: 18–35, doi: 10.1007/978-3-642-16552-8_3.

44. Gilbert, D., Wieckowicz, R., Kang, W.-J., Wilcox, E.G., and Ralys, B. 2010. TMDLs for Munson Slough WBID 807D (Dissolved Oxygen), Lake Munson WBID 807C [Dissolved Oxygen, Nutrients (Trophic State Index), and Turbidity] and Munson Slough Below Lake Munson WBID 807 (Dissolved Oxygen and Un-ionized ammonia). Florida Department of Environmental Protection, 136 pp.

45. Godsey, S.E., Aas, W., Clair, T.A., deWit, H.A., Fernandez, I.J., Kahl, J.S., Malcolm, I.A., Neal, C., Neal, M., Nelson, S.J., Norton, S.A., Palucias, M.C., Skjelkvale, B.L., Soulsby, C., Tetzlaff, D., and Kirchner, J.W. 2010. Generality of fractal 1/f scaling in catchment tracer time series, and its implications for catchment travel time distributions. Hydrologic Processes 24: 1660–1671.

46. Goel, A., McConnell, L.L., Torrents, A., Kuang, Z., Hapeman, C.J., Merritt, D.W., Alexander, S.T., Scudlark, J.R., and Scarborough, R. 2010. Environmental factors affecting the levels of legacy pesticides in the airshed of Delaware and Chesapeake Bays, USA. Environmental Toxicology and Chemistry 29: 1893–1906, doi: 10.1002/etc.243.

47. Goodman, K.J. 2010. The effect of in-line lakes on dissolved organic matter dynamics in mountain streams. All Graduate Theses and Dissertations, Paper 702, http://digitalcommons.usu.edu/etd/702.

48. Goodman, K. J., Baker, M.A., and Wurtsbaugh, W.A. 2010. Mountain lakes increase organic matter decomposition rates in streams. Journal of the North American Benthological Society 29(2): 521–529, doi: 10.1899/09-070.1.

49. Gratz, L.E. 2010. Identification of atmospheric mercury sources and transport pathways on local and regional scales. A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, University of Michigan.

50. Greenquist, M.A., Schwarz, A.K., Klopfenstein, T.J., Schacht, W.H., Erickson, G.E., Vander Pol, K.J., Luebbe, M.K., Brink, K.R., and Baleseng, L.B. 2010. Effects of nitrogen fertilization and dried distillers grains supplementation: Nitrogen use efficiency. Journal of Animal Science, online publication, doi:10.2527/jas.2010-2902.

51. Grenon, J., Svalberg, T., Porwoll, T., and Story, M. 2010. Lake and Bulk Sampling Chemistry, NADP, and IMPROVE Air Quality Data Analysis on the Bridger-Teton National Forest (USFS Region 4). Gen. Tech. Rep. RMRS-GTR-248WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, 44 pp.

52. Gustin, M. and Jaffe, D. 2010. Reducing the uncertainty in measurement and understanding of mercury in the atmosphere. Environmental Science & Technology 44(7): 2222–2227.

53. Hill, B.H., Elonen, C.M., Jicha, T.M., Bolgrien, D.W., and Moffett, M.F. 2010. Sediment microbial enzyme activity as an indicator of nutrient limitation in the great rivers of the Upper Mississippi River basin. Biogeochemistry 97(2-3): 195–209, doi: 10.1007/s10533-009-9366-0.

54. Hill, J. Jaron, Chumchal, M.M., Drenner, R.W., Pinder, J.E., and Drenner, S.M. 2010. Use of preserved museum fish to evaluate historical and current mercury contamination in fish from two rivers in Oklahoma, USA. Environmental Monitoring and Assessment 161(1-4): 509–516, doi: 10.1007/s10661-009-0764-5.

55. Hirmas, D.R., Amrhein, C., and Graham, R.C. 2010. Spatial and process-based modeling of soil inorganic carbon storage in an arid piedmont. Geoderma 154: 486–494, doi: 10.1016/j.geoderma.2009.05.005.

56. Huijnen, V., Williams, J.E., van Weele, M., van Noije, T.P.C., Krol, M.C., Dentener, F., Segers, A., Houweling, S., Peters, W., de Laat, A.T.J., Boersma, K.F., Bergamaschi, P., van Velthoven, P.F.J.,

Le Sager, P., Eskes, H.J., Alkemade, F., Scheele, M.P., N'ed'elec, P., and P'atz, H.-W. 2010. The global chemistry transport model TM5: Description and evaluation of the tropospheric chemistry version 3.0. Geosciences Model Development Discussion 3: 1009–1087, www.geosci-model-dev-discuss.net/3/1009/2010/, doi:10.5194/gmdd-3-1009-2010.

57. International Maritime Organization Marine Environment Protection Committee. 2010. Designation of an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter. Interpretations of and Amendments to MARPOL and Related Instruments (61st Session, Agenda Item 7, (MEPC 61/INF.9, 25 June, 2010), 57 pp.

58. Jardine, T.D. and Bunn, S.E. 2010. Northern Australia, whither the mercury? *Marine and Freshwater Research* 61(4): 451–463, doi:10.1071/MF09126.

59. Jin, L., Siegel, D.I., Lautz, L.K., Mitchell, M.J., Dahms, D.E., and Mayer, B. 2010. Calcite precipitation driven by the common ion effect during groundwater–surface-water mixing: A potentially common process in streams with geologic settings containing gypsum. Geological Society of America Bulletin 122(7-8): 1027–1038, doi: 10.1130/B30011.1.

60. Jonson, J.E., Travnikov, O. (eds) 2010. Joint MSC-W/MSC-E Report EMEP/MSC-W Technical Report 1/2010: Development of the EMEP global modeling framework: Progress report. http://emep.int/publ/reports/2010/emep_technical_1_2010.pdf.

61. Kelly, C.N. 2010. Carbon and nitrogen cycling in watersheds of contrasting vegetation types in the Fernow Experimental Forest, West Virginia. Dissertation submitted for partial fulfillment of the Doctor of Philosophy degree, Virginia Polytechnic Institute and State University.

62. Kendall, C., Young, M.B., and Silva, S.R. 2010. Applications of stable isotopes for regional to national-scale water quality and environmental monitoring programs. Chapter 5 in Isoscapes: Understanding movement, pattern, and process on earth through isotope mapping, J.B. West et al. (eds.), doi 10.1007/978-90-481-3354-3_5.

63. King County. 2010. Initial Assessment of Nutrient Loading to Quartermaster Harbor. Prepared by Curtis DeGasperi, Water and Land Recourses Division, Seattle Washington.

64. Kolka, R.K., Giardina, C.P., McClure, J.D., Mayer, A., and Jurgensen, M.F. 2010. Partitioning hydrologic contributions to an 'old-growth' riparian area in the Huron Mountains of Michigan, USA. Ecohydrology 3: 315–324, doi: 10.1002/eco.112.

65. Kolker, A., Olson, M.L., Krabbenhoft, D.P., Tate, M.T., and Engle, M.A. 2010. Patterns of mercury dispersion from local and regional emission sources, rural Central Wisconsin, USA. Atmospheric Chemistry & Physics Discussion 10: 1823–1846, www.atmos-chem-phys-discuss.net/10/1823/2010/.

66. Krzyzanowski, J. 2010. Review and Identification of Research Needs to Address Key Issues Related to Reactive Nitrogen (RN) Deposition and Eutrophication in a Canadian Context (Final Report). Prepared for: Acid Rain Task Group, Canadian Council of Ministers of the Environment, PN 1450.

67. Lambert, W.J. and Aharon, P. 2010. Oxygen and hydrogen isotopes of rainfall and dripwater at DeSoto Caverns (Alabama, USA): Key to understanding past variability of moisture transport

from the Gulf of Mexico. Geochimica et Cosmochimica Acta 74: 846–861, doi:10.1016/j.gca.2009.10.043.

68. Landing, W.M., Caffrey, J.M., Nolek, S.D., Gosnell, K.J., and Parker, W.C. 2010. Atmospheric wet deposition of mercury and other trace elements in Pensacola, Florida. Atmospheric Chemistry and Physics 10: 4867–4877, doi: 10.5194/acp-10-4867-2010.

69. Laudon, H. and Norton, S.A. 2010. Drivers and evolution of episodic acidification at the Bear Brook Watershed in Maine, USA. Environmental Monitoring and Assessment, published online, doi: 10.1007/s10661-010-1526-0.

70. Li, H., Sivapalan, M., Tian, F., and Liu, D. 2010. Water and nutrient balances in a large tile-drained agricultural catchment: A distributed modeling study. Hydrological Earth Systems Science Discussion 7: 3931–3976, www.hydrol-earth-syst-sci-discuss.net/7/3931/2010/, doi:10.5194/hessd-7-3931-2010.

71. Liu, X.-H., Zhang, Y., Olsen, K.M., Wang, W.-X., Do, A.B., and Bridgers, G.M. 2010. Responses of future air quality to emission controls over North Carolina, Part I: Model evaluation for current-year simulations. Atmospheric Environment 44(10): 2443–2456, doi:10.1016/j.atmosenv.2010.04.002.

72. Lloyd, P.J. 2010. Changes in the wet precipitation of sodium and chloride over the continental United States, 1984-2006. Atmospheric Environment 44(26): 3196–3206, doi: 10.1016/j.atmosenv.2010.05.016.

73. Luyssaert, S., Ciais, P., Piao, S.L., Schulze, E.D., Jung, M., Zaehle, S., Schelhaas, M.J., Reichstein, M., Churkin, G., Papale, D., Abril, G., Beer, C., Grace, J., Lous Tau, D., Matteucci, G., Magnani, F., Nabuurs, G.J., Verbeeck, H., Sulkava, M., van der Werf, G.R., Janssens, I.A., and members of the Carboeurope-IP Synthesis Team, 2010. The European carbon balance. Part 3: forests. Global Change Biology 16: 1429–1450, doi: 10.1111/j.1365-2486.2009.02056.x.

74. Lyman, S.N., Gustin, M.S., and Prestbo, E.M. 2010. A passive sampler for ambient gaseous oxidized mercury concentrations. Atmospheric Environment 44: 246–252.

75. Maryland, State of. 2010. Total Maximum Daily Load of Mercury for Watersheds Draining to Millington Wildlife Management Area Ponds. Maryland, Department of Environment, Baltimore, MD 21230, http://www.mde.state.md.us/assets/document/Millington_WMA_Hg_081910_PCdraft.pdf.

76. Maryland, State of. 2010. Watershed Report for Biological Impairment of the Deep Creek Lake Watershed in Garrett County, Maryland: Biological Stressor Identification Analysis Results and Interpretation. Department of the Environment, July 2010, 28pp.

77. Mast, A.M., Manthorne, D.J., and Roth, D.A. 2010. Historical deposition of mercury and selected trace elements to high-elevation National Parks in the Western U.S. inferred from lake-sediment cores. Atmospheric Environment 44: 2577–2586.

78. McLauchlan, K.K., Ferguson, C.J., Wilson, I.E., Ocheltree, T.W., and Craine, J.M. 2010. Thirteen decades of foliar isotopes indicate declining nitrogen availability in central North American

grasslands. New Phytologist Special Issue 187(4): 1135–1145, doi: 10.1111/j.1469-8137.2010.03322.x.

79. McMahon, S.M., Parker, G.G., and Miller, D.R. 2010. Evidence for a recent increase in forest growth. Proceedings of the National Academy of Sciences 107(8): 3611–3615, www.pnas.org/cgi/doi/10.1073/pnas.0912376107.

80. Moravec, B.G., Keller, C.K., Smith, J.L., Allen-King, R.M., Goodwin, A.J., Fairley, J.P., and Larson, P.B. 2010. Oxygen-18 dynamics in precipitation and streamflow in a semi-arid agricultural watershed, Eastern Washington, USA. Hydrologic Processes 24: 446–460.

81. Naik, A. 2010. Trace metal fluxes in southwest Ohio watersheds. A thesis submitted for the degree of Master of Science, Wright State University.

82. National Park Service, Air Resources Division. 2010. Air Quality in National Parks: 2009 Annual Performance and Progress Report. Natural Resource Report NPS/NRPC/ARD/NRR—2010/266. National Park Service, Denver, Colorado.

83. National Park Service, Environmental Protection Agency, and Colorado Department of Public Health and Environment. 2010. Rocky Mountain National Park Initiative Nitrogen Deposition Reduction Contingency Plan. http://www.cdphe.state.co.us/ap/rmnp/RMNPContingencyPlanFinal.pdf

84. National Park Service. 2010. Final Environmental Impact Statement: Jackson Hole Airport Agreement Extension, Grand Teton National Park. U.S. Department of the Interior, National Park Service.

85. Navratil, T., Norton, S.A., Fernandez, I.J., and Nelson, S.J. 2010. Twenty-year inter-annual trends and seasonal variations in precipitation and stream water chemistry at the Bear Brook Watershed in Maine, USA. Environmental Monitoring and Assessment, online publication, 23 pp., doi: 10.1007/s10661-010-1527-z.

86. North Carolina, State of. 2010. 2006 Ambient Air Quality Report. Department of Environment and Natural Resources, Division of Air Quality.

87. North Carolina, State of. 2010. 2005 Ambient Air Quality Report. Department of Environment and Natural Resources, Division of Air Quality.

88. Norton, S.A., Fernandez, I.J., Kahl, J.S., Rustad, L.E., Navratil, T., and Almquist, H. 2010. The evolution of the science of Bear Brook Watershed in Maine, USA. Environmental Monitoring and Assess 171: 3–21, doi: 10.1007/s10661-010-1528-y.

89. O'Driscoll, M.A. and DeWalle, D.R. 2010. Seeps regulate stream nitrate concentration in a forested Appalachian catchment. Journal Environmental Quality 39: 420–431, doi: 10.2134/jeq2009.0083.

90. Padgett, P.E. 2010. The effect of ambient ozone and humidity on the performance of nylon and Teflon filters used in ambient air monitoring filterpack systems. Atmospheric Pollution Research 1: 23–29.

91. Pan, L., Lin, C.-J., Carmichael, G.R., Streets, D.G., Tang, Y., Woo, J.H., Shetty, S.K., Chu, H.-W., Ho, T.C., Friedli, H.R., and Feng, X. 2010. Study of atmospheric mercury budget in East Asia using

STEM-Hg modeling system. Science of The Total Environment 408(16): 3277–3291, doi: 10.1016/j.scitotenv.2010.04.039.

92. Parman, J.N. 2010. Climatological and elevational controls on organic and inorganic nutrients in stream waters, Boulder Creek watershed, Colorado Front Range. A master's thesis submitted to the University of Colorado.

93. Parsons, M.J., Long, D.T., and Yohn, S.S. 2010. Assessing the natural recovery of a lake contaminated with Hg using estimated recovery rates determined by sediment chronologies. Applied Geochemistry 25: 1676–1687.

94. Peters, D.P.C. 2010. Accessible ecology: Synthesis of the long, deep, and broad. Trends in Ecology & Evolution 25(10): 592–601, doi: 10.1016/j.tree.2010.07.005.

95. Ponette-González, A.G., Weathers, K.C., and Curran, L.M. 2010. Tropical land-cover change alters biogeochemical inputs to ecosystems in a Mexican montane landscape. Ecological Applications 20:1820–1837, doi:10.1890/09-1125.1.

96. Pouyat, R.V., Weathers, K.C., Hauber, R., Lovett, G.M., Bartuska, A., Christenson, L., Davis, J.L.D., Findlay, S.E.G., Menninger, H., Rosi-Marshall, E., Stine, P., and Lymn, N. 2010. The role of federal agencies in the application of scientific knowledge. Frontiers in Ecology and the Environment 8: 322–328, doi:10.1890/090180.

97. Prospero, J M., Landing, W.M., and Schulz, M. 2010. African dust deposition to Florida: Temporal and spatial variability and comparisons to models. Journal of Geophysical Research 115: D13304, doi:10.1029/2009JD012773.

98. Reese, E. 2010. Comparison of agricultural area source ammonia gas concentration and flux measurements. All Graduate Theses and Dissertations, Paper 543, http://digitalcommons.usu.edu/etd/543.

99. Ren, X., Gao, H., Zhou, X., Crounse, J.D., Wennberg, P.O., Browne, E.C., LaFranchi, B.W., Cohen, R.C., McKay, M., Goldstein, A.H., and Mao, J. 2010. Measurement of atmospheric nitrous acid at Blodgett Forest during BEARPEX2007. Atmospheric Chemistry and Physics Discussion 10: 7383–7419, www.atmos-chem-phys-discuss.net/10/7383/2010/.

100. Richardson, B., Richardson, M., González, G., Shiels, A., and Srivastava, D. 2010. A canopy trimming experiment in Puerto Rico: The response of litter invertebrate communities to canopy loss and debris deposition in a tropical forest subject to hurricanes. Ecosystems 13(2): 286–301, doi: 10.1007/s10021-010-9317-6.

101. Risch, M.R., Baker, N.T., Fowler, K.K., Egler, A.L., and Lampe, D.C. 2010. Mercury in Indiana Watersheds: Retrospective for 2001-2006. U.S. Geological Survey Professional Paper 1780, 66 pp.

102. Rothenberg, S.E., McKee, L., Gilbreath, A., Yee, D., Conner, M., and Fu, X. 2010. Wet deposition of mercury within the vicinity of a cement plant before and during cement plant maintenance. Atmospheric Environment 44(10): 1255–1262, doi: 10.1016/j.atmosenv.2009.12.033.

103. Rygiwicz, P.T., Monleon, V.J., Ingham, E.R., Martin, K.J., and Johnson, M.G. 2010. Soil life in reconstructed ecosystems: Initial soil food web responses after rebuilding a forest soil profile for a climate change experiment. Applied Soil Ecology 45: 26–38.

104. Sahu, S.K., Gelfand, A.E., and Holland, D.M. 2010. Fusing point and areal level space–time data with application to wet deposition. Journal of the Royal Statistical Society Series C (Applied Statistics) 59(1): 77–103, doi: 10.1111/j.1467-9876.2009.00685.x.

105. Sanei, H., Goodarzi, F., and Outridge, P.M. 2010. Spatial distribution of mercury and other trace elements in recent lake sediments from central Alberta, Canada: An assessment of the regional impact of coal-fired power plants. International Journal of Coal Geology 82(1-2): 105–115, ISSN doi: 10.1016/j.coal.2010.01.010.

106. Sanei, H., Outridge, P.M., Goodarzi, F., Wang, F., Armstrong, D., Warren, K., and Fishback, L. 2010. Wet deposition mercury fluxes in the Canadian sub-Arctic and southern Alberta, measured using an automated precipitation collector adapted to cold regions. Atmospheric Environment 44(13): 1672–1681, doi: 10.1016/j.atmosenv.2010.01.030.

107. Schultheis, E.H., Hopfensperger, K.N., and Brenner, J.C. 2010. Potential impacts of climate change on *Sphagnum* bogs of the Southern Appalachian Mountains. Natural Areas Journal 30(4): 417–424, doi: 10.3375/043.030.0407.

108. Seaver, G.A. 2010. Estuary response to an abrupt, large increase in groundwater nitrate input. Applied Geochemistry 25: 1453–1460, doi:10.1016/j.apgeochem.2010.07.003.

109. Sherwood, O.A., Lapointe, B.E., Risk, M.J., and Jamieson, R.E. 2010. Nitrogen isotopic records of terrestrial pollution encoded in Floridian and Bahamian Gorgonian corals. Environmental Science & Technology 44(3): 874–880.

110. Sigleo, A.C., Frick, W.E., and Prieto, L. 2010. Red Alder (*Alnus rubra*) distribution influences nitrate discharge to coastal estuaries: Comparison of two Oregon watersheds. Northwest Science 84(4): 336–350, doi: 10.3955/046.084.0403.

111. Skogen, K.A., Holsinger, K.E., and Cardon, Z.G. 2010. Nitrogen deposition, competition and the decline of a regionally threatened legume, Desmodium cuspidatum. Oecologia, online publication, doi: 10.1007/s00442-010-1818-7.

112. Springsteen, A., Loya, W., Liebig, M., and Hendrickson, J. 2010. Soil carbon and nitrogen across a chronosequence of woody plant expansion in North Dakota. Plant Soil 328: 369–379, doi 10.1007/s11104-009-0117-8.

113. Sprovieri, E., Pirrone, N., Ebinghaus, R., Kock, H., and Dommergue, A. 2010. Worldwide atmospheric mercury measurements: A review and synthesis of spatial and temporal trends. Atmospheric Chemistry and Physics Discussion 10: 1261–1307, www.atmos-chem-phys-discuss.net/10/1261/2010/.

114. Stevens, C.J. and Tilman, D. 2010. Point source ammonia emissions are having a detrimental impact on prairie vegetation. Water, Air, & Soil Pollution 211(1-4): 435–441, doi: 10.1007/s11270-009-0312-5.

115. Stevenson, B.A., Kelly, E.F., McDonald, E.V., Busacca, A.J., and Welker, J.M. 2010. Oxygen isotope ratios in Holocene carbonates across a climatic gradient, eastern Washington State, USA: Evidence for seasonal effects on pedogenic mineral isotopic composition. The Holocene Online, doi:10.1177/0959683609356588.

116. Stoleson, S.H., King, D.I., and Tomosy, M. 2010. Avian research on U.S. Forest Service experimental forests and ranges: Emergent themes, opportunities, and challenges, forest ecology and management. In Press, Corrected Proof, doi: 10.1016/j.foreco.2010.07.038, http://www.sciencedirect.com/science/article/B6T6X-50WXY57-3/2/99da408e75b1ca65e6b6571d162ed9a0.

117. Stupple, G. 2010. Air mercury speciation, foliar uptake, and wash-off along an urban-rural gradient. A thesis submitted for the degree of Masters of Science, University of Toronto.

118. Sunderland, E.M., Dalziel, J., Heyes, A., Branfireun, B., Krabbenhoft, D.P., and Gobas, F.A.P.C. 2010. Response of a macrotidal estuary to changes in anthropogenic mercury loading between 1850 and 2000. Environmental Science and Technology 44: 1698–1704.

119. Tabatchnick, M.D. 2010. Mercury speciation in temperate tree foliage, A master's thesis for the degree of Master of Science, Wright State University.

120. Thornton, J.A., Kercher, J.P., Riedel, T.P., Wagner, N.L., Cozic, J., Holloway, J.S., Dube, W.P., Wolfe, G.M., Quinn, P.K., Middlebrook, A.M., Alexander, B., and Brown, S.S. 2010. A large atomic chlorine source inferred from mid-continental reactive nitrogen chemistry. Nature 464: 271–274, doi:10.1038/nature08905.

121. Tonnessen, K.A. 2010. Protecting wilderness air quality in the United States. In: McCool, D.N., Borrie, S.F., O'Loughlin, W.T. (cmpls.), Wilderness science in a time of change conference—Volume 5: Wilderness Ecosystems, Threats, and Management; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

122. Tronstad, L.M., Hall, R.O., Koel, T.M., and Gerow, K.G. 2010. Introduced lake trout produced a four-level trophic cascade in Yellowstone Lake. Transactions of the American Fisheries Society 139: 1536–1550, doi: 10.1577/T09-151.1.

123. Troxler, T.G. and Childers, D.L. 2010. Biogeochemical contributions of tree islands to everglades wetland landscape nitrogen cycling during seasonal inundation. Ecosystems 13: 75–89, doi: 10.1007/s10021-009-9302-0.

124. Tucker, W.A. 2010. Final Report: Wekiva River Basin Nitrate Sourcing Study Prepared for: St. Johns River Water Management District, Palatka, Florida 32177 and Florida Department of Environmental Protection.

125. Ullman, W.J., Scudlark, J.R., and Volk, J.A. 2010. Standard Operating Procedure for the Calculation of N and P Deposition from the Atmosphere to Waters of Delaware's Inland Bays. Report for the Delaware Department of Natural Resources and Environmental Control, Dover DE 19901, http://www.inlandbays.org/cib_pm/pdfs/uploads/CIB_Atmos_Dep_SOP_FINAL.pdf

126. United States Department of the Interior, Bureau of Land Management. 2010. Competitive Oil and Gas Lease Sales (WY-080-EA10-22), August and November, 2010. Newcastle Field Office, Newcastle, Wyoming.

127. United States Forest Service, National Park Service, and U.S. Fish and Wildlife Service. 2010. Federal land managers' air quality related values work group (FLAG): phase I report—revised (2010). Natural Resource Report NPS/NRPC/NRR—2010/232. National Park Service, Denver, Colorado.

128. Vachon, R.W., Welker, J.M., White, J.W.C., and Vaughn, B.H. 2010. Monthly precipitation isoscapes (d18O) of the United States: Connections with surface temperatures, moisture source conditions, and air mass trajectories. Journal of Geophysical Research 115: D21126, doi:10.1029/2010JD014105.

129. Vadeboncoeur, M.A. 2010. Meta-analysis of fertilization experiments indicates multiple limiting nutrients in northeastern deciduous forests. Canadian Journal of Forest Research 40: 1766–1780.

130. Van Diepen, L.T.A., Lilleskov, E.A., Pregitzer, K.S., and Miller, R.M. 2010. Simulated nitrogen deposition causes a decline of intra- and extra-radical abundance of Arbuscular Mycorrhizal Fungi and Changes in microbial community structure in northern hardwood forests. Ecosystems 13(5): 683–695, doi: 10.1007/s10021-010-9347-0.

131. Van Furl, C., Colman, J.A., and Bothner, M.H. 2010. Mercury sources to Lake Ozette and Lake Dickey: Highly contaminated remote coastal lakes, Washington State, USA. Water, Air & Soil Pollution 208: 275–286, doi: 10.1007/s11270-009-0165-y.

132. Van Riper, L.C., Larson, D.L., and Larson, J.L. 2010. Nitrogen-limitation and invasive sweet clover impacts vary between two Great Plains plant communities. Biological Invasions 12(8): 2735–2749, doi: 10.1007/s10530-009-9678-y.

133. Vidon, P. and Cuadra, P.E. 2010. Impact of precipitation characteristics on soil hydrology in tile-drained landscapes. Hydrological Processes 24: 1821–1833.

134. Vijayaraghavan, K., Herr, J., Chen, S.-Y., and Knipping, E. 2010. Linkage between an advanced air quality model and a mechanistic watershed model. Geosciences Model Development Discussion 3: 1503–1548, doi:10.5194/gmdd-3-1503-2010.

135. Walters, D.M., Blocksom, K.A., Lazorchak, J.M., Jicha, T., Angradi, T.R., and Bolgrien, D.W. 2010. Mercury contamination in fish in midcontinent great rivers of the United States: Importance of species traits and environmental factors. Environmental Science & Technology 44(8): 2947–2953.

136. Ward, D.M., Nislow, K.H., Chen, C.Y., and Foltt, C.L. 2010. Rapid, efficient growth reduces mercury concentrations in stream-dwelling Atlantic salmon. Transactions of the American Fisheries Society 139: 1–10, doi: 10.1577/T09-032.1.

137. Weand, M.P., Arthur, M.A., Lovett, G.M., McCulley, R.L., and Weathers, K.C. 2010. Effects of tree species and N additions on forest floor microbial communities and extracellular enzyme activities. Soil Biology & Biochemistry 42: 2161–2173.

138. Wetherbee, G.A., Shaw, M.J., Latysh, N.E., Lehmann, C.M.B., and Rothert, J.E. 2010. Comparison of precipitation chemistry measurements obtained by the Canadian Air and Precipitation Monitoring Network and National Atmospheric Deposition Program for the period 1995–2004. Environmental Monitoring and Assessment 164: 111–132, doi: 10.1007/s10661-009-0879-8.

139. Winder, V.L. and Emslie, S.D. 2010. Mercury in breeding and wintering Nelson's Sparrows (Ammodramus nelsoni). Ecotoxicology (online), doi: 10.1007/s10646-010-0573-1.

140. Williams, S.F. 2010. Spatial distribution of fluoride concentration in Goathill North Rock Pile, Questa Molybdenum Mine, Questa, New Mexico. A master's thesis submitted for the degree of Master of Science in Hydrology, University of Nevada, Reno.

141. Wyn, B., Kidd, K.A., Burgess, N.M., Curry, R.A., and Munkittrick, K.R. 2010. Increasing mercury in yellow perch at a hotspot in Atlantic Canada, Kejimkujik National Park. *Environmental Science and Technol*ogy 44(23): 9176–9181, doi: 10.1021/es1018114.

142. Yi, L., Xiaolan, Y., Hongbing, C., Weili, L., Jie, T., and Shufeng, W. 2010. Chemical characteristics of precipitation at three Chinese regional background stations from 2006 to 2007. Atmospheric Research 96: 173–183, doi:10.1016/j.atmosres.2009.12.011.

143. Young, C.R. 2010. Extent of denitrification in Northport groundwater. A master's thesis for the degree of Master of Science, Stony Brook University.

144. Zhang, Y., Wen, X.-Y., and Jang, C.J. 2010. Simulating chemistry-aerosol-cloud-radiation-climate feedbacks over the continental U.S. using the online-coupled Weather Research Forecasting Model with chemistry (WRF/Chem). Atmospheric Environment 44: 3568–3582.

145. Zhao, S.Q., Liu, S., Li, Z., and Sohl, T.L. 2010. A spatial resolution threshold of land cover in estimating terrestrial carbon sequestration in four counties in Georgia and Alabama, USA. Biogeosciences 7: 71–80.