Appendix F: NRSP BUDGET REQUESTS SUMMARY

Project Number and Title
NRSP-3,The National Atmospheric Deposition Program (NADP) - A Long-term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition

MRF FUNDING

DESCRIPTION	Proposed FY 10 (year 1)		Proposed FY11 (year 2)		Proposed FY12 (year 3)		Proposed FY13 (year 4)		Proposed FY14 (year 5)	
	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE
SALARIES	46,898	.5	46,898	.5	46,898	.5	46,898	.5	46,898	.5
FRINGE BENEFITS	3,102		3,102		3,102		3,102		3,102	
WAGES	0		0		0		0		0	
TRAVEL	0		0		0		0		0	
SUPPLIES	0		0		0		0		0	
MAINTENANCE	0		0		0		0		0	
EQUIPMENT/ CAPITAL IMPROVEMENT	0		0		0		0		0	
TOTAL	50,000	.5	50,000	.5	50,000	.5	50,000	.5	50,000	.5

OTHER SOURCES OF FUNDING

Please check one of the following: ☐ **Industry** ☐ **Federal Agencies** ☐ **Grants/Contracts** ☐ **SAESs**

☒ **Other (please list):** **States, Tribes, local and other NGO's**

DESCRIPTION	Proposed FY10 (year 1)		Proposed FY11 (year 2)		Proposed FY12 (year 3)		Proposed FY13 (year 4)		Proposed FY14 (year 5)	
	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE	Dollars	FTE
SALARIES	545,956	10.0	545,956	10.0	545,956	10.0	545,956	10.0	545,956	10.0
FRINGE BENEFITS	175,094		175,094		175,094		175,094		175,094	
WAGES										
TRAVEL	54,312		53,112		53,112		53,112		53,112	
SUPPLIES	29,000		29,000		29,000		29,000		29,000	
*PUBS & PRINTING	62,804		65,504		65,504		65,504		65,504	
*ANALYTICAL LAB SERVICES	2,291,820		2,373,891		2,373,891		2,373,891		2,373,891	
MAINTENANCE										
EQUIPMENT/ CAPITAL IMPROVEMENT										
TOTAL	3,158,986	10.0	3,242,557	10.0	3,242,557	10.0	3,242,557	10.0	3,242,557	10.0

*Additional Categories Added

View Report

Participants

Minutes Summary

Accomplishments

Impacts

Publications

SAES-422 Multistate Research Activity Accomplishments Report

Approved

Project No. and Title:	NRSP003 The National Atmospheric Deposition Program (NADP)
Period Covered:	10-2009 to 09-2010
Date of Report:	15-Dec-2010
Annual Meeting Dates:	06-Oct-2009 to 08-Oct-2009

Participants

- All meeting participants from our Fall Meeting and Scientific can be found at our website (http://nadp.isws.illinois.edu/committees/minutes.aspx), and are available for viewing and download.

Brief Summary of Minutes of Annual Meeting

All meeting minutes from our Spring Meeting (Business Meeting) and our Fall Meeting and Scientific Symposium (both Oct 2009, and now Oct 2010 minutes) can be found at our website(http://nadp.isws.illinois.edu/committees/minutes.aspx), and are available for viewing and download.

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 nitro¬gen 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

1. 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.
2. 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.
3. 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.
4. 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.

5. 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. 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 141 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, Mary Beth, Loughry, L., 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, Daniel, J., Brent, G.F., 2010. Sequestering CO2 by Mineral Carbonation: Stability against Acid Rain Exposure. Environmental Science & Technology 44 (7): 2735-2739.

3. Ashton, Isabel W., Miller, A.E., Bowman, W.D., 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, Jesse 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, Jacqulyn Ann, 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., 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, Katherine 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., 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, Bray J., Amatya, D.M., Youssef, M., Jones, M., Callahan, T.J., Skaggs, R.W., 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 Bormann, Nancy, L, Baxter, C.A., Adraski, T.W., Good, L.W., 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, Laura A., 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., 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, Meijun, Schwartz, J., Robinson, R., Moore, S., 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, Ya-Mei, Hsu, N.-J., Huange, H.-C., 2010. 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., Kinney, P.L., 2010. Evaluation of an 18-year CMAQ simulation: Seasonal variations and long