

Project Title: NRSP003 - The National Atmospheric Deposition Program (NADP)

Requested Duration: October 1, 2009 to September 30, 2014

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STATEMENT OF ISSUES AND JUSTIFICATION

Prerequisite Criteria: Mission

This proposal seeks renewal of National Research Support Project 003 (NRSP-3) - The National Atmospheric Deposition Program (NADP) for fiscal periods FY10 through FY14 with annual off-the-top support of \$50,000.

The mission of NRSP-3 (NADP) is to provide quality-assured data and information in support of research on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, mercury, and base cations in atmospheric deposition and to evaluate improvements in its measurement systems and the addition of other chemical and biological species.

NRSP-3 provides a framework for participating scientists from State Agricultural Experiment Stations (SAES); universities; federal, state, local, and tribal government agencies; national forests and laboratories; environmental institutes; private companies; and other research organizations to cooperate in sponsoring NADP measurement networks and responding to current and future needs for environmental information on the effects of atmospheric deposition on terrestrial and aquatic ecosystems, biogeochemical cycling, climate change, and human health.

NRSP-3/NADP data support informed decisions on air quality issues related to precipitation chemistry. This project provides the only regional and national-scale data and information on the amounts, geographic distribution, and trends in chemical deposition by precipitation in the United States. This information has been invaluable in (a) documenting the presence and removal of inorganic pollutant gases and aerosols in our atmosphere (i.e., our chemical climate); (b) documenting how these chemicals are changing in amount and composition over time; (c) understanding the effects of atmospherically deposited chemicals on agricultural crops, forests, rangelands, surface and ground waters, estuaries, aquatic impoundments, and other natural resources; (d) assessing the accelerated weathering of material and cultural resources resulting from atmospheric chemical deposition; (e) discerning pollutant sources and source distributions and their relationships to deposition (i.e., source-receptor relationships); and (f) evaluating the effectiveness of current Clean Air Act legislation and rules, promulgated under the Act, and the impact of atmospheric deposition on water quality requirements set by the Clean Water Act.

Prerequisite Criteria: National Relevance

This section demonstrates the national and international relevance of NRSP-3 and describes the logical progression of the project from its formation to the present, identifying issues of contemporary importance.

In October 1977, the SAES North Central Region established NC-141 to address “Chemical Changes in Atmospheric Deposition and Effects on Agricultural and Forested Land and Surface Waters in the United States” (1). Principal objectives of this project were to “establish an atmospheric deposition network for

measuring beneficial nutrients and potentially injurious substances in precipitation and dry particulate matter” and to “organize and coordinate research on atmospheric deposition effects.” Sites in this NADP network first began collecting one-week, wet-only deposition samples and one-month dryfall samples in 1978, and by the end of the year there were sites in all four SAES regions. Organizing the efforts were scientists from SAES, federal and state agencies, universities, non-governmental organizations, and Canada. Justification for NC-141 centered on the increasing recognition of the potential for human activities to affect the chemistry of atmospheric deposition and in turn the nutrient status of terrestrial and aquatic systems. European precipitation chemistry was documented, (2) and the same was expected in the U.S. (3). Formation of the NC-141 NADP network was responsive to the call by a National Academy of Sciences panel (4) to establish a U.S. network for measuring the spatial extent and intensity of acidic precipitation.

Acidic precipitation concerns resulted in NADP growth from 21 sites in 1978 to 110 sites in 1982. NADP measurements revealed much of the spatial extent, intensity, and frequency of occurrence of acidic precipitation, as well as the chemical relationships between free acidity and its root causes, un-neutralized sulfates and nitrates resulting largely from fossil fuel combustion. SAES Directors in all four regions approved Interregional Project 7 (IR-7), extending the project nationwide for the five-year period 1982-1987.

In 1980, a 10-year program entitled the National Acid Precipitation Assessment Program (NAPAP) was launched “to identify the sources, causes, and processes involved in acid precipitation and to evaluate the environmental, social, and economic effects of acid precipitation” (5). A principal goal was to establish a long-term acid deposition monitoring network (the National Trends Network, NTN). The IR-7 Technical Committee merged the NADP and NTN and designated the combined networks NADP/NTN. Eight federal agencies, led by the U.S.G.S, supported growth of the NADP/NTN to 203 sites by 1987. New sites were added to represent regional ecological properties (6) and lead one peer review panel to conclude: “The monitoring program and resultant data set that is being constructed is perhaps the most significant, long-term, continuous, and comprehensive sampling and analysis program to be undertaken in the environmental sciences” (7).

SAES Directors renewed IR-7 through 1992 and IR-7 scientists participated in NAPAP-funded studies of acidic deposition and its effects on crops, forests, soils, and surface waters. These findings were summarized as: (a) acidic sulfate and nitrate decreased at more than 75 % of NADP sites between 1979 and 1987 (8); (b) there is no evidence to show that acidic precipitation at ambient U.S. levels is responsible for regional crop yield reductions (9); (c) ambient deposition in high-elevation eastern-U.S. forests is thought to alter nutrient status leading to growth reduction, frost intolerance, or decline of these ecosystems (9); (d) acidic deposition is expected to cause long-term chemical changes in some soils (9); (e) atmospheric sulfate deposition results in some poorly buffered surface waters becoming more toxic (10); and (f) acidic deposition increases the corrosion of metals and alloys (11). An overarching conclusion of NAPAP research was that chronic chemical loading from atmospheric deposition can result in long-term changes.

During the early 1990s the SAES Directors changed the governance and identified a new class of projects called national research support projects. The primary purpose of NRSPs was to support, rather than conduct, research. Among the target activities of NRSPs was collection of data that researchers could use to address issues of national significance. The mission and activities of the NADP had evolved and now were consistent with NRSPs, and the Directors approved the project as NRSP-3 for the period 1992-1997.

A pilot program to measure mercury in precipitation led to a second expansion of the NADP measurement system in 1996, when the Technical Committee approved the addition of the Mercury Deposition Network (MDN). Research suggested that mercury had entered many of the affected lakes and streams in precipitation (13). A 13-site pilot network has grown to the MDN network of today with more than 110 sites, which are funded mostly by state, local, and tribal government agencies.

NRSP-3 continues to offer a unique opportunity for cooperation among scientists from land-grant and other universities, government agencies, and non-governmental organizations. It provides a framework for leveraging the resources of nearly 100 different sponsoring agencies to address contemporary and emerging issues of national importance. Figure 1 shows the locations of the 50 NADP sites either sponsored or operated by Agricultural Experiment Stations or located on Agricultural or Forestry Experiment Station properties. All but three have been cooperators for more than 20 years and these sites are located in all four SAES Regions (7 – Northeast, 18 - North Central, 18 – South, and 7 – West).

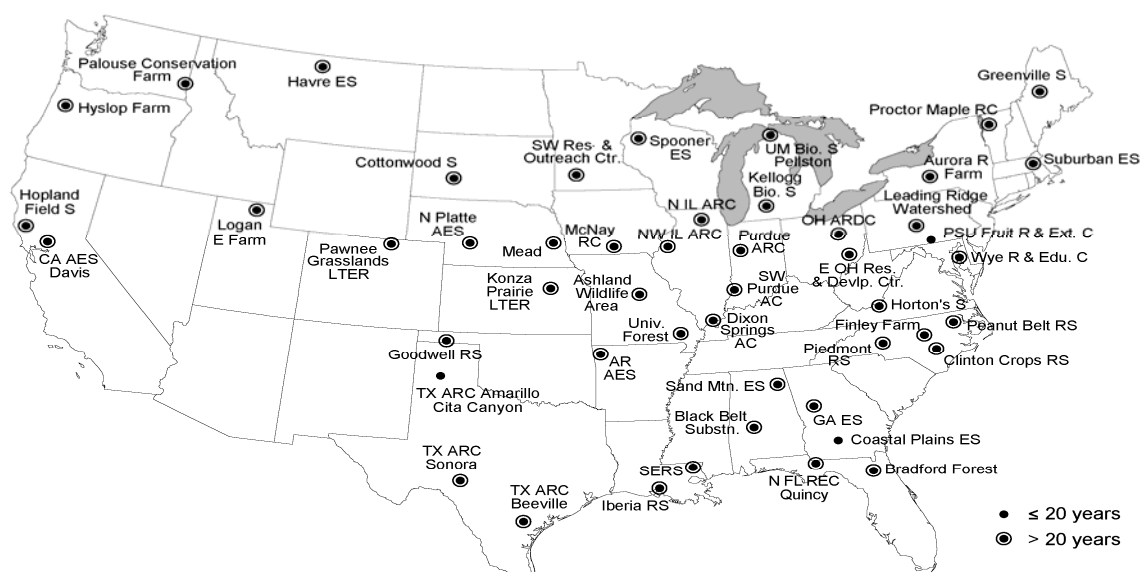


Figure 1. NADP sites sponsored or operated by Agricultural Experiment Stations or located on Agricultural or Forestry Experiment Station properties.

The role of NRSP-3 in providing long-term high-quality measurements has complemented the national need to evaluate atmospheric deposition trends in order to assess the effectiveness of mandated pollutant emissions reductions. The CAAA-90 seeks “to reduce the adverse effects of acid deposition through reductions in annual emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x).” The Act required monitoring and reporting the effect of these emissions reductions on deposition (**12**). NTN measurements provided the only basis for evaluating regional scale trends in the sulfate deposited by precipitation, and as early as 1996, NRSP-3 scientists were able to report that large SO_2 emission reductions had decreased sulfate deposition by as much as 25% in portions of the East (**14**). These trends have been consistent over time and space (**15**). Trends in nitrogen species, however, have been less straightforward. Although nitrate concentrations have decreased in Mid-Atlantic and New England states, significant increases have occurred in Great Plains and Rocky Mountain states. And, ammonium increases have been nearly as widespread as sulfate decreases (**16**). The increases in nitrate and ammonium, especially in the West, were unexpected.

Below are contemporary issues in which NRSP-3 has ongoing national relevance.

- The NADP NTN and AIRMoN provide the only regional and national scale data on the wet deposition of acidic sulfur and nitrogen species. These data are needed to assess the efficacy of the federal and state efforts to reduce SO_2 and NO_x emissions over the next decade, and the Clean Air Visibility Rule (CAVR), which requires SO_2 and NO_x emissions reductions at electric generating units in the West.
- Ammonia emissions data (Figure 2) are not consistent with the widespread ammonium deposition increases reported from NTN measurements (**16**). Researchers need widespread airborne ammonia/ammonium measurements to determine the causes of this discrepancy. Since ambient gaseous ammonia measurements are lacking, the NRSP-3 Executive Committee approved a pilot study, initiated in

late 2007, to assess the accuracy, feasibility, and costs of adding passive ammonia measurements at NADP sites. NADP's Passive Ammonia Monitoring Network is currently measuring atmospheric concentrations, with publicly available data expected in February 2009 (<http://nadp.sws.uiuc.edu/nh3net/>). This study represents how NRSP-3 is responding to a contemporary issue of growing importance, an especially important issue to agriculture. Ammonia is a precursor of haze-producing aerosols and CAVR has the potential to require ammonia emission reductions that would significantly affect agricultural production costs. As with other rules, ammonia measurements can provide a baseline for evaluating emission reductions.

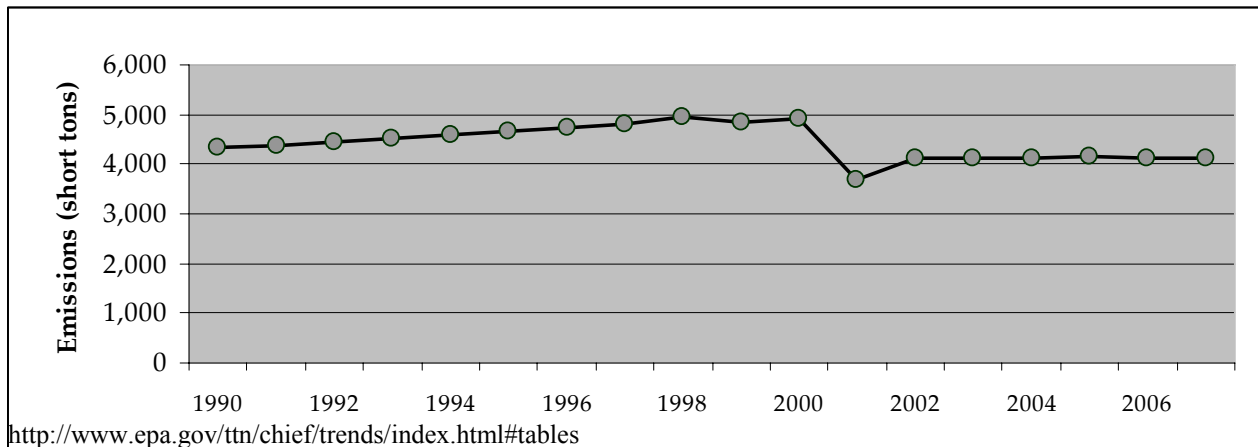


Figure 2. National ammonia emissions (1990-2007) from U.S. EPA emissions factors.

- A third rule promulgated under the CAAA-90, the Clean Air Mercury Rule (CAMR) has recently been vacated. However, further regulation is expected, and will likely require some type of reductions in mercury emissions from coal-fired power plants soon. Existing MDN data serve as a baseline against which to gauge the effects of these reductions. Complementing the precipitation-only MDN measurements, the NRSP-3 Executive Committee approved an Atmospheric Mercury Initiative (see <http://nadp.sws.uiuc.edu/amn/>). The goal is to measure mercury in its gaseous and elemental forms, along with the meteorological and land-cover data needed for computing dry deposition fluxes. The combination of MDN wet and dry (i.e., total) deposition data will support model development, source-receptor assessments, as well as evaluations of federal and state regulations.
- Studies have connected atmospheric nitrogen (N) deposition, primarily from nitrate and ammonium, to estuarine eutrophication and related low dissolved oxygen concentrations and losses of aquatic vegetation (17,18). Since 2000, 19 NTN sites located in Atlantic and Gulf Coast watersheds have joined the NADP in order to provide data in support of N deposition research in these areas. Other studies have reported alterations of species richness and diversity of soil flora in sensitive western ecosystems (19). Upward N deposition trends in the West have heightened concerns over the potential effects of nutrient additions in alpine and subalpine areas in the Rockies, Cascades, etc. NTN data provide the information needed to investigate the relationships of N deposition to effects in the aquatic and terrestrial ecosystems.
- *Phakopsora pachyrhizi*, commonly called Asian Soybean Rust (ASR), was first reported in the continental United States in November 2004. ASR is an obligate fungal parasite thought to rely on a living host (legumes such as soybean) for survival (20). ASR spreads through aerial dispersal and deposition of urediniospores, which can be transported hundreds of kilometers before being deposited by precipitation. Under the right conditions of temperature, relative humidity, and (legume) plant stage, deposited spores can germinate and spread the infection (21). With supplemental support from the Agricultural Research Service (ARS), NADP staff collected and prepared filters containing rain sample residue from eastern U.S. NTN samples. The filters were sent to the ARS Cereal Disease Laboratory, where they were tested for ASR using Polymerase chain reaction (PCR). Results of a case study during the 2005, 2006, and 2007 growing

seasons demonstrated the application of this methodology in tracking *P. pachyrhizi* spores to the Midwest (22). These studies demonstrate the potential for using NADP to assist in tracking airborne pathogens in spreading diseases in U.S. agricultural crops and in supporting additional research in this area.

Rationale: Priority Established by ESCOP/ESS

This section summarizes how NRSP-3 addresses and can support objectives in four of the challenges listed in priority order in “A Science Roadmap for Agriculture – Update 2006” (<http://www.csrees.usda.gov/business/reporting/stakeholder/pdfs/roadmap.pdf>).

Challenge 1. *We can ensure food safety and health through agricultural and food systems.*

— In 2004, ARS, NRSP-3, and University of Minnesota scientists collaborated to explore the potential for detecting wheat stem rust (*Puccinia graminis*) in rain samples along the “Puccinia Pathway” (<http://www.ars.usda.gov/Main/docs.htm?docid=14574>). Residues on rain-sample filters from 22 Midwestern NTN sites were tested for *P. graminis* using a real-time PCR assay. Filters testing positive were collected from rain samples at NTN sites where wheat stem rust was later reported. The *P. graminis* study led to the 2005-2007 ASR studies described in the previous section. Success in detecting *P. graminis* and *P. pachyrhizi* suggests this methodology could be extended to other cereal grain and legume rusts, and possibly to molds such as Sudden Oak Death (*Phytophthora ramorum*) and other aerially dispersed plant diseases (23). Developing a decision-support system that combines these data with other pertinent information can help farmers make informed decisions about herbicide applications. **These results demonstrate NRSP-3 support of research that could help producers mitigate losses from invasive (plant pathogen) species.**

— When the NRSP-3 Technical Committee approved expansion of the NADP to include the MDN in 1996, 39 states had advisories warning people to limit consumption of fish taken from certain water bodies because of mercury contamination. Today, the count has risen to 49 states (www.epa.gov/ost/fish). State and federal agencies have issued these advisories because of high levels of methyl-mercury in fish tissue, particularly in predator fish at or near the top of the aquatic food chain. Methyl mercury is a bioaccumulative toxin that forms in anoxic sediments, and research has shown the leading source of mercury entering many of the affected lakes and streams is precipitation (13). MDN data are being used to quantify mercury inputs directly to surface water bodies, including fish farms, and the new Atmospheric Mercury Initiative, discussed in the previous section, will expand the MDN to include dry deposition estimates, enabling total mercury deposition to be estimated for the first time. The MDN database has become an invaluable resource for developing regional and national models (24). Continued measurements will support assessments of mercury emissions reductions. **Investigations using the MDN database can help inform policies for reducing mercury to the point where this food-borne toxin no longer jeopardizes the health of fish consumers.**

— An explosion on 26 April 1986 at the Chernobyl nuclear power plant in the Ukraine released significant amounts of cesium and iodine radionuclides into the atmosphere. Over the ensuing days, a radionuclide plume released from the plant crossed the United States. The NADP responded to a request from the U.S. Department of Energy to send samples to its Environmental Measurements Laboratory in New York City, where scientists could make radionuclide measurements and map the distribution of radioactive fallout across the United States. The authors of a feature article on environmental monitoring and national security suggested several ways in which environmental monitoring networks, such as the NADP, could assist in a national surveillance system for biological, chemical, or radiological agents spread by terrorists (25). **With nearly 30 years of experience, geographically dispersed monitoring stations, a communications network, and a management infrastructure, the NRSP-3/NADP stands ready to help, if called on to assist in homeland security efforts.**

Challenge 2. *We can provide the information and knowledge needed to further improve environmental stewardship.*

— Ammonia was among the pollutants identified in a recent article that addressed emerging national research needs in the agricultural air quality community (26). Ammonia is a nutrient and atmospheric deposition of ammonia and ammonium in some ecosystems can alter the structure and diversity of native plant communities and contribute to acidification (27). Domestic animals, fertilizers, and crops are important sources of atmospheric ammonia, though their source strength depends on a matrix of physical, chemical, and biological factors; consequently, ammonia emissions are highly variable and have large uncertainties. This has led to a call for a new approach for quantifying agricultural emissions, mechanistic process-based modeling (28), and to a National Air Emissions Monitoring Study (<http://cobweb.ecn.purdue.edu/~odor/NAEMS/>). Further, the NRSP-3 Executive Committee approved a pilot study, initiated in late 2007, to evaluate gaseous ammonia monitoring, using passive samplers, at NADP sites. Some researchers have already applied an inverse modeling approach, using NTN ammonium measurements to estimate ammonia emissions (29). **New and existing NADP ammonium data, complemented by new ambient gas-phase ammonia measurements, can support ongoing efforts to quantify agricultural ammonia emissions, assess the effectiveness of emissions reductions practices in farm fields (e.g., cropping systems, fertilizer applications) and facilities (animal feeding operations, waste management), and enable total ammonia/ammonium deposition estimates.**

Challenge 3. *We can improve the economic return to agricultural producers.*

— Success in detecting *P. graminis* and *P. pachyrhizi* in rain sample residues (see description under challenge 1) opens a new area of research supported by NRSP-3 monitoring networks: aerial dispersal and deposition of plant pathogens and the spread of disease. The three NADP monitoring networks have more than 300 sites across the nation, including some in Canada. Sites in Puerto Rico (Forest Service) and the Virgin Islands (Park Service) stand as sentinels for detecting pathogens borne in trans-oceanic dust plumes from Africa or South America. Measurements at continental U.S. sites could be used to monitor the seasonal re-entry of pathogens from winter refugia or the spread of diseases to a new area. **Measurements of plant pathogens in NADP samples could be used in a decision-support system for risk-based farm management, informing such decisions as cropping practices and pesticide applications.**

— Recent studies have estimated that mercury emissions from fires may be as much as ~30% of the EPA's national mercury emissions inventory. Emissions from forests dominate those from agricultural fires on an annual basis, and may be one of the largest sources of mercury to the atmosphere (30). Much of the mercury released during fires results from volatilization of legacy mercury held in the organic soil layer. Emissions are highly variable, depending on the temperature and mercury content of these soils. Airborne mercury measurements from NADP's Atmospheric Mercury Initiative will help researchers identify mercury from smoke plumes and evaluate mercury emissions and emission factors from fires. **These data could be used in a decision-support system for risk-based management of forests, informing such decisions as prescribed-burning practices.**

Challenge 7. *We can develop new and more competitive animal production practices and products and new uses for animals.*

— Animal feeding and dairy operations are important sources of atmospheric ammonia (see description under challenge 2). **New and existing NADP ammonium data, complemented by new ambient gas-phase ammonia measurements, can be used to assess the overall effectiveness of innovative technologies for reducing the impact of animal agriculture on the environment.**

Rationale: Relevance to Stakeholders

This section identifies stakeholders and their involvement in committees that review progress and operations, recommend improvements and corrective actions, and initiate changes that address stakeholder needs and interests. It also describes how the project's output is accessed and used in scientific publications and support of public policy.

NRSP-3 brings together the fiscal, material, human, and intellectual resources of scientists, educators, and policy-makers from SAES, universities, government agencies, and non-governmental organizations. Stakeholders include: (a) sponsors that pay for NADP site participation, site operations, and/or other program activities; (b) site operators whose efforts are contributed; (c) cooperators that provide land access, electric power, laboratory or office facilities, and/or shipping costs; (d) scientists who use and present NADP data; (e) educators who use NADP data in their classrooms or textbooks; and (f) students who use NADP data in classroom exercises, science fair projects, or graduate studies. Cooperators in categories (a) to (c) are listed at the NADP Web site (currently 937 people).

All program participants are invited to attend twice yearly committee/subcommittee meetings. Three subcommittees meet in the spring and fall. Typical joint meeting attendance is 35-50. Subcommittees receive status and progress reports on network activities, review network operations and documents, consider procedures and equipment changes, propose actions to correct deficiencies and improve operations, and propose and review initiatives for new measurements. The NADP Quality Management Plan calls for triennial reviews of each network laboratory and NADP management procedures. Review team members are drawn from subcommittee membership. Other committee roles are discussed in "Management, Budget, and Business Plan."

The Executive Committee has continued to look for ways to engage stakeholders in NADP activities. The potential for long-term low-level inputs of acidifying chemicals, nutrients, mercury, and base cations from atmospheric deposition to affect changes in soil chemistry, species diversity and succession, surface water chemistry, and aquatic biota has led to new interest among land managers in investigating critical loads to inform policy (e.g., **31**). Recognizing this need, the 2006 Program Chair formed a Critical Loads AD hoc (CLAD) committee. The CLAD meets along with other subcommittees and membership totals 124. CLAD activities increased interest in the 2007 technical meeting, which had 172 registered participants (record attendance). The CLAD will continue into 2009.

Another class of stakeholders emerged in recent years: researchers using archival NADP samples and subsamples for analyses not routinely performed. These samples had been discarded until NADP committees, seeking to leverage their original investments, developed a policy for making samples available for additional measurements. Researchers were invited to submit simple proposals to an NADP review panel. Since adoption, virtually every archival sample has been delivered to an outside researcher. Topics addressed include: applying O^{18} and H^2 measurements to examine the relationship between precipitation and surface and ground water sources (**32-34**), using N^{15} measurements to infer atmospheric NOx sources (**35**), and testing for the presence of potentially hazardous chemicals (**36-37**).

Stakeholder use of NADP data is assessed by recording Web site activity, requesting program participants to report their activities annually, and performing literature reviews. This information is summarized annually in SAES-422 reports, Current Research Information System AD-421 reports, and other federal agency reports. From 2002 to 2007, the number of registered NADP Web site users more than tripled and now totals more than 37,000 (33%- universities, 27%-federal and state agencies, 20%-K to 12 students, and 20%- private research groups). Registrants are from more than 150 nations and from every continent, except Antarctica. Through an agreement with the Canadian Atmospheric Environment Service (AES), the annual data set is loaded into the AES National Atmospheric Chemistry database. Since 2002, the annual number of data downloads from the Web site has risen 35% to 24,500 files and the most used data products remain the color concentration and deposition maps. NADP data use is classified as 60% for research purposes and 40% for educational purposes.

NADP participants send their publication lists to the NADP Program Office. During 2007 and 2008 (Jan to Nov), the NADP's information and data were used in 99 and 124 journal articles, respectively. These publications are searchable at NADP (<http://nadp.sws.uiuc.edu/lib/>).

NADP data are used frequently to inform and evaluate environmental policies and agreements. Perhaps most conspicuous was the appearance of NADP maps in the materials prepared by the EPA (e.g., nitrogen deposition map in <http://www.epa.gov/air/clearskies/benefits.html>) in support of former President Bush's Clear Skies Initiative. In its evaluations of the CAAA-90, the EPA Clean Air Markets Division uses NADP data in its annual reports (e.g., **38**). Similarly, NAPAP reports to Congress use NADP data in assessing the effects of emissions changes on deposition and deposition changes on aquatic and terrestrial systems (**39**). The International Joint Commission uses NADP data in its periodic evaluations of the U.S.-Canada Air Quality Agreement (**40**) and the Canadian government in its independent evaluation of the agreement and acidic deposition assessments (**41**). NADP data are also used in regional and state policy assessments related to acidic deposition (e.g. **42**), nutrient deposition (e.g. **43-44**), and mercury deposition (**45**).

Special Relevance to SAES Participation Of special note is the particularly important role that SAES and off-the-top funding plays in NADP. The SAES funding provides three very important advantages, restated again here (see Attachment One):

1. the NADP enhances the ability of the SAES to address pressing needs of agriculture,
2. the lack of NRSP-3 funding will result in the probable shutdown of monitoring at many of the 50 agriculture monitoring locations, thereby dramatically reducing the ability of agriculture to understand the spatial and temporal variation in deposition of chemicals in precipitation, and
3. SAES funding is heavily leveraged by other federal and state agencies and provides a critical service to the operation of the NADP.

Expanding on these points:

1. Addressing Pressing Needs of Agriculture. The NADP is addressing highly relevant issues related to nitrogen, ammonia, transport of plant pathogens, among others, and provides a scientific forum for communication about agriculture research. At many locations we have a 30-year record of this deposition, and these show increasing trends at many sites.

2. SAES Monitoring Site Losses. All NADP sites pay a management fee for operations. The SAES funding pays all or some of this fee for the SAES sites. Currently, 19 SAESs have these fees paid in full, and all other sites have reduced fees relative to average federal site expenses. The remaining costs are borne by the individual SAES. With a loss of NRSP status, the operational costs at all SAES sites would increase significantly and many sites located in the agricultural production areas could shut down. This loss would greatly affect the ability to follow national trends in deposition since many of these SAES sites are the oldest sites in the network (10 have precipitation chemistry records back to 1978).

3. Federal and State Leveraging. The continued active status of NRSP-3 allows funding contributions from many federal agencies, totaling \$1.8 million dollars annually, to flow through the CSREES to the University of Illinois and NADP by cooperative agreement. Without this mechanism, funding to NADP will be permanently disrupted and potentially all funding lost due to increased indirect cost recoveries by other mechanisms. Consequently, if the NRSP-3 is terminated, then all NADP sites would likely see a 50% increase in total monitoring costs for each year. Not only does the NRSP status leverage large amounts of federal and state funding, but the NRSP-3 also leverages a lower cost for all NADP site sponsors.

Consequently, even though the \$50,000 is a relatively small part of the NRSP-3 total budget, the SAES funding is very important to the NADP and to the United States.

IMPLEMENTATION

Objectives and Proposed Outcomes

Objectives

- 1) Characterize geographic patterns and temporal trends in chemical or biological atmospheric (wet and dry) deposition.
- 2) Support research activities related to: (a) the productivity of managed and natural ecosystems; (b) the chemistry of surface and ground waters, including estuaries; (c) critical loads in terrestrial and aquatic ecosystems; (d) the health and safety of the nation's food supply; and (e) source-receptor relationships.
- 3) Support education and outreach through the development of informational brochures and programs aimed at people of all ages.

Deliverables Scientists, educators, students, policy-makers, and others are encouraged to access data at no charge from the NADP Web site (<http://nadp.sws.uiuc.edu>). This site offers on-line retrieval of individual data points, seasonal and annual averages, trend plots, concentration and deposition maps, reports, manuals, educational brochures, and other information about the program. Quality-assured data and information from all networks are loaded quarterly into the on-line database system with a lag of ~180 days. This lag ensures that the NADP can correct or resolve errors and discrepancies uncovered during verification and screening tests. Information available from this Web site and linked database management system constitutes the deliverables that support the project objectives. NADP also addresses special request data products, answers scientific questions, and assists users to find related information.

Complementing the on-line data and information are publications such as annual data summaries, annual meeting proceedings, quality assurance documents (e.g., *QMP*), manuals, informational and educational brochures, and reports. Publications are also posted in public display format (<http://nadp.sws.uiuc.edu/lib/>). Talks and abstracts from some annual meetings are also available on-line.

Project Assessment and Revision of Objectives In order to assess the type and amount of research activity supported by NRSP-3, participants are asked annually to report their program activities and publications that use NADP data (see website). More than ~95% of these publications are journal articles, reports (including theses), and proceedings papers that summarize research activities. The balance includes informational pieces, such as newspaper reports, etc. In order to assess research type, these publications were classified by the NRSP-3 objective or objectives that were addressed. For 2002 through 2006, the database lists 541 publications. Figure 3 shows a breakdown of the current NRSP-3 objective classifications. These results, along with growing stakeholder interest in air concentration measurements of ammonia and mercury, in measurements of soybean rust spores in rain samples, and in the new ad hoc critical loads committee, were used to amend the NRSP-3 objectives in this renewal proposal.

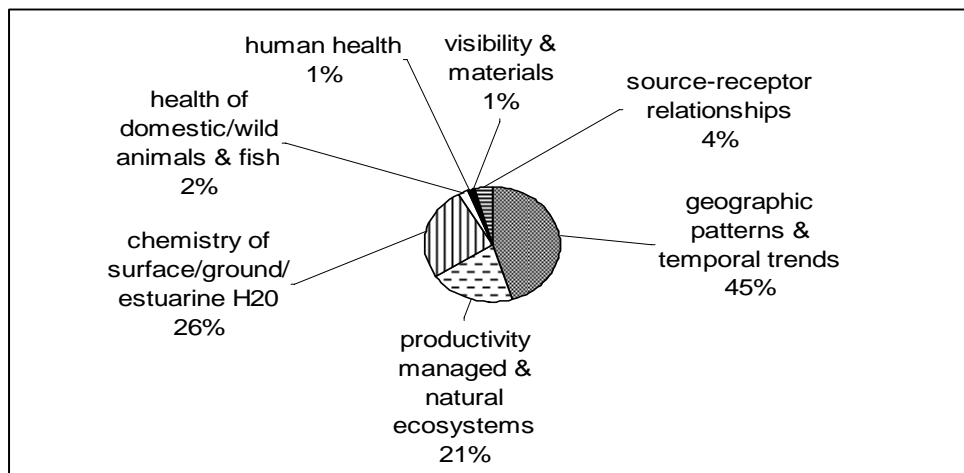


Figure 3. Classification of 2002-2006 publications by NRSP-3 objective.

Objective (1) was changed to “chemical or biological atmospheric (wet and dry) deposition.” This objective now explicitly mentions wet and dry deposition, and includes the (biological) deposition of plant pathogens, such as soybean rust spores. Current initiatives to measure air concentrations of ammonia and mercury make possible the estimation of dry deposition fluxes, building new research support capacity. Research activities under objective (2) were amended to replace areas with little activity with emerging interest in critical loads and the health and safety of the nation’s food supply. Including the health of food supplies embraces the work being done to understand mercury sources that have led to advisories in 49 states to limit fish consumption, and also embraces the work being done to track ASR, a disease that can drastically reduce yields in unprotected soybean crops. Objective (3) articulates what is already being done (see summary in Integration and Documentation of Research Support).

Management, Budget, and Business Plan

Project Management Project management is described in the *National Atmospheric Deposition Program Quality Management Plan (QMP)*, which is posted on the NADP Web site (<http://nadp.sws.uiuc.edu/lib/qaplans/NADP-QMP-Dec2003.pdf>). The QMP describes the roles and responsibilities of the committees, subcommittees, and Program Office and is briefly summarized here. The QMP is currently going through an update, due at the 2009 Technical Meeting.

The NADP Program Office (NPO), located at the University of Illinois (UI), is responsible for promoting long-term NADP operations that comply with the operational procedures and quality-assurance standards set by the Executive Committee (EC), with guidance from its subcommittees. The NPO manages day-to-day operations. NPO responsibilities include: (1) securing site support, chemical analytical, and data validation services for NADP measurement programs; (2) ensuring measurement programs produce consistent quality-assured data; (3) managing the NADP Web site and linked database; (4) publishing data reports and summaries; (5) providing support for committee and subcommittee meetings; and (6) coordinating special studies. The NADP Coordinator is the NPO Director and principal investigator of the cooperative agreements between NADP sponsors and the UI. At least two times a year, the Coordinator reports to the EC on the status and progress of NPO and NADP activities.

Budgeting is done on a federal fiscal (October-September) year basis. The Coordinator reports on the fiscal status of the project to the Budget Advisory Committee (BAC), which is responsible for financial planning. The BAC reviews the Coordinator’s report and the Coordinator’s income and expenditure plans for the

upcoming fiscal year. The BAC makes its budget recommendations to the EC, which has budget approval authority. BAC membership consists of elected and ex-officio members.

The EC is responsible for making budgetary decisions and ensuring program continuity and balance. It provides technical and administrative guidance to the NPO. The EC receives input and recommendations from the BAC on budgetary matters and the Quality Assurance Advisory Group on quality assurance matters. It also receives input and recommendations from three technical subcommittees: (1) the Network Operations Subcommittee, which oversees field-siting criteria and laboratory and sample collection protocols, and evaluates equipment and recordkeeping methods; (2) the Data Management and Analysis Subcommittee, which guides data collection, storage, QA/QC, and, most importantly, web-based data presentations in tables, maps, and graphs; and (3) the Ecological Responses and Outreach Subcommittee, which provides input on data user needs, and initiates and develops programs and products to promote the program and increase participation. The EC acts on recommendations and sets program policies and procedures. EC membership consists of four elected officers, the elected chairs of each of the technical subcommittees, the BAC co-chair, and an SAES representative, all of whom have voting privileges. Membership also includes ex-officio non-voting members, such as the SAES Regional Administrative Advisors, the USDA/CSREES program manager, and others. Membership in the technical subcommittees is open and the rosters range from 40 to 60 members.

As mentioned in the earlier section on “Relevance to Stakeholders,” the EC has continued to look for ways to engage new participation in its technical subcommittees and annual meetings. In 2006 the Program Chair formed the CLAD to provide a venue for discussing current and emerging issues regarding the science and application of critical loads. This action has been rewarded with substantial new participation in the 2007 annual meeting, and again in 2008. CLAD membership now totals 124. Both the EC and Ecological Responses and Outreach Subcommittee, which seeks ways to promote the program, have struggled to increase participation from land-grant university scientists. Two new initiatives have the potential of stimulating new interest from this group, the pilot program to measure ambient ammonia with passive samplers and the project to use NADP samples to test for ASR spores and map their deposition. Specific sessions at the 2008 Technical Meeting were devoted to agricultural and ammonia issues (<http://nadp.sws.uiuc.edu/meetings/> for session titles, abstracts and talks).

Project Budget NRSP-3 provides the authority and framework for combining the resources of many and diverse sponsors in support of the project. Project support is divided into monies administered by the UI and the monies and in-kind support for operating NADP sites. Monies administered by the UI provide the resources for the NPO to perform duties and obligations required to satisfy the six responsibilities listed in the “Program Management” section above. Money and in-kind support for site operations cover the cost of sample collection, transportation and electricity to run the site, sample shipping, and land access and office space. Support for site operations is not administered by the UI but is provided through contractual arrangements between funders and operating agencies. These are not well-documented.

Three funding streams provide support for the NPO: (1) SAES off-the-top monies, (2) a cooperative agreement between the USDA-CSREES and UI, and (3) agreements between individual SAES, universities, government agencies, or non-governmental organizations and the UI. The USDA-CSREES/UI cooperative agreement combines the support of eight federal agencies (BLM, EPA, FWS, NOAA, NPS, TVA, USDA-Forest Service, USGS), each having an interagency agreement with the CSREES. Each individual (type 3) agreement funds one or more sites. There are nearly 100 individual agreements. Twelve NTN sites are sponsored by SAES through individual agreements between land-grant universities and the UI. Support for the 38 other NADP sites at SAES facilities comes either from federal agencies through the USDA-CSREES/UI cooperative agreement or from state agencies through individual (type 3) agreements. Hatch funds provide off-the-top support and the land-grant university support of SAES sites. Since these funds can pay only direct program costs and under the NRSP-3 are combined with funds from other sources, all NPO support, no matter the source, pays only direct program costs. Indeed, the USDA-

CSREES/UI cooperative agreement stipulates that monies be used only for direct costs and not for facilities and services. Total FY08 support from these three funding streams was \$3.2M, an increase of 10% since FY03. From FY03 to FY08, off-the-top support decreased from \$112,029 to \$61,000 and in FY09 is \$50,000. Over this same period, the number of MDN sites rose by 22%, while the number of NTN sites remained constant. This growth was realized by containing costs and gaining efficiencies in network operations.

The NRSP-3 funding model has enabled project growth and diversification of funding sources (see previous section and Appendix One). With the addition of the MDN in 1996, the number of individual (type 3) agreements doubled. MDN support comes largely from state, local, and tribal government agencies in states confronting a growing number of health advisories because of mercury-contaminated fish. NPO outreach efforts have been successful in enlisting new MDN support from these agencies. Plans for a ~150-site nationwide MDN are progressing with recent commitments from new sponsors (States: AK, AZ, KS, NE, OK, UT; Tribal Nations: Micah, Cheyenne River Sioux, Micmac, Grand Traverse Band of Ojibawa; and Canaan Valley Institute).

The NRSP-3 committees and NPO continue to look for ways the project can serve regional and national needs. Establishing the critical loads ad hoc committee is an example of engaging new scientific participation. Partnering with USDA-ARS to use NADP samples for detecting ASR spores in rain opens new possibilities for supporting research in the transport and deposition of airborne plant pathogens. Initiating a pilot program to evaluate cost-effective methods for measuring ambient ammonia responds to the national need to better understand ammonia sources, atmospheric cycling, and deposition. These and other efforts remain true to the vision that NRSP-3/NADP will remain one of the nation's premier research support projects, serving science and education and supporting informed decisions on air quality issues.

NRSP-3 off-the-top monies provide partial support of the Program Coordinator and Database Manager, who maintains the NADP Web site. Since these positions spearhead day-to-day outreach to new stakeholders and development of innovative data products that support new research interests, we propose a level NRSP-3 budget of \$50,000 per year for the FY10-FY14 renewal period.

Integration and Documentation of Research Support

Academic Programs Data and information on the NADP Web site have become an important resource for educators at virtually every level. Users indicate that 40% access the site for educational purposes and the balance for research, with little change since 1998 (38% education). In 2008, 24% was at the college level, 15% at the secondary level, and 1% was for unaffiliated individuals. NADP data have been used in M.S. (e.g. 46) and Ph.D. (e.g. 47) thesis research. But the greatest use has been in undergraduate classrooms. Over the last six years, authors have used NADP figures and maps in undergraduate textbooks in biology, chemistry, ecosystem change and public health, geographic information systems, and meteorology. The NADP willingly supplies high quality graphics for these efforts. Secondary students continue to access on-line brochures, data and maps for use in science fair projects and classroom exercises. *Inside Rain, Working with Precipitation Chemistry Data*, a curriculum for grades 9 to 12, engages students in activities requiring them to access and utilize NADP data to solve problems, create graphs, and plot maps. This curriculum was published in 2000 by the National Science Teachers Association, with support from the U.S.G.S. and NADP.

Extension Since 2002, NADP staff members have participated in an Extension Service program entitled Environmental Stewardship Days. This program targets students in grades 4 to 6 and is designed to engage them in hands-on learning. Annually, ~ 200 students participate in an NADP-developed learning activity about water quality, where they measure the pH of lake water, drinking water, and NADP rain samples. NADP staff has been involved in extension work with Native American organizations concerning mercury,

due to high tribal fish consumption. NADP has contributed to the Institute of Tribal Environmental Professionals, National Tribal Air Association, and Tribal Air Monitoring Support Center. Another activity involved the Upper Midwest Aerospace Consortium (U. North Dakota), which produced a video entitled “Acid Rain.” The video uses NADP pH data to show the distribution of acidic precipitation. This video also became an episode in the public TV series *Our Changing Planet*.

New Partnerships The NRSP-3 Executive Committee adopted the International Center for First-Year Undergraduate Chemistry Education (ICUC) as an institutional program participant. Our organizations collaborated in preparing a Spanish version of NADP’s *Nitrogen in the Nation’s Rain*. The *ICUC Quarterly* published an article featuring the NADP in June 2006. NADP staff also partnered with the American Chemical Society (ACS) to develop an earth day activity for elementary students. The activity provided instructions for assembling a simple rain collector and in measuring pH with materials provided. Students were directed to a special web site (<http://nadp.sws.uiuc.edu/earthday/>) where they could post and compare their measurements to nearby NADP sites, etc. Compared to previous ACS activities, participation tripled, prompting the ACS to grant a “Salute to Excellence” to NADP for its commitment to education. The other partnership recently formed with the ARS Cereal Disease Laboratory to look for soybean rust spores in rain samples was described in the National Relevance section.

Support Nationwide Research NADP has registered data users in every state (except Rhode Island) and the District of Columbia, with only seven states having fewer than 100 registrants and 12 having more than 1000. There are also registered data users in more than 150 countries. The NADP has sites in every state (except HI, RI), and in Canada, Puerto Rico, and the Virgin Islands. NADP’s pilot Ammonia network has 22 sites in 13 states, and began measuring gaseous ammonia in late 2007 in response to the national need for gas-phase ammonia measurements. These are all indications of the breadth of support and interest in the program, and recognition that NADP is responsive to emerging needs of researchers and policy-makers. The breadth of reports and journal articles using or citing NADP data demonstrates the nationwide, indeed international, use of NADP data.

Researchers continue to need data that can address acidic deposition issues in eastern states and there is increasing evidence of a similar need in the Rockies, Cascades, Sierras, and other sensitive high-elevation ecosystems in the West. Researchers continue to need nutrient deposition data in nitrogen-limited montane and alpine ecosystems and in estuaries and coastal watersheds. Researchers also need mercury deposition data to investigate the cause of widespread mercury contamination of fish and piscivores. And, researchers need gaseous ammonia data to better understand the cause of increases in ammonium deposition and the relationship of ammonia emissions to air quality.

The NRSP-3/NADP has effectively supported these and other research activities and proposes to continue this support.

Outreach, Communications, and Assessment

Audience The NRSP-3 mission is to provide quality-assured data and information on atmospheric deposition for use by scientists, educators, students, policy-makers, and the general public. The NADP Web site provides on-line access to virtually all project data and information, including educational and informational brochures. User statistics, described in the section on “Relevance to Stakeholders,” show the continual growth in the number of registered users and data downloads, two indicators of the importance and relevance of the data. In its role of assessing project performance, the NRSP-3 EC has charged the NPO with updating the Web site to improve the organizational layout, facilitate data and map accessibility, enhance communications, and modernize the “look and feel.” In addition, users want wet **and** dry deposition data, so the site needs to improve access to dry deposition data available from other programs. The site also needs to continue producing value-added products that respond to user needs, such as computing inferential dry deposition estimates from air concentration measurements of ammonia and

mercury. Finally, should plant pathogen measurements in NADP samples be used in a decision-support system for herbicide applications, agricultural producers could become a new audience.

Engagement of Stakeholders Stakeholder involvement in committee and subcommittee activities is described in the section on “Relevance to Stakeholders.” In addition to twice-yearly committee meetings, members participate in triennial laboratory and quality management reviews, where they can offer recommendations for change. Committees and subcommittees also can help identify emerging scientific needs and interests. For example, the Atmospheric Mercury Initiative got its start in committee discussions. To foster topical discussions and feedback on the program, the updated Web site will include a section where users can enter comments and suggestions. Committees and subcommittees will be able to host on-line forums on topics of interest. Site operators will be able to post data and retrieve reports. As mentioned in the section on “Management, Budget, and Business Plan,” the committees are currently seeking ways to increase participation from land-grant university scientists, especially at annual technical meetings.

Measuring Accomplishments Methods to measure program outputs, accomplishments, and impacts have been described in previous sections of the proposal and include: (1) an annual request to all program participants to send a list of accomplishments, including publications, to the NPO; (2) a review of references lists in published reports and journal articles to identify additional investigations that use NADP data; (3) compilations of Web user statistics; (4) identification of NADP data use in policy-related documents and Web sites, e.g., NAPAP reports, NRC reviews, government agency reports and Web sites; (5) participation in NADP meetings; and (6) occasional program reviews.

Communication Pieces Six brochures are available on the NADP Web site and in print form: (1) *Welcome to NADP*, which describes the program and encourages involvement, (2) *Monitoring Mercury Deposition*, which describes the mercury problem and promotes the MDN, (3) *Nitrogen in the Nation’s Rain*, which describes nutrient deposition and potential problems from excess nutrients, (4) *El Nitrogeno en la Lluvia Nacional*, a Spanish version of (3), (5) *Inside Rain*, which describes atmospheric deposition and the NADP, and (6) the NADP’s *Governance Handbook*, a simple review of NADP’s structure and operation of the various officers, committees, and organization, and is designed for new members. Annual summary reports present the latest maps and program information and are distributed at scientific meetings and to all program participants, students, educators, and the public.

Distribution of Results As described in previous sections of this proposal, NADP data are distributed almost exclusively by way of the NADP Web site, which offers selective on-line retrieval of data from a linked database management system. This site receives ~1.4M hits per year, and in 2008 there were 89,103 unique users, who downloaded 24,538 data files. These data are used in approximately 100 publications (reports and journal articles) a year. Every year, a scientific symposium is held where presenters summarize the results of their scientific studies, using NADP data. Over the past five years, attendance at these meetings has averaged 140; the typical number of oral presentations is 40 and the number of poster presentations is 35. Attendance at the 2007 meeting in Boulder, Colorado, reached 172, a new record for this 30-year-old program.

Appendix: Literature Cited

1. Cowling, E.B., J. Fulkerson, K. Huston, and J.H. Gibson. 1977. *Plan of Research for NC-141 North Central Regional Project on Atmospheric Deposition and Effects on Agricultural and Forested Land and Surface Waters in the United States*. National Atmospheric Deposition Program (contact NADP Program Office, nadp@sws.uiuc.edu) 85 pp.
2. Oden, S.N.F. 1968. *The Acidification of Air and Precipitation and Its Consequences in the Natural Environment*. Swedish National Science Research Council, Ecology Committee Bulletin No. 1. Stockholm, Sweden. 68 pp.
3. Likens, G.E. 1976. Acid Precipitation. *Chemical and Engineering News*. **54**(48):29-44.
4. National Academy of Science. 1975. *Atmospheric Chemistry: Problems and Scope*. National Academy of Sciences, Washington, D.C. 130 pp.
5. Interagency Task Force on Acid Precipitation. 1982. *National Acid Precipitation Assessment Plan*. Council on Environmental Quality, Washington, D.C. 100 pp.
6. Robertson, J.K. and J.W. Wilson. 1985. *Design of the National Trends Network for Monitoring the Chemistry of Atmospheric Precipitation* (U.S. Geological Survey Circular 964). U.S. Geological Survey, Alexandria, VA.
7. Jansen, J., K. Aspila, M. Hoffman, G. Ohlert, and J. Winchester. 1988. Session Summary Report, NAPAP Task Group IV, Wet Deposition Monitoring Peer Review. National Acid Precipitation Assessment Program, Washington, D.C.
8. National Acid Precipitation Assessment Program. 1991. "Response of Vegetation to Atmospheric Deposition and Air Pollution," IN: *Acidic Deposition: State of Science and Technology* (Volume I – Emissions, Atmospheric Processes, and Deposition). National Acid Precipitation Assessment Program, Washington, D.C. pp. 6-1 – 6-338.
9. National Acid Precipitation Assessment Program. 1991. "Response of Vegetation to Atmospheric Deposition and Air Pollution," IN: *Acidic Deposition: State of Science and Technology* (Volume III – Terrestrial, Materials, Health and Visibility Effects). National Acid Precipitation Assessment Program, Washington, D.C. pp. 18.1-206.
10. National Acid Precipitation Assessment Program. 1991. "Watershed and Lake Processes Affecting Surface Water Acid-Base Chemistry," IN: *Acidic Deposition: State of Science and Technology* (Volume II – Aquatic Processes and Effects). National Acid Precipitation Assessment Program, Washington, D.C. pp. 10-1 – 10-167.
11. National Acid Precipitation Assessment Program. 1991. "Effects of Acidic Deposition on Materials," IN: *Acidic Deposition: State of Science and Technology* (Volume III – Terrestrial, Materials, Health and Visibility Effects). National Acid Precipitation Assessment Program, Washington, D.C. pp. 19-1 – 19-280.
12. Public Law 101-549. November 15, 1990. The Clean Air Act Amendments of 1990. <http://www.epa.gov/oar/caa/caaa.txt>.
13. U.S. Environmental Protection Agency. 1997. "Executive Summary," IN: *Mercury Study Report to Congress* (EPA-452/R-97-003). Office of Air Quality Planning and Standards and Office of Research and Development, Washington, D.C. 95 pp.
14. Lynch, J.A., V.C. Bowersox, and J.W. Grimm. 1996. *Trends in Precipitation Chemistry in the United States, 1983-94: An Analysis of the Effects in 1995 of Phase I of the Clean Air Act Amendments of 1990, Title IV* (Open-File Report 96-0346). U.S. Geological Survey, Reston, VA. 100 pp.
15. Lynch, J.A., V.C. Bowersox, and J.W. Grimm. 2000. Changes in Sulfate Deposition in Eastern USA Following Implementation of Phase I of Title IV of the Clean Air Act Amendments of 1990. *Atmospheric Environment*. **34**(11):1665-1680.
16. Lehmann, C.M.B., V. C. Bowersox, and S.M. Larson. 2005. Spatial and Temporal Trends of Precipitation Chemistry in the United States, 1985-2002. *Environmental Pollution*. **135**:347-361.
17. Paerl, H.W. 2002. Connecting Atmospheric Nitrogen Deposition to Coastal Eutrophication. *Environmental Science & Technology*. August 1, 2002:323A-326A.
18. Hameedi, J., H. Paerl, M. Kennish, and D. Whittall. 2007. Nitrogen Deposition in U.S. Coastal Bays and Estuaries. *EM*. December 2007: 19-25.
19. Fenn, M.E., J.S. Baron, E.B. Allen, H.M. Rueth, K.R. Nydick, L. Geiser, W.D. Bowman, J.O. Sickman, T. Meixner, D.W. Johnson, and P. Neitlich. 2003. Ecological Effects of Nitrogen Deposition in the Western United States. *BioScience*. **53**(4):404-420.
20. Pivonia, S., and X.B. Yang. 2004. Assessment of the Potential Year-Round Establishment of Soybean Rust Throughout the World. *Plant Disease*. **88**:523-529.
21. Melching, J.S., W.M. Dowler, D.L. Koogle, and M.H. Royer. 1989. Effects of Duration, Frequency, and Temperature of Leaf Wetness Periods on Soybean Rust. *Plant Disease*. **73**:117-122.

22. Krupa, S., V. Bowersox, R. Claybrooke, C.W. Barnes, L. Szabo, K. Harlin, and J. Kurle. 1006. Introduction of Asian Soybean Rust Urediniospores into the Midwestern United States – A Case Study. *Plant Disease*. **90**(9): 11254-1259.
23. Brown, J.K.M., and M.S. Hovmoller. 2002. Aerial Dispersal of Pathogens on the Global and Continental Scales and Its Impact on Plant Disease. *Science*. **297**:537-541.
24. Knightes, C., M. Meaburn, and R. Araujo. 2007. Atmospheric Deposition of Mercury. *EM*. December 2007: 26-30.
25. Lambert, K.F. and V. Bowersox. 2002. Environmental Monitoring and National Security: Is There a Connection? *EM*. August 2002: 17-22.
26. Aneja, V.P., W.H. Schlesinger, D. Niyogi, G. Jennings, W. Gilliam, R.E. Knighton, C.S. Duke, J. Blunden, and S. Krishnan. 2006. Emerging National Research Needs for Agricultural Air Quality. *EOS*. **87**(3): pp. 25, 29.
27. Krupa, S.V. 2003. Effects of Atmospheric Ammonia (NH₃) on Terrestrial Vegetation: A Review. *Environmental Pollution*. **124**: 179-221.
28. National Research Council. 2003. *Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs*. p. 263. National Academy Press, Washington, D.C.
29. Gilliland, A.B., R.L. Dennis, S.J. Roselle, and T.E. Pierce. 2003. Seasonal NH₃ Emission Estimates for the Eastern United States Based on Ammonium Wet Concentrations and an Inverse Modeling Method. *J. Geophysical Research*. **108**(D15):4477, doi: 10.1029/2002JD003063.2003.
30. Wiedinmyer, C. and H. Friedli. 2007. Mercury Emission Estimates from Fires: An Initial Inventory for the United States. *Environmental Science & Technology*. **41**: 8092-8098.
31. Porter, E., and S. Johnson. 2007. Translating Science into Policy: Using Ecosystem Thresholds to Protect Resources in Rocky Mountain National Park. *Environmental Pollution*. **149**: 268-280.
32. Harvey, F.E. 2001. Use of NADP Archive Samples to Determine the Isotope Composition of Precipitation: Characterizing the Meteoric Input Function for Use in Ground Water Studies. *Ground Water*. **49**(3):380-390.
33. Dutton, A., B.H. Wilkinson, J.M. Welker, G.J. Bowen and K.C. Lohmann. 2005. Spatial Distribution and Seasonal Variation in 18O/16O of Modern Precipitation and River Water Across the Conterminous USA. *Hydrological Processes*. **39**:4121-4146.
34. Harvey, F.E. 2005. Stable Hydrogen and Oxygen Isotope Composition of Precipitation in Northeastern Colorado. *Journal of American Water Resources Association*. April 2005:447-459.
35. Elliott, E.M., C. Kendall, S.D. Wankel, D.A. Burns, E.W. Boyer, K. Harlin, D.J. Bain, and T.J. Butler. 2007. Nitrogen Isotopes as Indicators of NO_x Source Contributions to Atmospheric Nitrate Deposition Across the Midwestern and Northeastern United States. *Environmental Science & Technology*. **41**: 7661-7667.
36. Dasgupta, P.K., J.V. Dyke, A.B. Kirk, and W.A. Jackson. 2006. Perchlorate in the United States: Analysis of Relative Source Contributions to the Food Chain. *Environmental Science & Technology*. **40**:6608-6614.
37. Scott, B.F., C. Spencer, S.A. Mabury, and D.G. Muir. 2006. Poly and Perfluorinated Carboxylates in North American Precipitation. *Environmental Science & Technology*. **40**:7167-7174.
38. U.S. Environmental Protection Agency. 2007. *Acid Rain and Related Programs, 2006 Progress Report* (EPA-430-R-07-011). U.S. Environmental Protection Agency Office of Air and Radiation, Clean Air Markets Division,. 54 pp.
39. 2005. National Acid Precipitation Assessment Program Report to Congress: An Integrated Assessment. See www.napap.noaa.gov/reports. NOAA, Silver Spring, MD. 85 pp.
40. Air Quality Committee. 2006. United States - Canada Air Quality Agreement, Progress Report 2006. International Joint Commission, Washington, D.C. pp. 1-6, 65-66.
41. Meteorological Service of Canada. 2005. 2004 Canadian Acid Deposition Science Assessment: Summary of Key Results. Environment Canada, Ontario, Canada. 32 pp.
42. New England Governors and Eastern Canadian Premiers. 2002. Critical Loads of Acidity and Water Sensitivity in New England States and Eastern Canadian Provinces. http://www.cap-cpma.ca/images/pdf/eng/09-critical_loads_e.pdf. 6pp.
43. Center for the Inland Bays. 2004. An Indication of Progress through Government Action: Nutrient Pollution. In Delaware Inland Bays' Environmental Indicators. Center for the Inland Bays, Lewes, DE.
44. Greening, H. and B.D. DeGrove. 2002. Implementing a Voluntary, Non-regulatory Approach to Nitrogen Management in Tampa Bay, FL: A Public/Private Partnership. *The Scientific World*: 378-383.
45. Minnesota Pollution Control Agency. 2007. Minnesota Statewide Mercury Total Maximum Daily Load. Minnesota Pollution Control Agency, St. Paul, MN. 69 pp.
46. Muldoon, K. 2003. *A Hydrologic and Nitrogen Mass Balance for Embryo Pond, Rocky Mountain National Park, Colorado*. M.S. thesis. Colorado State University, Fort Collins, CO. 53 pp.
47. Lehmann, C.M.B. 2006. *Atmospheric Deposition Monitoring to Assess Trends in Atmospheric Species*. Ph.D. thesis. University of Illinois, Urbana-Champaign, IL. 404 pp.

Attachment One

Letter to the National Research Support Project – Review Committee (NRSP-RC)

From: Dr. Richard Grant (Agricultural Advisor) and Dr. Eric Prestbo (Executive Committee Chair)

Date: November, 13, 2008



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November 13, 2008

To the NRSP Review Committee:

In reading through the reasons for the recent denial of the NRSP-3 project continuance we realized that we were not as clear as we should have been as to how critically-important the NRSP-3 is to the *viability* of the National Atmospheric Deposition Program (NADP). Over \$5,000,000 dollars in annual NADP research funding from a multitude of federal and state agencies and the ability to determine long-term trends in the chemical climate of the USA and impacts of climate mitigation on the USA is at stake in the \$50,000/year NRSP-3 renewal from SAES. Therefore, we offer the following clarifications of the value and leveraging that the NRSP-3 provides to the NADP and respectfully request reconsideration of the NADP's recent application for NRSP-3 renewal.

There are three primary aspects in which the SAES through the NRSP-3 and the NADP are contributing to their respective missions:

1. the NADP enhances the ability of the SAES to address pressing needs of agriculture,
2. the lack of NRSP-3 funding will result in the probable shutdown of monitoring at 50 monitoring locations, thereby dramatically reducing the ability of agriculture to understand the spatial and temporal variation in deposition of chemicals in precipitation, and
3. the funding provided through the NRSP-3 is heavily leveraged by other federal and state agencies and provides a critical service to the operation of the NADP.

Expanding on these points:

Point 1: Research and monitoring goals address pressing needs of Agriculture

The NADP is addressing highly relevant issues related to nitrogen, ammonia, transport of plant pathogens, among others, and provides a scientific forum for communication about agriculture research—evidenced by the recent fall symposium where three of the six presentation sessions were Ag-focused. At many locations we have a 30-year record of this deposition, and show increasing trends at many sites. These relationships were detailed specifically in our proposal.

Point 2: SAES Monitoring Site Losses

All NADP sites pay a management fee for operations. The SAES Hatch funding for the NRSP-3 project pays all or some of this fee for the SAES sites. Currently, 19 SAESs have these fees paid in full (charge = \$0), and all other sites have reduced fees (-\$840/site) relative to average federal site expenses. The remaining costs of operation are borne by the individual SAES sites (analytical costs of \$4,732/year at 11 sites, operator salary support at about 30 sites, travel and shipping costs at all sites). With a loss of NRSP status, the operational costs at the 50 SAES-supported sites would increase significantly and likely cause the closure of many of the sites located in the agricultural production areas of the USA due to the increasing cost. These closures would force management fees to rise and thereby increase the risk the closure of additional sites due to higher operation costs. The loss of the SAES sites would affect the ability to follow national trends in deposition related to agriculture since many of these SAES-supported sites are the oldest sites in the network (10 of the 50 having precipitation chemistry records dating back to 1978). Consequently, even though the \$50,000 is a relatively small part of the NRSP-3 total budget, the SAES

sites are very important to the NADP and to the United States.

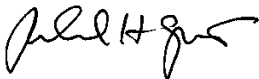
Point 3: Federal and State Leveraging

The continued active status of NRSP-3 allows funding contributions from many state and federal agencies (namely, USGS, EPA, NPS, NOAA, TVA, BLM) totaling \$1.8 million dollars annually, to flow through the CSREES to the University of Illinois and NADP by cooperative agreement. Without this mechanism, funding from state and federal agencies to NADP will be permanently disrupted and potentially lost due to increased indirect cost recoveries by other mechanisms. Consequently, if the NRSP-3 is terminated, then all NADP sites would likely see a 50% increase in total monitoring costs for each site and year. Not only does the NRSP status leverage large amounts of federal and state funding, but the NRSP-3 also leverages a lower cost for all NADP site sponsors.

To conclude, we would appreciate if, as a committee, you would reconsider our standing and original proposal for continued funding. We will be glad to answer any questions by phone, in writing, or through a presentation to your membership.

Thank you for your reconsideration.

Sincerely,



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