SAES-422 Multistate Research Activity Accomplishments Report

Project No. and Title:	NRSP-3, The National Atmospheric Deposition Program – A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition
Period Covered:	5-2013 through 4-2014
Date of Report:	June 13, 2014
Meeting Dates:	Fall, October 8-11, 2013; Spring, April 14-17, 2014.

Participants

A listing of the attendees is provided, and also available at the meeting summary location at the NADP website (http://nadp.isws.illinois.edu/nadp2013/) (attachment).

Meeting Minutes

The NADP is comprised of a technical committee (all participants), an executive committee, several scientific committees, and a series of subcommittees focusing on specific areas of the ongoing project, including operations, quality assurance, ecological response and outreach, and data management. All approved meeting minutes from our 2014 Spring Meeting (and all other meetings) are available on our website (http:// http://nadp.isws.illinois.edu/committees/minutes.aspx. Some subcommittee minutes from the Spring Meeting will be delayed for approval, but they will be posted when approved at the same address.

The attachment is the minutes of the Fall 2013 Joint Subcommittee Meeting (a meeting of all participants, with topics of interest to all) (attachment).

Spring 2014 Subcommittee minutes will be available here (http://nadp.isws.illinois.edu/committees/minutes.aspx) as they become finalized and available.

Accomplishments

The NRSP-3 provides a framework for cooperation among State Agricultural Experiment Stations (SAES), the U.S. Department of Agriculture-National Institute of Food and Agriculture, and other cooperating governmental and non-governmental

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 several of these compounds. NADP data support informed decisions on air quality and ecosystem 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 Agricultural Experiment Station's research challenges (Science Road Map #6). 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).

The 256-site NTN provides the only long-term nationwide record of basic ion wet deposition in the United States. Sample analysis includes free acidity (H^+ as pH), specific conductance, and concentration and deposition measurements for calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, bromide (new), and ammonium. We also measure orthophosphate ions (PO_4^{3-}, the inorganic form), but only for quality assurance as an indicator of sample contamination. At the end of April 2014, 256 NTN stations were collecting one-week precipitation samples in 48 states, Puerto Rico, the Virgin Islands, Canada, and a new site in Argentina. Additionally, there are multiple quality assurance and test sites. Complementing the NTN is the 7-site AIRMoN which are essentially NTN sites operated on a daily basis (i.e., single precipitation events). Samples are collected to support continued research of atmospheric transport and removal of air pollutants and development of computer simulations of these processes.

The 114-site MDN offers the only long-term and routine measurements of mercury in North American precipitation. Measurements of total mercury concentration and deposition (and optional methyl-mercury) are used to quantify mercury deposition to water bodies, some of which have fish and wildlife mercury consumption advisories.

Since 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.

The NADP operates two newer gaseous atmospheric chemistry networks: the Atmospheric Mercury Network (AMNet) and the Ammonia Monitoring Network (AMoN, NADP's newest network). In each case, the network goal is to provide atmospheric concentrations of these particular gases, and then to estimate the rate of dry deposition (without precipitation) of the gas. In many cases, dry deposition of the gas could far exceed the wet deposition of the same compound.

At the end of April 2014, 20 AMNet sites were collecting five-minute estimates of gaseous elemental mercury and two-hourly average concentrations of gaseous oxidized mercury and particulate bound mercury. The AMNet provides the only long-term region-wide record of basic atmospheric mercury concentrations in the United States.

The AMoN has 66 sites operating as of April 2014, where two-week averages of atmospheric ammonia gas are being collected with passive devices. This low-cost network is designed to provide long-running estimates of ammonia in the atmosphere. These data are particularly important to agriculture, since many sources of ammonia are agricultural (Roadmap Challenge #6). Data from both gaseous networks support continued research of atmospheric transport and removal of air pollutants and development of computer simulations of these processes.

Short-term Outcomes and Outputs.

Samples Collected. NADP's principal objective and accomplishment/outcome is the collection and analysis of samples for precipitation and atmospheric chemistry. Briefly, the NADP processed a total of 13,608 samples from the NTN, including 106 quality assurance (QA) samples. The analyses included observations of 10 different analyte concentrations and precipitation volume, which allow for calculation of deposition flux for each analyte. These same data were collected daily (i.e., every day with measurable precipitation) from the AIRMoN network. AIRMoN collected and processed 919 precipitation samples, including 64 QA samples. The MDN collected and processed 5,910 weekly mercury-in-precipitation samples, including 1,182 QA samples. Additionally, 420 methyl-mercury samples were also processed, with 84 QA samples. The AMoN collected and quality assured 1,034 ammonia samples, which included 561 QA samples. The AMNet collected, quality assured, and produced approximately

51,200 hourly and two-hourly averages. QA samples are run at the individual sites and not part of the NADP sample counts.

NADP Database. Our second most important accomplishment/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 website 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, 2012 calendar year data are complete and online, and the 2013 data is online with final QA to be completed in the next several weeks for development of the final 2013 annual maps and database. Website usage statistics provide evidence that our data are being used. During this reporting period, website usage remained strong. We have recorded 37,582 registered users who accessed our website information and there were 27,806 data downloads from the site (about our typical number). The website received over 1.27 million "hits." Maps (single or multiple) were downloaded 22,582 different times. We continually divide users into types, and this year was again very typical; about 40% were from federal and state, 36% from universities, 16% from K-to-12 schools, and 8% from other individuals or organizations. The NADP website has registered users from more than 150 countries across the globe. These statistics demonstrate that NADP continues to be relevant to both the scientific and educational communities and continues to attract new users.

Map Summary. The 2012 annual map series and Map Summary Report was developed during June 2013 and available in September 2013. These maps are used widely and constitute one of the major products of the network. Individual maps are filed by network, year, and constituent, and can be downloaded in several formats (http://nadp.isws.illinois.edu/data/annualmaps.aspx). Individual maps are compiled into annual Map Summary reports, and the 2012 Map Summary is also available for download (http://nadp.isws.illinois.edu/lib/dataReports.aspx). We printed 2,000 copies of the 2012 Annual Summary, and about 80% of these have been distributed thus far. The 2013 data is about to be completed at this writing, and the map development will begin very soon. The 2013 Map Summary report will be available about September 1.

Scientific Meeting (Fall 2013). At the end of each federal year, a combined business and scientific meeting is held to showcase some of the latest deposition research that occurred during the year. During FY13, the meeting focused on "Western U.S. Monitoring and Analysis: Progress and Current Issues" with a goal of focusing more on the observations most important in the Western U.S. (Park City, UT Oct 8-11, 2013). This meeting was a bit unusual due to the federal shutdown and the lack of federal

attendees. We were expecting about 140 attendees, but we only realized about 90 people and participants. The meeting included eight sessions, 44 oral presentations, and 37 posters. Most presentations were given, although a number were given by secondary authors. A significant number of posters were not available at the meeting. Additionally, this meeting was provided as a webcast to benefit those members unable to attend the meeting. Observers could hear the presenters, see the slides, and ask questions. This may become a regular offering of the meetings.

One session was devoted to nitrogen fluxes, a topic of particular interest to agriculture. This shortened session led into an all-day Friday special Nitrogen Flux Workshop. The workshop was hampered by missing federal speakers and chair. Specific topics included U.S. nitrogen flux budgets, the increasing importance of ammonia, and the flux of organic nitrogen. Attendance at the workshop was about 50 people. All presentations, posters, and meeting proceedings (including the workshop) are available on the NADP website (nadp.isws.illinois.edu/conf/2013/session4.html).

Scientific Meeting (FY14, Spring 2014) was held in Ft. Lauderdale, FL on April 14-17, 2014. The Spring meeting is the typical business meeting, and agendas and minutes of all committee meetings are available online (as they become available), including an Executive Committee summary (http://nadp.isws.illinois.edu/committees/minutes.aspx).

Scientific Meeting (FY15, Fall 2014). The next fall scientific meeting will be held in Indianapolis, IN (October 19-23, 2014). As of now, a planned "Agriculture and Atmospheric Deposition" session is in the schedule. Ammonia deposition will likely dominate this session. All are welcome, with all presentations, posters, and meeting proceedings to be added to the NADP website.

These basic activities fulfilled the project objectives: (1) coordination of these networks; (2) quality assurance to ensure consistency; and (3) analytical, site support, and data validation services for the sites financed directly through this agreement. Specifically, this report is for the 46 SAES sites, but all of the network results are equivalent for all sites. Over the year, 46 SAES sites operated, none were lost, and LA12 should be restarted within 30 days. Additionally, plans are formulating for starting NADP sites at Florida Agricultural and Mechanical University (FAMU) and North Carolina Agricultural and Technical University (NCA&T), both of which are 1890 Land Grant Universities.

Additional 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). An added

advantage to this change is that digital stations will have a very accurate, hourly record of precipitation. As of 5/1/2014, there were 33 sites (of ~300 locations, 89% complete) without digital gages available or installed. Only two of these sites are SAES sites (Cornell/Aurora, UI/Shabbona).

The Central Analytical Laboratory has begun to measure the concentration of bromide ion in all NADP samples as a routine analyte for NTN and AIRMoN sites. Three years of bromide data will be available routinely in the NTN database starting with the 2013 data finalization. Bromide is important to agricultural users, given its fumigant usage in the agriculture industry.

During CY2013, 208 journal articles and reports were generated using the NADP data. Listed in the publications section of this report are the 112 journal articles that were not listed in 2013 SAES-422 report. For CY2014, 72 journal articles have been identified, and will be listed in the 2015 SAES-422 report. This is again evidence that NADP continues to produce data that are both valuable and useful.

In support of our education and outreach responsibilities, two new text books used NADP information during 2013: (1) Millard, S. P., 2013. Probability, Statistics and Information. Also w/ compendium of methods. Springer Science+Business Media NY. ISBN 978-1-4614-8455-4., and (2) Harris, D.C., 2013. Exploring Chemical Analysis, (in Chinese), W. H. Freeman and Co. Additionally 3 dissertations and theses used NADP data: (1) Hale, R. L., 2013. Coupled Hydrology and Biogeochemistry in Social-Ecological Watersheds. Dissertation, Arizona State University; (2) Jones, G. B., 2013. Nutrient Dynamics in Cool-Season Pastures, Master's Thesis, Virginia Polytechnic Institute and State University), and (3) Fleming, C. S., 2013. Nitrogen and Phosphorus Management in the Mid-Atlantic, Doctoral dissertation, Virginia Polytechnic Institute and State University.

A new litterfall mercury monitoring initiative is measuring mercury and methyl mercury in forest litterfall (leaves, twigs, etc.). These dry deposition estimates will complement the MDN wet deposition mercury monitoring. Initiation of the trial began in September 2012, and will continue during CY2014. Analysis and field support is provided through the USGS (http://nadp.isws.illinois.edu/newIssues/litterfall/).

During the completion of the 2013 data (occurring now), methyl mercury data, which is currently an MDN, will be released on the NADP website for the first time. Release has been delayed for a number of reasons, which have now been cleared.

Continued Quality Assurance Audits. NADP contract laboratories and the Program Office are each reviewed annually in rotation to identify problems, improve performance, and provide external checks to the program. These audits are a mix of external and NADP member scientists. The Program Office of NADP was audited in 2013. The audit results were reporting back to the Executive Committee at the Spring 2014 meeting (the audit team was mostly federal employees, so the normal report back at the Fall 2013 meeting was not given).

Another improvement is to digitize all of the individual field precipitation records (back to 1978) and make them available to researchers via the NADP website, for a more complete site and sample collection record. This is ongoing and should be completed during 2014.

Dry deposition estimates are planned for the gaseous measurements of the AMoN and AMNet networks using modelled estimates of deposition velocity. The Total Deposition Science Ad hoc Committee within NADP is charged with determining methods and protocols for the development of this dataset. These discussions are ongoing, and dry deposition estimates should be available in the near future.

Impacts

As a National Research Support Project, the NADP's most important impact is that our data are used in research, per our research support mission. For 2013, we identified 208 journal articles and reports that used NADP data, maps, and procedures in their own research, for modeling applications, and for comparison to NADP results, etc. These articles are included in our online database of NADP publications.

Here is a short summary of 10 articles (and theses/dissertations) that are of particular interest to the agricultural community, and were not included in our 2013 SAES-422 report.

1. Cady-Pereira et al. evaluated the ammonia emissions estimate of the Tropospheric Emission Spectrometer (TES), a satellite-based atmospheric emissions product from NASA. Using modelling, the 2010 and 2013 TES emissions estimates were compared to the NADP's AMON ammonia network observations. Results showed good agreement during spring and fall, but July TES estimates were clearly biased high as compared to the NADP observations. All available AMON data and stations (66) were used in the analysis.

2. Carson (thesis, Kansas State University) studied the effects of annual burning vs. fire suppression and/or chronic nitrogen additions on soil carbon at the Konza Prairie LTER Station (NTN KS31). Annual burning significantly increased the soil C:N ratio and in situ CO2 efflux, while decreasing potential ammonification and nitrification rates. Chronic N addition (100 kg N ha-1 year-1) significantly reduced the soil C:N ratio, while increasing total soil N and potential nitrification and ammonification rates. Chronic N addition reduced potential C mineralization, microbial biomass C and N, and altered microbial community composition. These results indicate that different fire regimes and chronic N enrichment over decades affects soil C and N pools and transformations, as well as microbial biomass and composition. The 26 years of observations from KS31 and respective N deposition trends were used to justify the study, and to measure the N wet deposition and other compounds to the plots.

3. Kobe et al. (SAES scientists) were trying to determine how soil characteristics control tree growth performance, and were comparing multiple type of soils in Michigan versus a tropical Costa Rica site. The authors found that the soil characteristics were tremendously heterogeneous, base cations could limit growth in either the tropical or temperate conditions, specific nutrients could limit aspects of tree growth performance, and the trees have the ability to actively manage access to nutrients

with microbial changes. NADP data from multiple sites were used to characterize the base cations and nitrogen flux to the tree stands in the U.S.

4. Mikhailova et al. (SAES scientists) investigated the potential contribution of calcium and magnesium wet deposition to changes in soil inorganic carbon sequestration. The input of Ca and Mg form pedogenic carbonates. The soil orders with the greatest potential inorganic C formation (and therefore C sequestration changes) were Mollisols, followed by Alfisols and Entisols. Normalized per square kilometer, the important soils were Histosols, Alfisols, and Vertisols. The authors used all of the 1994-2003 NADP data for calcium and magnesium wet deposition fluxes.

5. Peckham and Gower simulated the carbon balance of Midwest forest (1800 to 2000) stands to understand the carbon balance under harvesting conditions, and particularly increased biomass removal for biofuel production (leafy mass). The authors used 220,000 km2 of temperate Midwest forests. They concluded that the forests were carbon sinks under current management, but the forests became C sources as biofuel production replaced traditional forest products. NADP nitrogen deposition data (~80 sites) were used in the N and C cycling models.

6. Robertson et al. were attempting to define the fate and transport of constituents in an alluvial aquifer in New Mexico. The authors used NADP sodium and chloride data from 7 sites (multiple years) to show that the groundwater Na:Cl ratios were significantly different than the groundwater ratios. Given the geologic, potentiometric, and mineral constraints, the authors were further able to delineated flow using the chemical nature of the groundwater, as compared to atmospheric deposition ratios.

7. Smart et al. (SAES, USDA scientists) studied the interaction of native grasses and introduced cool-season grasses to determine if active management (early season clipping, fire) could allow native species to dominate in the prairie, even under increasing N deposition conditions. Annual clipping and fire were effective, with annual application (vs. biannual or triennial) showed the best results. Low levels of nitrogen deposition (upward trends) should increase the cover of non-native species. South Dakota NADP wet deposition data and trends were used to determine the input fluxes to the crop test plots.

8. Smith et al. (SAES, ARS Authors) measured N losses and cycling in establishing miscanthus, switchgrass, and mixed prairie as compared to typical corn and soybean standing crops. One important finding was the reduction of N losses from some second generation biofuel crops which showed that high-yielding perennial grasses used for biofuel feedstock have the potential to greatly reduce N losses in the

Midwest corn soybean belt. NADP nitrogen deposition fluxes for 4 years were used in the N budget flowing into the test plots.

9. Sprague and Gronberg estimated the input of anthropogenic nitrogen and phosphorus to each county and five water body surfaces in the conterminous United States for 3 separate years. They include many source types: biological fixation by crops, crop and animal production for human consumption, net import of food and net import of feed and atmospheric deposition, fertilizer, and recoverable manure. The authors used nitrate and ammonium deposition fluxes from all NADP NTN sites for several years for their deposition inputs to their database. The data is presented as a database for further study by researchers.

10. Zhang, Wang et al. (Parts 1 & 2) modeled the agricultural air quality over the southeastern United States using two air quality models (CMAQ, CAMx). They were particularly interested in the ability to model the fate and transport of ammonia gas. Both models show large biases in principal gas concentrations (CO, NO, NO_2 and NH_3), particulate matter, and dry and wet deposition. The authors used 19 NADP NTN site observations of sulfate, nitrate and ammonium during 2002 to compare model estimates against.

Publications

Includes 112 publications that used NADP data or resulted from NRSP 3 activities in 2013 (96 publications from 2013 were previously reported last year). Jan-May 2014 publications will be included in next year's report. A publically available online database that lists citations using NADP data is accessible at: http://nadp.isws.illinois.edu/lib/bibliography.aspx.

1. Adeoye, E., Allison, P., Blackburn, C., Blocker, M., Grams, J., Jones, S., ... & Zitricki, B., 2013. The Effects of Simulated Acid Rain on Corn Seed Germination. Frostburg State University Term Paper.

2. Altieri, K. E., Hastings, M. G., Gobel, A. R., Peters, A. J., & Sigman, D. M. , 2013. Isotopic composition of rainwater nitrate at Bermuda: The influence of air mass source and chemistry in the marine boundary layer. J. Geophys. Res. Atmos. 118: 11,304–11,316. doi:10.1002/jgrd.50829.

3. Barger, N. N., Castle, S. C., & Dean, G. N., 2013. Denitrification from nitrogen-fixing biologically crusted soils in a cool desert environment, southeast Utah, USA. Ecological Processes, 2(1): 16.

4. Barnes, R. T., Williams, M. W., Parman, J. N., Hill, K., & Caine, N. Thawing glacial and permafrost features contribute to nitrogen export from Green Lakes Valley, Colorado Front Range, USA. Biogeochemistry 1–18. doi:10.1007/s10533-013-9886-5.

5. Baron, J. S. , Hall, E. K., Nolan, B. T., Finlay, J. C., Bernhardt, E. S., Harrison, J. A., Chan, F., & Boyer, E. W., 2013. The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States. Biogeochemistry 114: 71–92.

6. Barr, Inc., 2013. Endangered Species Act: Biological Evaluation, Flint Hills Resources Pine Bend, LLC Rosemount, Minnesota, http://yosemite.epa.gov/r5/r5ard.nsf/48b4cb59f43efe518625745800533fca/d5a343c69158c02886257b970070992b/$FILE/Flint%20Hills%20Biological%20Assessment.pdf.

7. Barret, M., Dommergue, A., Ferrari, C. P., & Magand, O., 2013. The monitoring of atmospheric mercury species in the Southern Indian Ocean at Amsterdam Island (38° S). In E3S Web of Conferences 1: 27001. EDP Sciences.

8. Bash, J. O., Carlton, A. G., Hutzell, W. T., & Bullock Jr., O. R., 2013. Regional air quality model application of the aqueous-phase photo reduction of atmospheric oxidized mercury by dicarboxylic acids. Atmosphere 5(1): 1–15.

9. Benedict, K. B., Carrico, C. M., Kreidenweis, S. M., Schichtel, B., Malm, W. C., & Collett Jr., J. L. , 2013. A seasonal nitrogen deposition budget for Rocky Mountain National Park. Ecological Applications 23(5): 1156–1169.

10. Benedict, K. B., Chen, X., Sullivan, A. P., Li, Y., Day, D., Prenni, A. J., ... & Collett, J. L., 2013. Atmospheric concentrations and deposition of reactive nitrogen in Grand Teton National Park. Journal of Geophysical Research: Atmospheres 118(20): 11–875.

11. Benoit, J. M., Cato, D. A., Denison, K. C., & Moreira, A. E., 2013. Seasonal Mercury Dynamics in a New England Vernal Pool. Wetlands 33(5): 887–894.

12. Borst, M., & Brown, R. A., 2013. Chloride released from three permeable pavement surfaces after winter salt application. Journal of the American Water Resources Association.

13. Boynton, W. R., Hodgkins, C. L. S., O'Leary, C. A., Bailey, E. M., Bayard, A. R., & Wainger, L. A., 2013. Multi-decade responses of a tidal creek system to nutrient load reductions: Mattawoman Creek, Maryland USA. Estuaries and Coasts 1–17. doi:10.1007/s12237-013-9690-4

14. Burgy, K., Resline, J., & Smith, P., 2013. Evaluation of lead concentrations in well water from the Piedmont Area of Harford County, Maryland. Maryland Department of Natural Resources, DNR Publication No. 12-10162013-672.

15. Busenberg, E., & Plummer, L. N. A., 2013. 17-Year Record of environmental tracers in spring discharge, Shenandoah National Park, Virginia, USA: Use of climatic data and environmental conditions to interpret discharge, dissolved solutes, and tracer concentrations. Aquatic Geochemistry 1–24. doi:10.1007/s10498-013-9202-y.

16. Cadwallader, A., Castagna, B., & Dinwoodie, S., 2013. Designing a Stormwater Runoff Control System to Help Prevent Pollution of Flint Pond. Major Qualifying Project Report submitted to the Faculty of Worcester Polytechnic Institute. In partial fulfillment of the requirements for the Degree of Bachelor of Science.

17. Cady-Pereira, K. E., Shephard, M. W., Henze, D. K., Zhu, L., Pinder, R. W., Bash, J. O., ... & Luo, M., 2013. Ammonia Measurements by the NASA Tropospheric Emission Spectrometer (TES). Presented at the 12th Annual CMAS Conference, Chapel Hill, NC, October 28-30, 2013.

18. Carson, M. A., 2013. Responses to Long-term Fertilization and Burning: Impacts on Nutrient Dynamics and Microbial Composition in a Tallgrass Prairie. Master's Thesis, Kansas State University.

19. Castle, S. C., & Neff, J. C., 2013. What controls plant nutrient use in high elevation ecosystems? Oecologia 173:1551–1561. doi:10.1007/s00442-013-2695-7.

20. Chapmann, L. Y., McNulty, S. G., Sun, G., & Zhang, Y., 2013. Net nitrogen mineralization in natural ecosystems across the conterminous U.S. International Journal of Geosciences 4: 1300–1312.

21. Chen, L., Wang, H. H., Liu, J. F., Zhang, W., Hu, D., Chen, C., & Wang, X. J., 2013. Intercontinental transport and deposition patterns of atmospheric mercury from anthropogenic emissions. Atmospheric Chemistry and Physics Discussions 13(9): 25185–25218.

22. Civerolo, K. L., and Roy, K. M., 2013. On the road to recovery: Acid rain and the Adirondacks. New York State Conservationist 67:17–19.

23. Clark, C. M., Morefield, P. E., Gilliam, F. S., & Pardo, L. H., 2013. Estimated losses of plant biodiversity in the United States from historical N deposition (1985-2010). Ecology 94(7): 1441-1448.

24. Classen, A. T., Chapman, S. K., Whitham, T. G., Hart, S. C., & Koch, G. W., 2013. Long-term insect herbivory slows soil development in an arid ecosystem. Ecosphere 4(5): article 52.

25. Coble, A. A., & Hart, S. C., 2013. The significance of atmospheric nutrient inputs and canopy interception of precipitation during ecosystem development in piñon–juniper woodlands of the southwestern USA. Journal of Arid Environments 98: 79–87.

26. Cui, S., Shi, Y., Groffman, P. M., Schlesinger, W. H., & Zhu, Y. G., 2013. Centennial-scale analysis of the creation and fate of reactive nitrogen in China (1910–2010). Proceedings of the National Academy of Sciences 110(6): 2052–2057.

27. Das, R., Bizimis, M., & Wilson, A. M., 2013. Tracing mercury seawater vs. atmospheric inputs in a pristine SE USA salt marsh system: Mercury isotope evidence. Chemical Geology 336: 50-61.

28. DiGirolomo, M. F., Allen, D. C., Stehman, S. V., Stout, S. L., & Wiedenbeck, J., 2013. Insect damage to wind-thrown and standing live black cherry resulting from delayed salvage after a major abiotic disturbance. Northern Journal of Applied Forestry 30(3): 101–108.

29. Divers, M. T., Elliott, E. M., & Bain, D. J., 2013. Constraining nitrogen inputs to urban streams from leaking sewers using inverse modeling: Implications for dissolved inorganic nitrogen (DIN) retention in urban environments. Environmental Science & Technology 47(4): 1816–1823.

30. Dodson, J., 2013. Final report: Nutrient TMDL for Jackson Blue Spring and Merritt's Mill Pond (WBIDs 180Z and 180A). Nutrients January 2013.

31. Eckley, C. S., Parsons, M. T., Mintz, R., Lapalme, M., Mazur, M., Tordon, R., ... & St Louis, V., 2013. Impact of closing Canada's largest point-source of mercury emissions on local atmospheric mercury concentrations. Environmental Science & Technology 47(18): 10339–10348.

32. Epstein, D. M., Neilson, B. T., Goodman, K. J., Stevens, D. K., & Wurtsbaugh, W. A., 2013. A modeling approach for assessing the effect of multiple alpine lakes in sequence on nutrient transport. Aquatic Sciences 75:199–212. doi:10.1007/s00027-012-0267-2.

33. Evans, D. M., Schoenholtz, S. H., Wigington Jr., P. J., Griffith, S. M., & Floyd, W. C., 2013. Spatial and temporal patterns of dissolved nitrogen and phosphorus in surface waters of a multi-land use basin. Environmental Monitoring and Assessment 1–15.

34. Faustini, J., Thom, T. A., Hunt, K. J., Nilius, R., & Burns, R. E., 2013, November. Water resource inventory and assessment: Cape Romain National Wildlife Refuge, Charleston County, South Carolina. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, Georgia. 84 p.

35. Florida Department of Environmental Protection, 2013. Final Report: Mercury TMDL for the State of Florida, Watershed Evaluation and TMDL Section, October 24, 2013.

36. Franzen, C., 2013. Determination of Atmospheric Mercury and its Deposition in Remote Areas of the Northern and Southern Hemisphere. Dissertation, Ruprecht-Karls-Universität, Heidelberg, Germany.

37. Freedman, Z., Eisenlord, S. D., Zak, D. R., Xue, K., He, Z., & Zhou, J., 2013. Towards a molecular understanding of N cycling in northern hardwood forests under future rates of N deposition. Soil Biology and Biochemistry 66: 130–138.

38. Gay, D. A., Schmeltz, D., Prestbo, E., Olson, M., Sharac, T., & Tordon, R., 2013. The Atmospheric Mercury Network: Examination of a long-term atmospheric mercury record across North America. Atmospheric Chemistry & Physics 13: 11339–11349. doi:10.5194/acp-13-11339-2013.

39. Geddes, J. A., & Murphy, J. G., 2013. Observations of reactive nitrogen oxide fluxes by eddy covariance above two mid-latitude North American mixed hardwood forests. Atmospheric Chemistry and Physics Discussions 13(10): 27891–27936.

40. Goss, N. R., Mladenov, N., Seibold, C. M., Chowanski, K., Seitz, L., Wellemeyer, T. B., & Williams, M. W., 2013. Quantifying particulate matter deposition in Niwot Ridge, Colorado: Collection of dry deposition using marble inserts and particle imaging using the FlowCAM. Atmospheric Environment 80: 549–558.

41. Gu, B. & Howard, N., 2013. Annual Permit Compliance Monitoring Report for Mercury in Downstream Receiving Waters of the Everglades Protection Area. Appendix 3-2, Attachment F in 2012 South Florida Environmental Report Vol III. South Florida Water Management District, West Palm Beach, FL.
http://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_sfer/portlet_prevreport/2013_sfer/v3/appendices/v3_app3-2.pdf .

42. Guretzky, J. A., Schacht, W. H., Wingeyer, A., Klopfenstein, T. J., & Watson, A., 2013. Litter deposition and nitrogen return in rotationally stocked smooth bromegrass pastures. Agronomy Journal 105 (4): 915–921.

43. Hale, R. L., 2013. Coupled Hydrology and Biogeochemistry in Social-Ecological Watersheds. Dissertation, Arizona State University.

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Appendices

National Atmospheric Deposition Program 2013

Annual Meeting and Scientific Symposium

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Joint Subcommittee Meeting
Park City, Utah
October 8, 2013

- Welcome – Mark Olson
  - broadcast and recording of Joint/NOS through anymeeting.com
  - Richard Tanabe will be taking minutes due to NOS Vice-chair and Secretary unavailable to attend due to Shutdown

- ***Motion to approve*** *minutes from Spring Meeting – Madison, WI moved by Chris Lehmann, seconded by Pam Padgett****. Minutes approved.***

- Introductions around the room.

- State of the NADP (David Gay)
  - Joint/NOS/Symposium/N Flux Workshop will be on-line

Financial Highlights - Income and Expenses
FY14 6.2% increase over FY13
- majority of dollars are spent @ labs
- CAL 45%, HAL 24% accounts for ~70%
- Personnel 25%
- Line items 5%
  - Acid Rain 2015 13% - Combined with Fall Meeting, expected 600-900 attendees for conference

Network & Site News

NTN
- PA – Integrated the PA State Network 15-18 sites in the state
- NY – Integrated NY State Network
- Canada – BC22, SK20, SK21
- Argentina – still running, some shipping issues

- Since Oct 2012
- 1 lost, 11 added, 265 sites total

- New map for NTN/AIRMoN – Bromide is the map on the Annual Report Cover

AIRMoN
- VT99 closed on May 31, 2013
- Down to 6 sites and holding

AMoN
Since Oct 2012
- 1 lost (Kansas), 6 added, there will be 64 sites

- Substantial QA database

MDN
Since Oct 2012
- 4 lost, 2 added, 109 sites and some coming
- 16 methyl, 54 co-located, 7 urban, 4 daily
- Great Lakes Atmospheric Mercury Network
  - 9 new MDN sites (2 with continuous funding)
  - Fill in the gap for Michigan, Ohio, Indiana

AMNet
Since April 2012
- 3 lost, 7 added, 22 currently

Mercury Litterfall Initiative
- successful year 2012
- 14 sites
- 2013 sampling occurring now
  - 13 sites
  - Puerto Rico coming – will be year round sampling

Current Electronic Rain Gauge Network
- 260 out of 312
- 10-12 have e-gauges but not operating
- 85% of network is digital

Webinar Training
- started 2013
- alternating between the CAL and HAL
- 30-35 people
- a few technical issues early on, resolving issues with new equipment
- saving money
- how effective is yet to be seen
- training more, may not be as good/effective compared to in-person training

Recent Travel
- April in Montreal : Tri-national Workshop on Assessment of Monitoring Results from Mexico's PRONAME Program
- May in Chicago: Precipitation Chemistry Science Advisory Group
- May in Phoenix: National Tribal Forum
- Rochester : Acid Rain 2015 scouting trip

- CAL Status Report (Chris Lehmann)

Detailed report available at http://go.illinois.edu/NADPCALREPORT

New CAL Staff
- Tracey Dombek has left
- Annette Wells (FIA)
- Dr. Sybil Anderson (Special Projects)
- Katie Blaydes (ICP)
- Gustava Hoskins (Technician)
- Will add one more for shipping/receiving
- NADP Graduate Intern: Marcelo Vieira Silva

Other Staff changes
- Nina Gartman – CAL QA & Method Analyst
- Lee Green – CAL Lab Supervisor
- Brian Kerschner – Assistant Data Manager

Update analytical methods
- sulfite by IC
- Nitrite by Colorimetry
- Using passive samplers for ambient NO2 and SO2
- Total Nitrogen

New reports and data products
handling of low volume samples
See NOS for discussion

Site Operations and Site Support
- NTN – 11 new, 1 closed, 55 sites with significant issues
- AIRMoN – 1 closed, 1 with significant issue
- AMoN – 6 new, 1 closed, 1 with significant issues

CAL site support – Jeff Pribble
- Webinars on-line http://go.illinois.edu/NADPTraining

Lab Operations
- 2004 266 sites
- 2013 back to 265 sites
- CAL still has the capacity to absorb growth ~ 40-50 sites
- CAL detection limits
    - Excellent performance
    - By network and by instrument
    - Bromide still a concern – don't see it getting any lower

AMoN Sampler Issues
- updated cleaning procedures – consulted with manufacturer

- reduced the number of travel blanks
    - 1 in 4 sets

NTN/AIRMoN Archive Sample Distribution
- AIRMoN 3040 (1 research group)
- NTN 6020 (8 research groups)
- 2007 NTN currently being distributed
- 2009 AIRMoN currently being distributed

Data Deliverables - Average data lag
- NTN 67 days
- AIRMoN 49 days
- AMoN 79 days

Data Receipt Reports
- field forms scanned upon receipt and emailed back to NTN sites
- AIRMoN/AMoN – developing by end of year

Other Activities
- Total Nitrogen Deposition Study
- Total/Elemental Carbon Deposition Study
- Metro East St Louis Study completed
- Passive sampling of SO_2/NO_2
- Pursue as an expansion of AMoN Network
- Intern Ammonia Flux Study

Posters
- Sample Dilution Study
- AMoN 5 year Trends
- Training Webinars

- <u>HAL Report (Bob Brunette)</u>
    - review of Mercury Regulations

    MDN Site Startup/Shutdowns in 2013
    - LADCO support of ~ 20 MDN sites (~8-10 new)
    - Approximately half can get up and running quickly with existing sites/operators
    - High altitude locations – higher precipitation and higher Hg wet deposition
    - Makah MDN (WA03)
        - On life support from the HAL
        - Important site due to offshore flow
        - North American input, mostly non-US source influenced
    - proposal to monitor high altitude sites
    - high Hg deposition region not monitored

- corresponds to high inland lake and fish monitoring data (high fish Hg)

MDN Network Operations
Equipment Modernization
- ACM 56 (-5)
- NCON 52 (+5)
- Belfort 11 (-1)
- E-gage 97 (+1)

Site Liaison Activity
- 307 technical support calls
- 186 e-mails

Equipment Failures
N-CON
- 12 Thies sensors, 1 motor, 3 relays, 1 power cord/ 1 event recorder cable

ACM
- 14 motor boxes, 4 sensors, 4 heater, 1 thermostat

Ott Pluvio
- 1 gauge sent to Hach

ETI
- none

New staff - Dave Wunderlich – QA Manager since Oct 2012

HAL 2012 Lab Review
- specific recognition 11
- Findings 9

HAL database conversion
- Access to SQL conversion
- Submitted Nov 2012, original and new and compared
- Submitted to Program Office QA – 1st/2nd round
- HAL to submit response to 2nd round of comments

Data Deliverable Schedule
- submitted annual 2012 QA Report
- need to respond on comments

Commission new instrument
- automated Total Mercury Instrument
- comparison looks good, not final values
- close to green light to move forward

HAL proposal for NOS for collocated MDN/NTN site precip depth data
- when the gauge fails and no backup data, currently use bottle catch/bucket catch, may produce 2 different values
- there is a concern if challenged in court

HAL Sample Evaporation Study
- follow up from PO report Spring/Fall 2012 – PO data showed ACM evaporation with fan on
- HAL ran an 8 month study using 2 MDN ACM
- Not seeing losses so far

Trace Metal Initiatives
- 12 point plan – further discussion 2014
- 7 new Trace Metal Sites in 2013

Total Mercury Deposition at MDN sites
- estimate Dry Deposition of RGM (reactive gaseous mercury)Hg monitor
- passive system to supplement wet deposition
- HAL selected to support Natural Rivers and Streams Assessment 2013-14
- Measuring fish tissues

- <u>QA Report (Mark Rhodes)</u>

2012 QA Reports
- Field Survey – in progress
- HAL – comments from external reviewers received
- CAL – in progress
- AMNet – in progress

2013 QA Reports
- start working on reports

External Reviews
2013 Program Office – Aug 2013
- Gary Lear – USEPA (Team Leader)
- Kristi Morris – NPS
- Amy Ludke – USGS
- No report at this meeting as all reviewers are federal employees

2014 CAL
- Greg Wetherbee – USGS (Team Leader)
- Eric Hebert – EEMS
- Richard Tanabe – Environment Canada
- Chemistry person - ?

Site Survey – June 2013 (# completed)
- AIRMoN – 0, MDN – 18, NTN – 38, Collocated – 9
- AMNet – 2, AMoN – 5

Training Webinars
- CAL/HAL on alternate months
- AMNet pendingUSGS Field Audit Program recorded and posted in August

Updates in NOS
- SOP approval
- Revision to Site Selection and Installation Manual
- NTN Bag Sampling
- Sensor Study
- AMoN Travel Blanks
- Belfort Rain Gauge
- Methyl Mercury
- MDN Evaporation

SOP usage citation and disclaimer – other agencies/networks are using but not crediting NADP

Breakout to sub committees and meet back after lunch for continuation of Joint Sub-committee Meeting.

Call to Order – Mark Olson @ 13:39

- <u>Sub-Committee Reports</u>
  - See each sub-committee's minutes for details and highlights from the individual meetings

- <u>Webinar Training (Jason Karlstrom)</u>

  NADP Site operations On-Line Training Sessions
  - using anymeeting.com
  - Since the Spring meeting there have been 8 sessions
  - MDN 18-22 attendees
  - NTN 21-34 attendees

  Technical issues
  - YouTube is often blocked on attendees computers
  - YouTube videos are not viewable in recordings
  - Live demos not best due to lack of multiple viewing angles
  - Significant audio issues – USGS webinar in August and MDN sample change webinar
  - Upcoming webinars 2013-10-30 AMON and 2013-11-13 NTN FORF
  - After the audio is resolved, need to redo the sample change
  - Other topics monthly data review, MDN overview
  - Sample video was played

Discussion

- Are other technologies available [Cari Furness]
- Possible to have operators watch every few years, customize a DVD eventually [Jason Karlstrom]
- host on NADP server [Chris Lehmann]
- consider production options [Cindy Huber]
- may be training the same people every time [Jason Karlstrom]
- are operators/supervisors notified [Mark Rhodes]
- for MDN note goes in coolers, e-mails also go out for both NTN and MDN [Jason Karlstrom]

- <u>Mercury Litterfall Report (David Gay)</u>
  - second year – 13 sites, in 2012 there were 14 sites
  - data in on time
  - data is not released on web
  - some numbers are quite large
  - moving along quite nicely
  - advertised this year and got some more sites

- <u>AMNet Report (Mark Olson)</u>

  2013 Progress Report
  - 18 to 22 sites up 20%
  - OH02 back on line
  - OH52, Toledo, Lake Erie
  - Soon to add AK03, first GEM only site
  - Presque Isle, Maine on-line in November 2013

  Site Visits
  - 13 in 2013
  - 4 for the first time
  - 9 repeat
  - next up is NS01, MD08
  - NYSDEC site visits – shuffling of equipment at sites
  - NYSERDA supports 3 NY sites

  AMNet Data Availability

  Data Posting Lag Times
  - Reduce lag between collection and submission
  - Work toward real time data submission
  - Collocate 2537X and speciation at WI07 (Aug 2013)

  What's next?
  - expected data transfer
  - site visits
  - expansion to Asia

- NY State relocation of 3 sites
- Continue collocation in WI

Questions
- Is Tekran providing new instrument for approval [Mark Rhodes]
- 2537X – NADP is in possession at WI07, rest of Speciation system from Florida DEC [Mark Olson]

- Shutdown Samples (Chris Lehmann)
  - there were 47 NTN site changes on September 30
  - 194 hours? Once sample exceeds, what to do with the data? Invalidate?
  - Pam Padgett – NPS asked for furlough exemption for CA94
  - Will have to look at on a case by case basis

- AMoN Status Report (Chris Lehmann)
  - 64 AMoN sites
  - 3 new Canadian sites

  Average Concentrations 2012
  - time weighted mean
  - quarterly relative concentration

  Independent Audit Program
  - 8 sites participated in independent audit program

  Passive Sampler Precision
  - 2007-2010 triplicates on all deployments
  - 2011-present triplicates on 5%
  - Precision data quality 20%

  Travel Blanks
  - remains an interesting problem
  - the lab continues to test, including staff lunches

  QA – DQO – Spring Meeting
  - Sigma-Aldrich coupler – drilled & tapped for 5/16" – #18 bolt
  - Why Radiello PDS (passive diffusion sampler)?
    - Comparison with Alpha, Ogawa
    - Collocated at Bondville
    - Not sure if Alpha is still available
    - Ogawa – not sure if still a US distributor

  Current AMoN Research
  - MARGA comparison

Planned Activities
- collocate IL11 Pranalytica NH3
- NH3 Chamber Exposure Study
- AWMA – 5 year trend test
- Significant trends ($p<0.1$) at 8 sites, no trend at 6 sites

- Nitrogen Flux Workshop Update (Chris Rogers for John Walker)
  - update on the block agenda on web

- Wednesday Symposium Start time at 9:15 am
  - "1st Deposition Dash" will start at 7:00am, meet in the lobby for a walk/run
  - 3 miles or 1 hour

- Spring 2014 Meeting – Ft Lauderdale, FL
  April 14-17, 2014
  Sheraton Ft. Lauderdale Beach Hotel
  Reservation Deadline: March 14, 2014

- Fall 2014 Meeting – Indianapolis, IN
  Date: TBD (maybe in September)

- NADP Secretary Nominations – Andy Johnson for Kathleen Weathers
  -recommended nominee: Emily Elliott from University of Pittsburgh

- Other Business
  Chris Rogers
  - what to do with MeHg database
  - very close – have something for spring
  - move forward

  MOTION: Pending HAL and Program Office resolving questions arising from Mark Rhodes' study, that the recalculated Program Office Methyl Mercury data be made available on the website as soon as practical.
  Moved by Chris Rogers, seconded by David Gay

  Discussion:
  - HAL reports already available [Mark Olson]
    - If the published values are different, is it a problem
    - Reports are stamped preliminary

  - If significant differences at site, what is the correct value, look to see why there is a difference and if significant, which is correct? [Bob Larson]

- Rounding issues when blank correcting [Jason Karlstrom]
    - thresholds for differences
- posting subset not all the data, why not accept HAL values as is the case with total Hg [Mark Rhodes]
- Moving forward is PO doing calculation [Mark Olson]
    - historical calculated by PO
    - accept HAL values moving forward

Friendly Amendment's

1. ***2002-2012 use Program Office data***
2. ***Going forward the HAL's values will be used***
3. ***Provide data advisory***

Abstain: Mark Rhodes
Motion passed with friendly amendments

- ***Motion to adjourn*** *moved by Pam Padgett, seconded by Tom Butler.* ***Motion Passed****.*