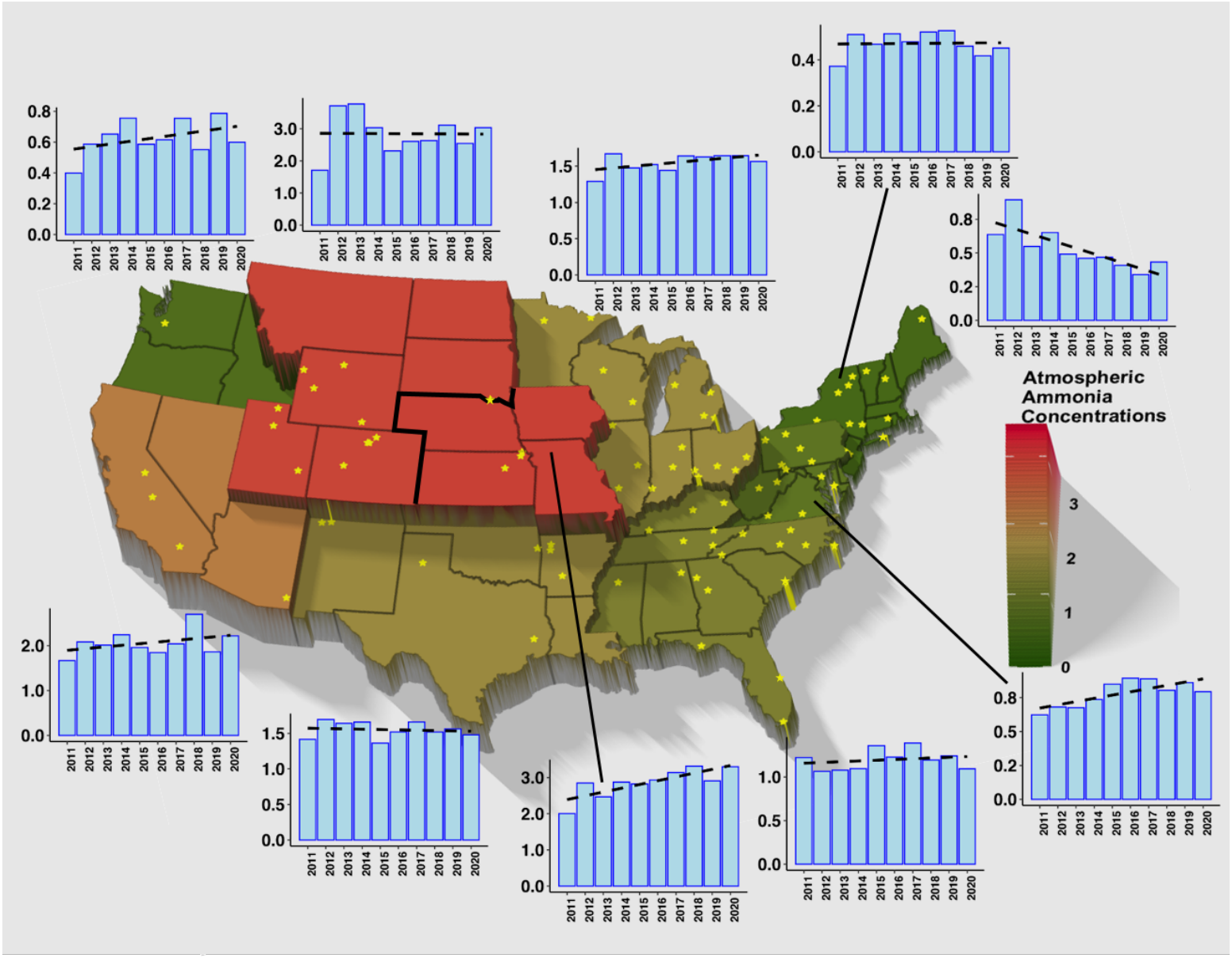
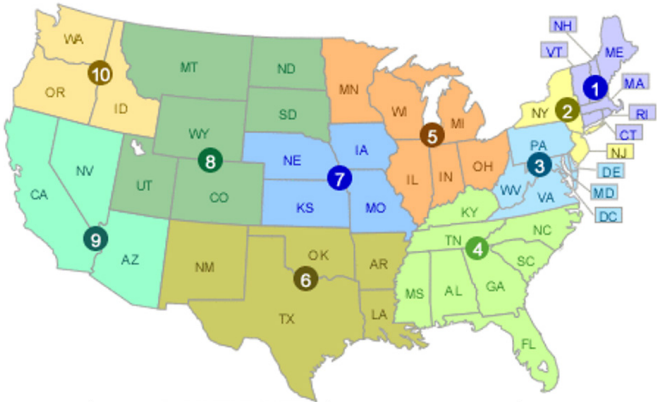
National Atmospheric Deposition Program

2020 Annual Summary



Atmospheric Ammonia Concentrations and Trends by Region

On the cover: Average ammonia concentration (in ug/m^3) for AMoN sites across the United States. The base map shows the stations and the regions of the U.S. (US EPA Regions) with the color of the region showing the average concentrations for all sites, seasons, and years (2011-2020). The inset bar graphs depict the general trends in these concentrations over time for all sites, seasons and years. Trends are Mann Kendall Seasonal Trends. Only sites with more than 5 years of observations are included here.



When referencing maps or information in this report, please use the citation: National Atmospheric Deposition Program, 2021. National Atmospheric Deposition Program 2020 Annual Summary. Wisconsin State Laboratory of Hygiene, University of Wisconsin-Madison, WI.

Contents

2020 Highlights 4
NADP Background..... 8
About the Maps.....10
National Trends Network (NTN).....12
Mercury Deposition Network (MDN) 22
Atmospheric Mercury Network (AMNet) 24
Ammonia Monitoring Network (AMoN) 26

2020 Highlights

The National Atmospheric Deposition Program (NADP) provides high-quality, robust measurements that support informed decisions about environmental and public health issues as they relate to atmospheric deposition chemistry, and advance our understanding of atmospheric processing through the measurement of gaseous ammonia and mercury. NADP data is relevant to scientists, educators, policymakers, and the public. All data is available without charge on the NADP website (http://nadp.slh.wisc.edu).

The NADP is composed of four networks, including the National Trends Network (NTN), the Mercury Deposition Network (MDN), the Atmospheric Mercury Network (AMNet), and the Ammonia Monitoring Network (AMoN). The table below summarizes the number of measurements from each network in 2020.

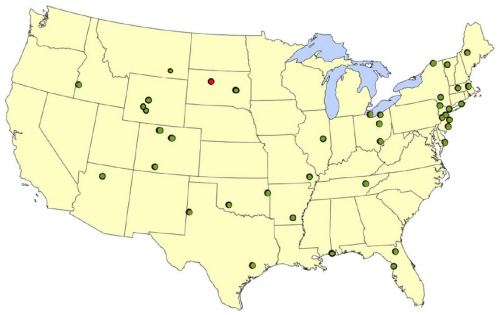
Summary of 2020 Network Measurements

Network	Measurements	Period	No. of sites
NTN	12,805	weekly	260
MDN	4,121	weekly	80
AMNet	37,765	hourly/ 2-hourly	10
AMoN	3,756	two week	115

Highlights:

COVID-19 Summary: As with all operations, COVID-19 had a detrimental impact on the operation of NADP. With the spread of the disease starting around January in the U.S., there was a looming concern that samples would not be collected at many of our sites and could slow all networks. However, after the year was over, it became quite apparent that the pandemic did not have nearly the impact on sample collection as was feared (see graphic for sites affected). The largest impact by percentage was to MDN. There was also some impact to the maps: note the Northeast in NTN. The laboratories never stopped working; 80% of sites were operating normally by July, and the longest site was stopped for 370 days. One site did not restart.

Network	NTN	MDN	AMoN	Total
Suspended Sites	36	18	6	60
% Suspended	14%	21%	6%	13%
Missed Samples	472	202	25	699
% of Total Samples	3%	7%	1%	5%



- Another impact of COVID-19 was on the 2020 Fall Scientific Symposium. The meetings were the first held completely virtually. Even though we were not in the same location, most people were happy with the meeting overall. It was held from October 26-31, 2020 with the business meetings held the following week. The meeting was originally planned for Knoxville, TN. The meeting was extremely well attended, with approximately 284 registrants, including many international attendees. The meeting also

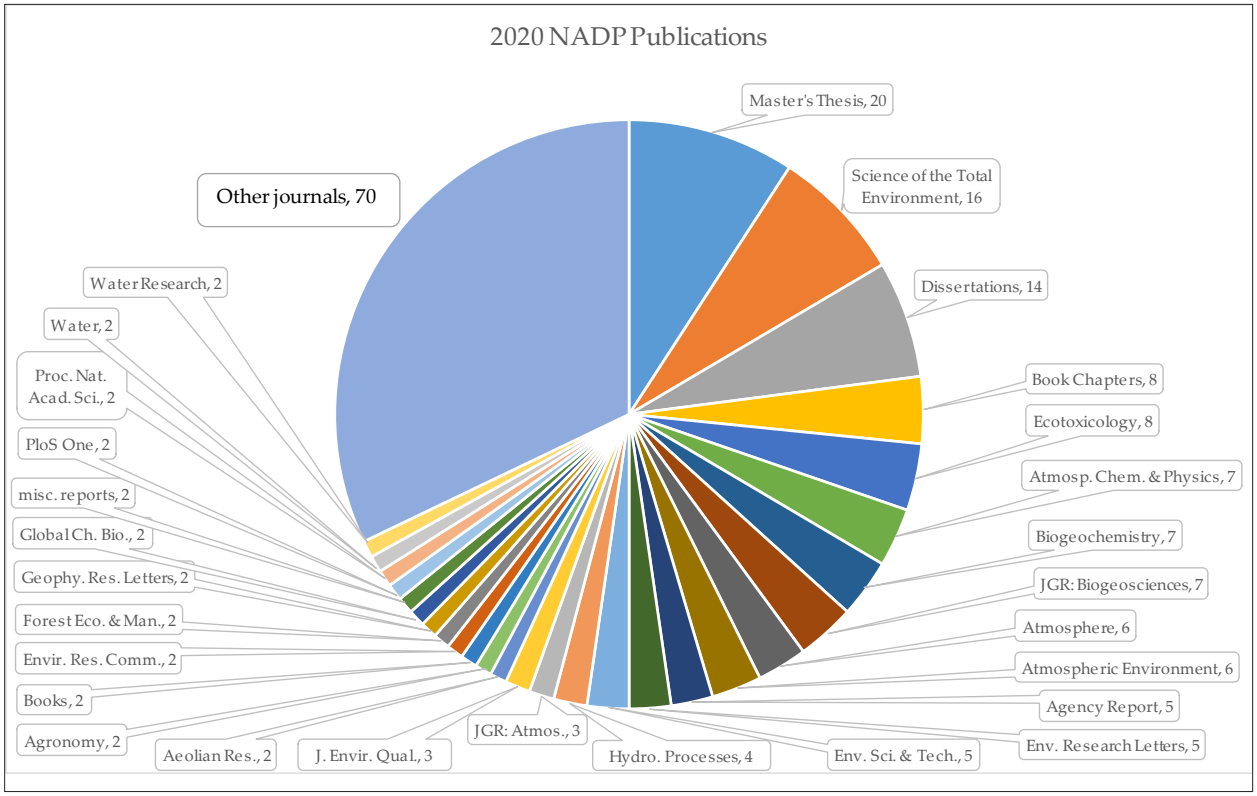
included one keynote speaker (Dr. L. Myles, NOAA) who spoke on atmospheric research in the 21st century.

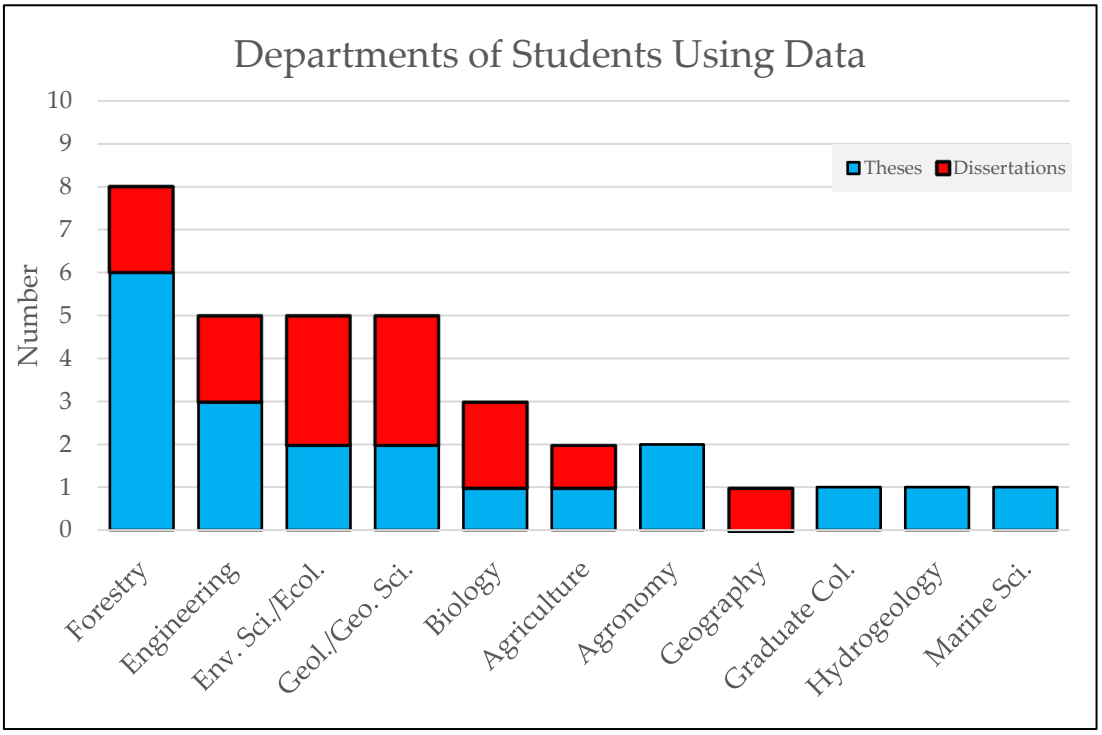
- During 2020, all functions of the NADP became part of the Wisconsin State Laboratory of Hygiene. First to transition to the WSLH were the NTN, AMoN, AIRMoN, and AMNet networks. During 2019, the MDN sample collection and analysis were moved to the laboratory starting in June. And finally, the Mercury Litterfall Initiative was moved in the Summer of 2020, leaving no outstanding operation of NADP at other universities, laboratories, or government agencies.

- The NADP supported 217 journal and report publications during the 2020 calendar year. See the charts below and on page 6 for more detail of the publication types, journals and departments of graduate work.

Publications included:

- 14 Doctoral Dissertations
- 19 Master's Theses
- 10 books and book chapters
- 1 *Science* and 1 *Nature* journal articles





- The Mercury Litterfall Initiative, originally with the U.S. Geological Survey (USGS), completed the sampling collection and analysis at the State Laboratory of Hygiene. This is the first year where all work for the network was accomplished by NADP. This is the 7th full year of operation for the network. A motion to the Executive Committee was accepted to make the initiative a full NADP network ("Mercury Litterfall Network") at the Spring Meeting, 2021.
- **UPDATE:** The long lifespan of the Belfort mechanical precipitation gages continues, but has been further reduced. During the year, NADP was able to remove 9 Belfort gages, and replace them with new digital precipitation gages. This leaves 5 Belfort gages still in the network. Additionally, fewer personal digital assistants (PDAs) are being used by sites. Currently there remain approximately 30 PDAs still being used in the network.

NADP will again try to convert the remainder to an alternate style of data collection during the year (Android phones, satellite transmission, etc.).

- Total Nitrogen & Phosphorus Sampler: During the year, an effort got underway to test a new "subsampler" for an NTN site to measure both total nitrogen and total phosphorus in precipitation. We currently measure nitrate, ammonium, and ortho-phosphate in filtered precipitation. But we plan to measure TN and TP in unfiltered precipitation, or measure true total N and P. The thought is that this subsample, if it is accurate and inexpensive, could be additional NTN analytes in the future. Also, organic N could be determined by difference. Testing is continuing in 2021.
- The 2020 sampling year was the 43rd sampling year for NTN, the 25th sampling year for MDN, the 12th sampling year for AMNet, and the 11th for AMoN.

Operator Recognition Award - Francis “Hoss” Parks

Inaugural Year: 2021

Nominated by Winston Luke, Ph.D., and Richard S. Artz (retired)

It is our great pleasure to nominate Mr. Francis W. “Hoss” Parks for the inaugural National Atmospheric Deposition Program’s Operator Recognition Award. On behalf of the NOAA Air Resources Laboratory (ARL), Mr. Parks has operated NADP’s National Trends Network (NTN) site on Smith Island, MD (MD15) since 1995. In the early 1990s, ARL partnered with coastal scientists to better determine the importance of atmospheric deposition to overall nitrogen loadings in the Chesapeake Bay watershed. To do that, we required the services of a top-quality operator at a remote site representative of background loadings in the bay region. We were very fortunate to hire Mr. Parks for the task, and he has demonstrated a remarkable dedication to excellence throughout his career with ARL. He has unfailingly collected daily and weekly precipitation samples for over 25 years, and has even postponed needed medical procedures to ensure that sample collection continued without interruption. Mr. Parks is also among a select group of site operators who work to maintain, rebuild, and improve site infrastructure at considerable cost savings to the program; continually provides valuable feedback to the NADP Program Office and Central Analytical Laboratory to improve sample deployment and collection protocols; and strives tirelessly to collect some of the highest-quality precipitation samples in the entire National Trends Network. For these and so many other reasons, we feel that Mr. Parks is richly deserving of the very first NADP Operator Recognition Award.

For 25 years of dedicated, meritorious service to NADP above and beyond the call of duty.

Photo credit: Michael O. Snyder https://www.michaelosnyder.com/erodingedges

NADP Background

The NADP was established in 1977 under State Agricultural Experiment Station (SAES) leadership to address the problem of atmospheric deposition, and its effects on agricultural crops, forests, rangelands, surface waters, and other natural and cultural resources. The NADP's primary charge was to provide data on the temporal trends and geographic distribution of the atmospheric deposition of acids, nutrients, and base cations by precipitation. In 1978, sites in the NADP precipitation chemistry network first began collecting weekly, wet-only deposition samples. Chemical analysis was performed at the Illinois State Water Survey's Central Analytical Laboratory (CAL), located at the University of Illinois at Urbana-Champaign and the Program Coordinator was housed at Colorado State University.

Initially, the NADP was organized as SAES North Central Regional Project NC-141, which all four SAES regions further endorsed in 1982 as Interregional Project IR-7. A decade later, IR-7 was reclassified as the National Research Support Project No. 3 (NRSP-3), which it remains to this day. NRSP projects are multistate activities that support research on topics of concern to more than one state or region of the country. Multistate projects involve the SAES in partnership with the USDA National Institute of Food and Agriculture (NIFA) and other universities, institutions, and agencies.

In October 1981, the federally-supported National Acid Precipitation Assessment Program (NAPAP) was established to increase our understanding of the causes and effects of acidic precipitation. This program sought to establish a long-term precipitation chemistry network of sampling sites away from point source influences. Building on its experience in organizing and operating a national-scale network, the NADP agreed to coordinate operation of NAPAP's National Trends Network. Later, to benefit from identical siting criteria, operating procedures, and a shared analytical laboratory, NADP and NTN merged with the designation NADP/NTN. This merger brought substantial new federal agency participation into the program. Many NADP/NTN sites were supported by the USGS, NAPAP's lead federal agency for deposition monitoring.

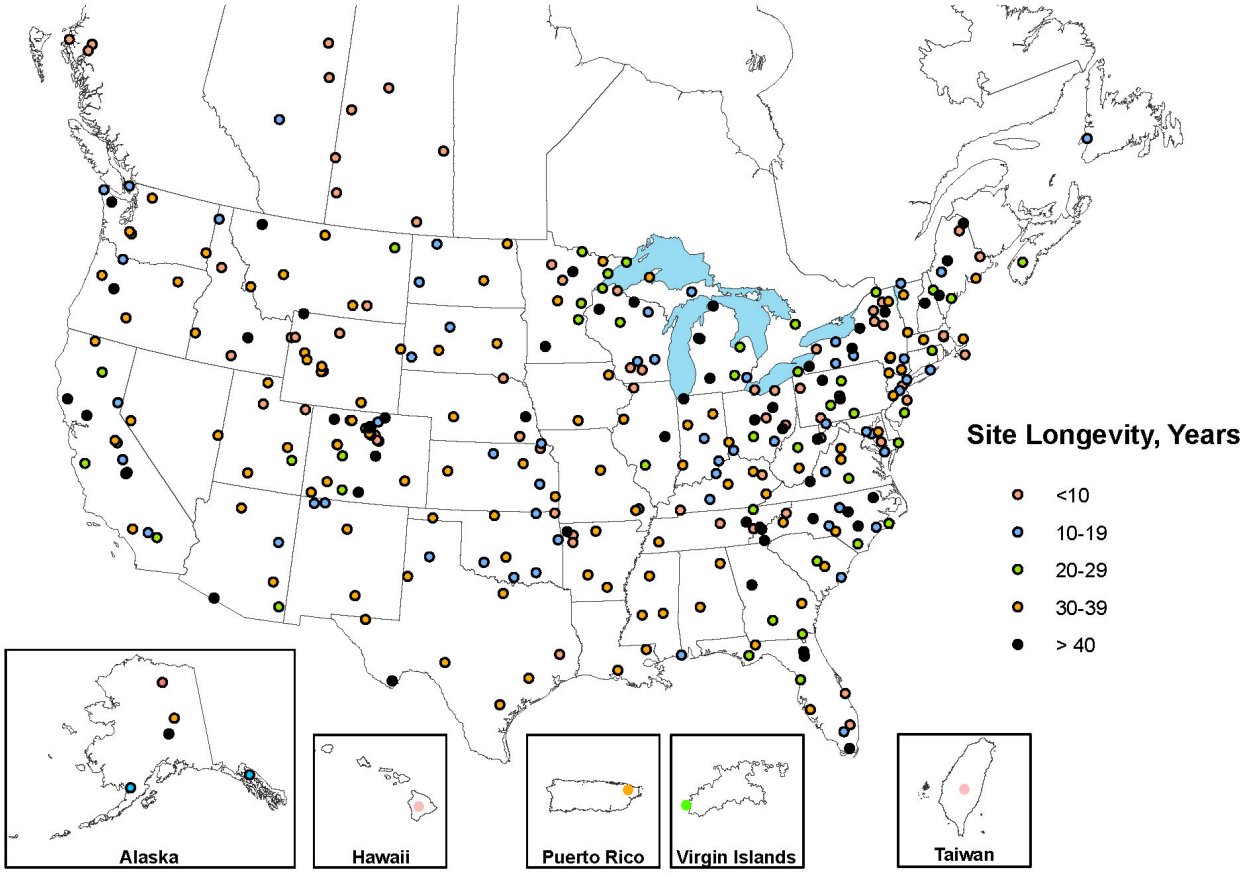
In October 1992, the AIRMoN was formed from the Multistate Atmospheric Power Production Pollution Study (MAP3S), which was operated by the Department of Energy and NOAA. MAP3S measured wet deposition and estimated dry deposition (later discontinued) for the same analytes. AIRMoN sites collect samples daily when precipitation occurs, and are analyzed for the same analytes as NTN samples.

In January 1996, the NADP established the MDN, the third network in the organization. The MDN was formed to provide data on the wet deposition of mercury to surface waters, forested watersheds, and other receptors. MDN samples, like NTN samples, are weekly collections.

In October 2009, AMNet joined the NADP as its fourth network. AMNet measures the concentration of atmospheric mercury at high-time resolution using on-site, real-time analyzers.

In October 2010, AMoN joined the NADP. Atmospheric ammonia concentrations are measured every two weeks using passive samplers. The AMoN furthers the understanding of wet and dry deposition and ammonia partitioning in the atmosphere, allowing better assessment of ecosystem impacts and secondary air pollution formation.

Beginning in late 2017 and completed in mid-2018, the NADP PO and CAL moved from the University of Illinois at Urbana-Champaign to the University of Wisconsin–Madison. In June 2019 the HAL moved to the University of Wisconsin–Madison. Also in 2019, AIRMoN collected its last sample and the network was closed.



Global distribution and longevity of NADP sites.

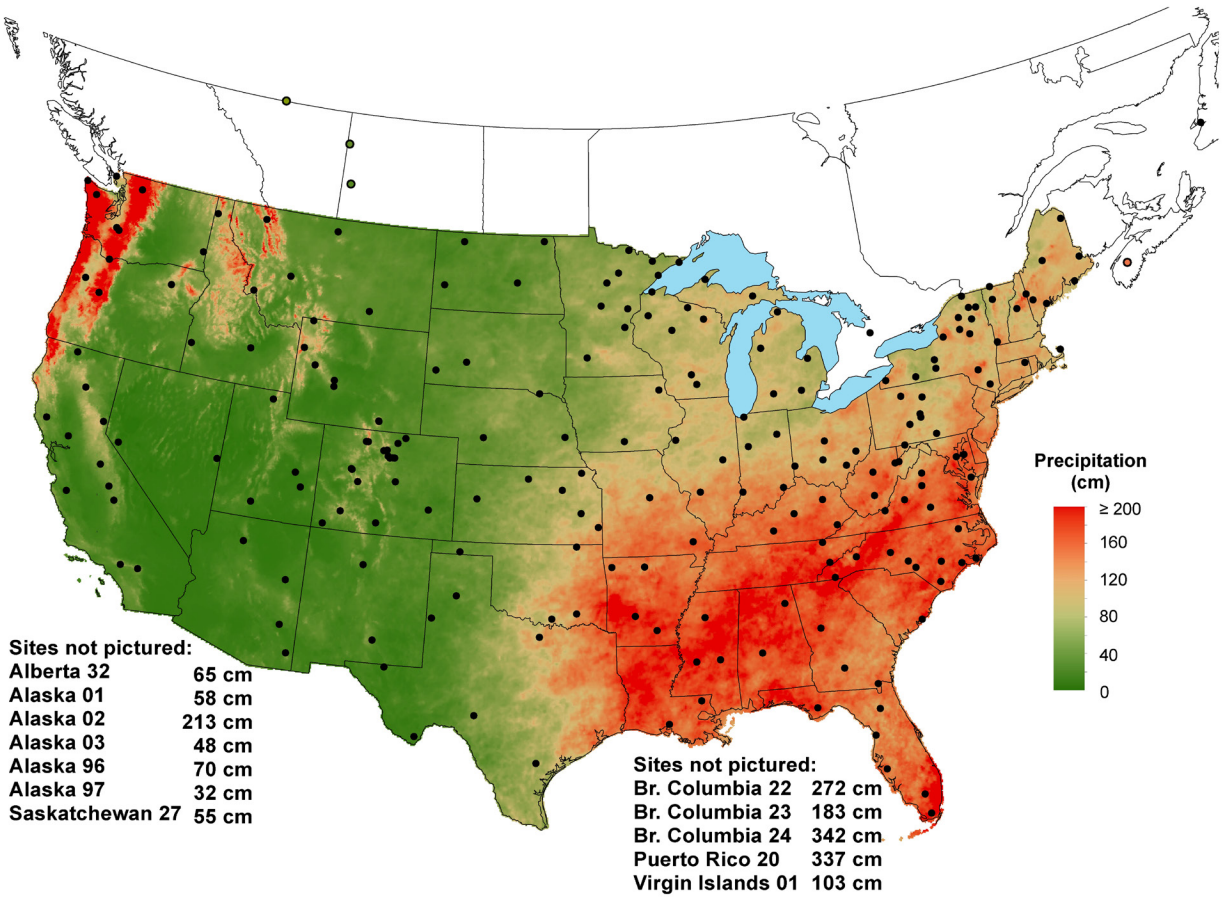
About the Maps

This map series is a principal product of the NADP. It summarizes the results of network operation for the most recent complete calendar year in graphical form. Additional maps, related geographic information, and reviewed analytical results are available on the NADP website.

To be included in a map product, site data must meet strict data completeness criteria (see the NADP website for details). Black dots mark site locations that met NADP completeness criteria in 2020. Open circles designate urban sites, defined as having at least 400 people per square kilometer (km^2) within a 15-km radius of the site. Sites (e.g., Canadian sites) that are too far removed from other observations to extend the contour surface are represented as color-filled circles.

The map contour surface represents a gridded interpolation. Grid points within 500 km of each site are used in computations. Urban sites do not contribute to the contour surface. Colors represent interpolated values of concentration, deposition, or precipitation. The precipitation surface is a modified version of the U.S. precipitation grid developed by the PRISM Climate Group ("Parameter-elevation Regressions on Independent Slopes Model," http:// prism.oregonstate.edu, data downloaded September 2021). These annual precipitation estimates incorporate point data, a digital elevation model, and expert knowledge of complex climatic extremes to produce continuous grid estimates. NADP precipitation observations are used to supplement the PRISM precipitation grids through an inverse distance weighting within a 20 km radius of each NADP site (see the NADP website for specific information). The resulting precipitation map is used to generate the deposition maps.

The precipitation figure on the next page has a continuous gradient of color from dark green (0 cm of precipitation) to yellow to dark red (greater than 200 cm of precipitation). Concentration and deposition maps follow this same format, with specified units on each map. All maps back to 1985 follow this schema and are available in multiple formats from the NADP website (http://nadp.slh.wisc.edu).



Total annual precipitation for 2020, using precipitation measurements from the NADP and PRISM (in cm).

National Trends Network (NTN)

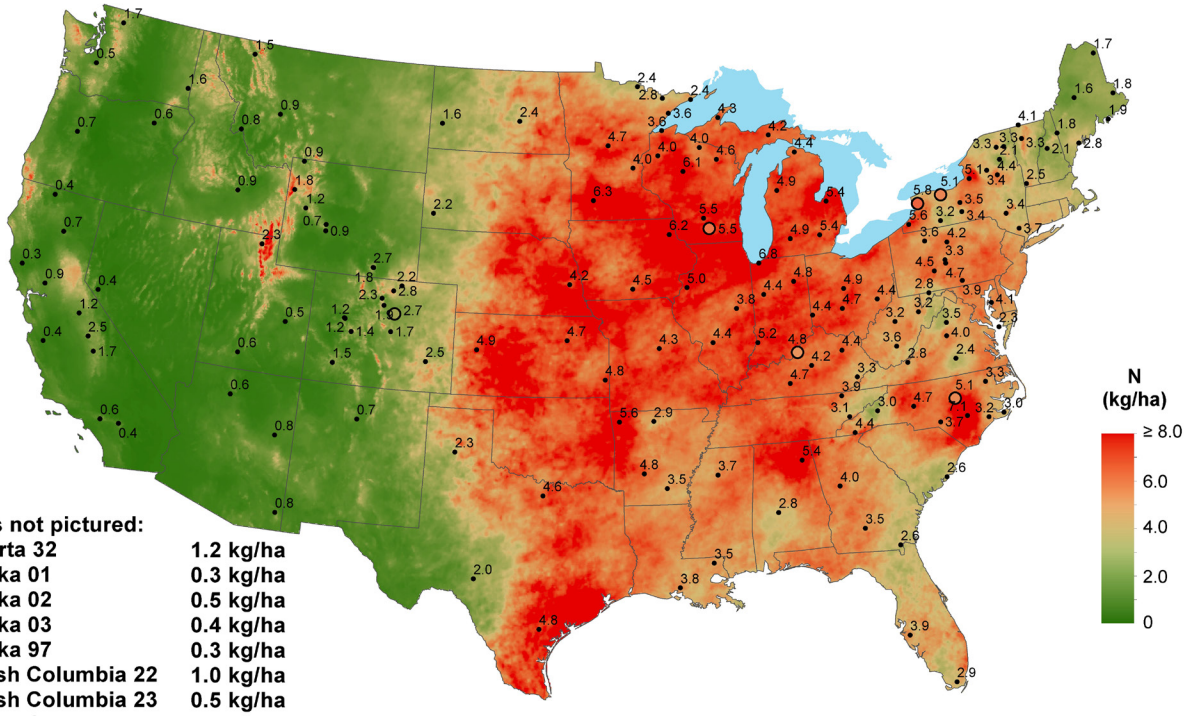
The NTN is the largest North American network that provides a long-term record of precipitation chemistry. Most sites are located away from urban areas and point sources of pollution, although urban sites do participate. Each site has a precipitation collector and rain gage. The automated collector ensures that sampling only occurs during precipitation events. Site operators follow standard operating procedures to help ensure NTN data comparability and representativeness across the network. Weekly samples are collected each Tuesday morning, using containers provided by the CAL. All samples are sent to the CAL for analysis of free acidity (H^+ as pH), specific conductance, calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), and ammonium (NH_4^+) ions. The CAL quantifies orthophosphate for quality assurance purposes, as an indicator of potential field contamination. The CAL reviews field and laboratory data for accuracy and completeness and flags samples that were mishandled, compromised by equipment failure, or grossly contaminated. Data from the NTN are available on the NADP website (http://nadp.slh.wisc.edu/).

NTN Maps

The maps on pages 13 through 21 show precipitation-weighted mean concentration and annual wet deposition for select acid anions, nutrients, and base cations. Substantial spatial heterogeneity across the nation is apparent for all measured species. In 2020,

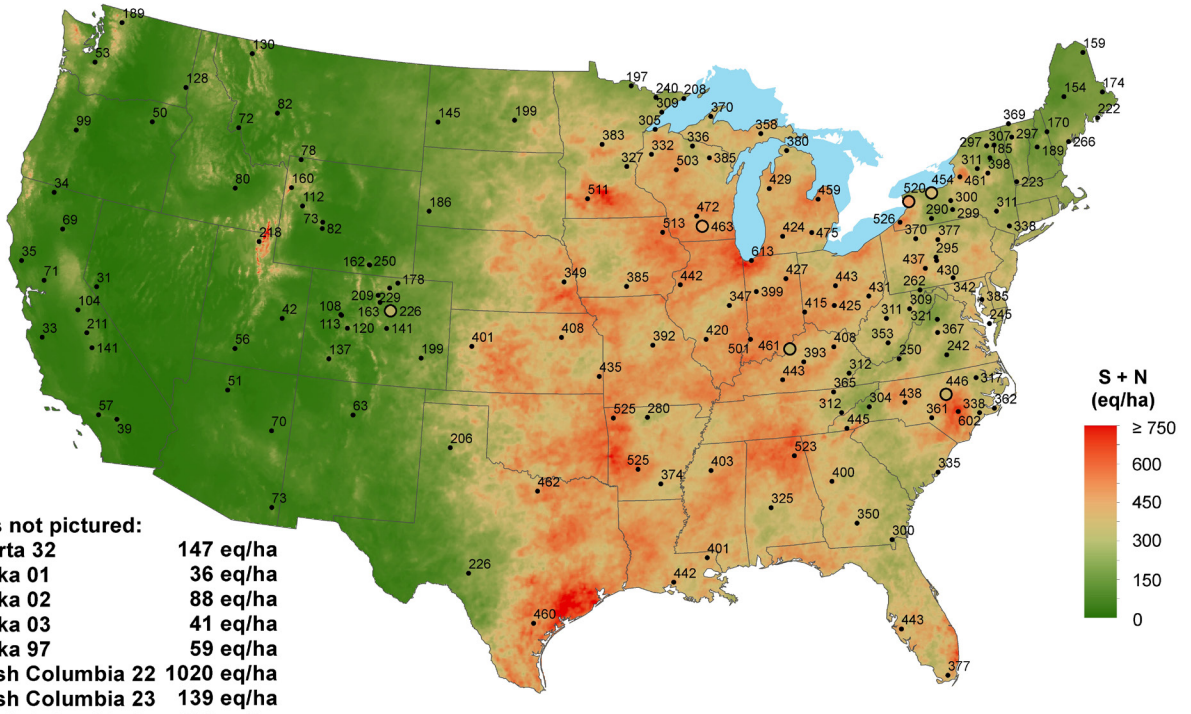
170 of the 260 active sites met NADP completeness criteria. Concentration and deposition maps are included for SO_4^{2-}, NO_3^-, NH_4^+, pH, Ca^{2+}, Mg^{2+}, Cl^-, and Na^+. Maps of K^+ are not included in this report, but are available from the NADP website.

Annual maps for wet deposition of inorganic nitrogen (i.e., $NO_3^- + NH_4^+$) and sulfur + nitrogen (S + N) are also included. S + N (i.e., $SO_4^{2-} + NO_3^- + NH_4^+$) deposition is mapped as hydrogen ion equivalents per hectare (eq/ha).



Sites not pictured:

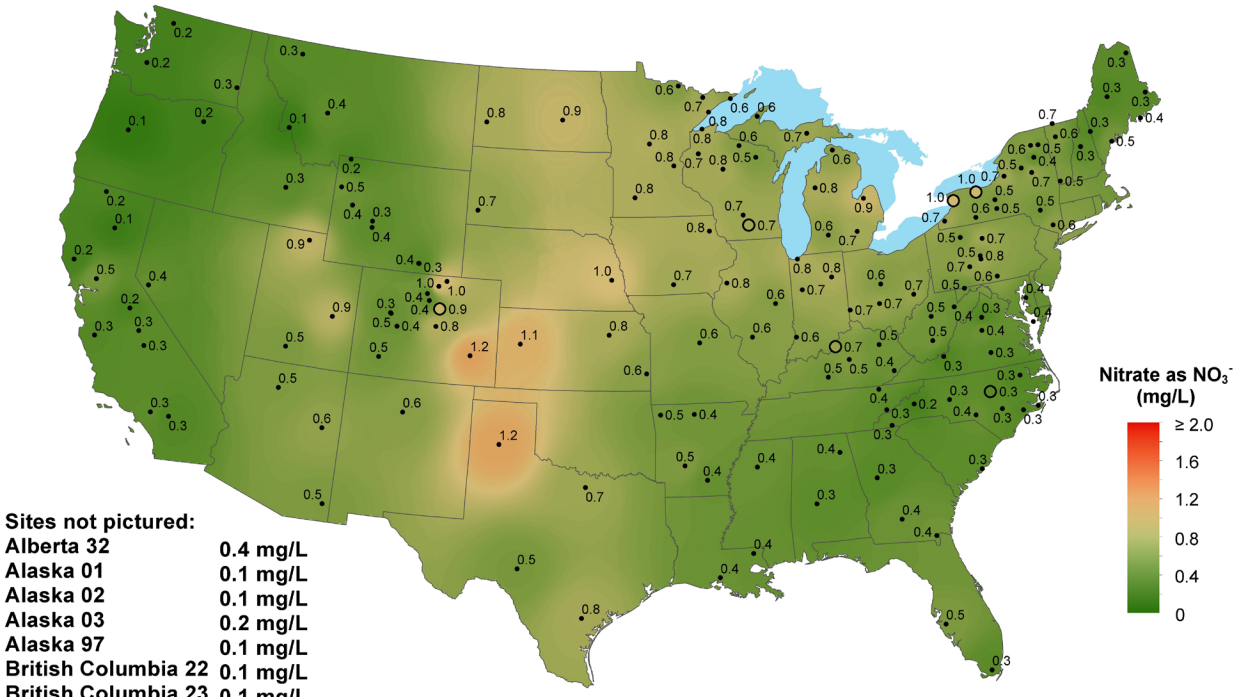
Alberta 32	1.2 kg/ha
Alaska 01	0.3 kg/ha
Alaska 02	0.5 kg/ha
Alaska 03	0.4 kg/ha
Alaska 97	0.3 kg/ha
British Columbia 22	1.0 kg/ha
British Columbia 23	0.5 kg/ha
British Columbia 24	1.1 kg/ha
Virgin Islands 01	0.8 kg/ha



Sites not pictured:

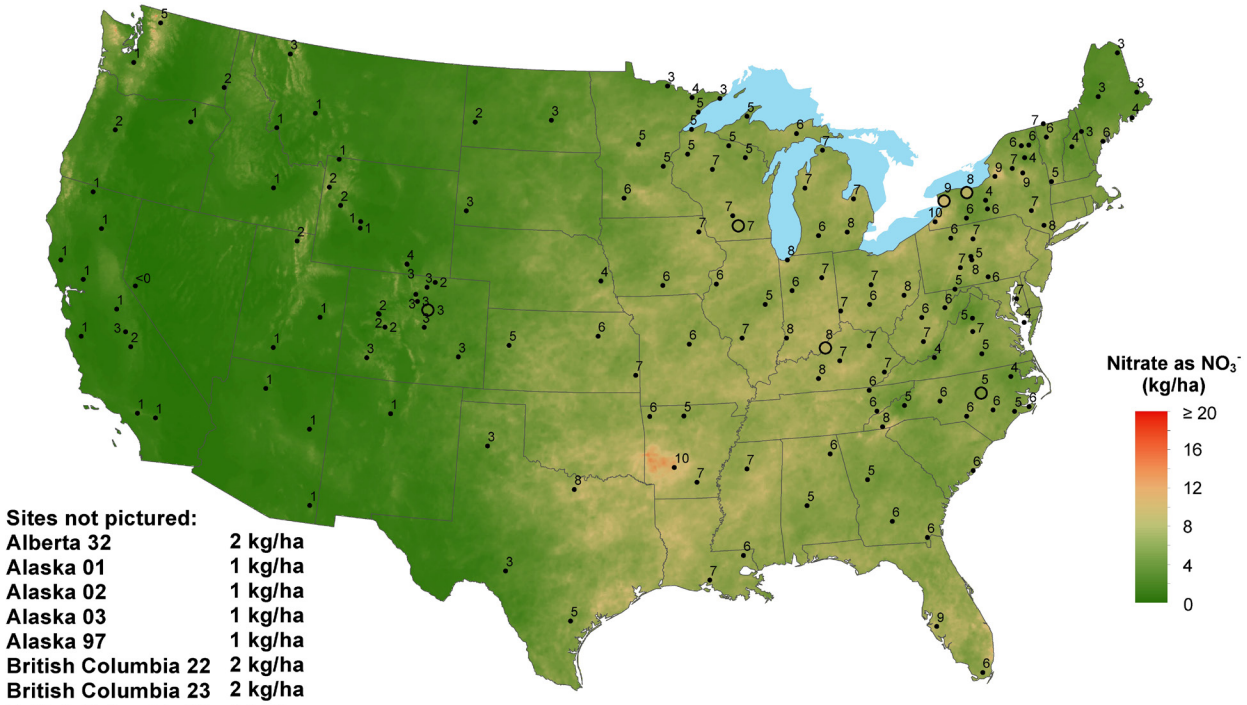
Alberta 32	147 eq/ha
Alaska 01	36 eq/ha
Alaska 02	88 eq/ha
Alaska 03	41 eq/ha
Alaska 97	59 eq/ha
British Columbia 22	1020 eq/ha
British Columbia 23	139 eq/ha
British Columbia 24	222 eq/ha
Virgin Islands 01	183 eq/ha

Inorganic nitrogen wet deposition from nitrate and ammonium (top) and sulfur plus nitrogen wet deposition from sulfate, nitrate and ammonium (bottom), 2020.



Sites not pictured:

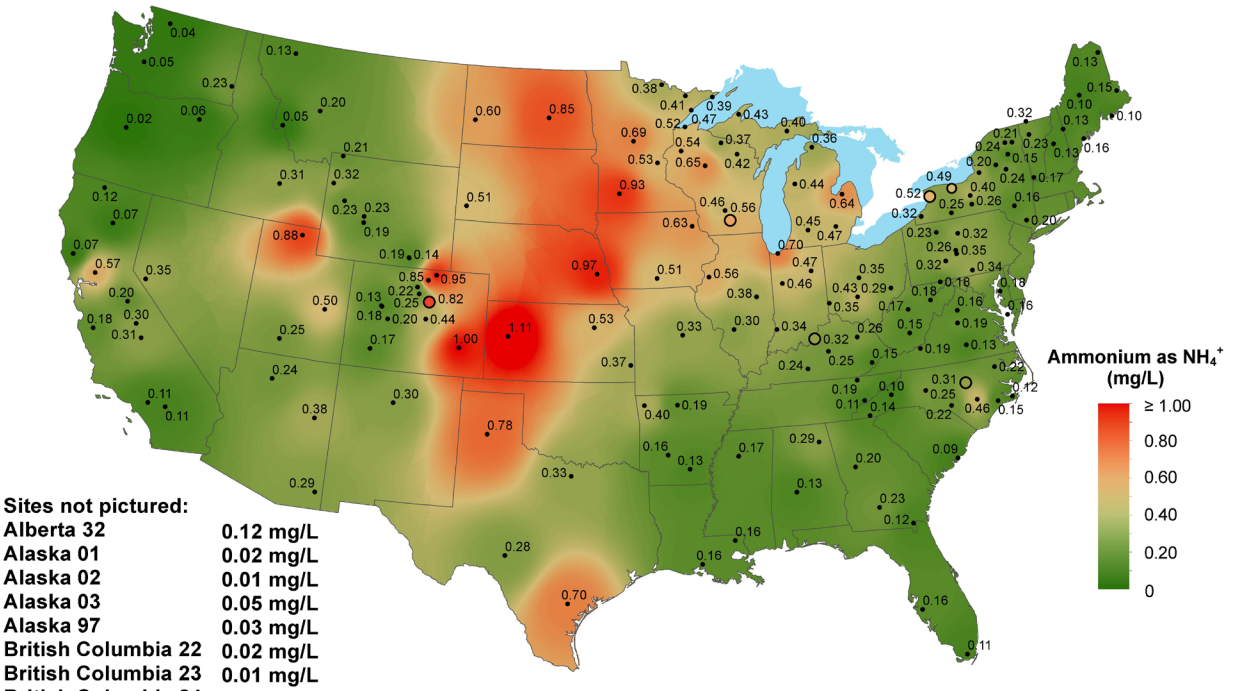
Alberta 32	0.4 mg/L
Alaska 01	0.1 mg/L
Alaska 02	0.1 mg/L
Alaska 03	0.2 mg/L
Alaska 97	0.1 mg/L
British Columbia 22	0.1 mg/L
British Columbia 23	0.1 mg/L
British Columbia 24	0.1 mg/L
Virgin Islands 01	0.2 mg/L

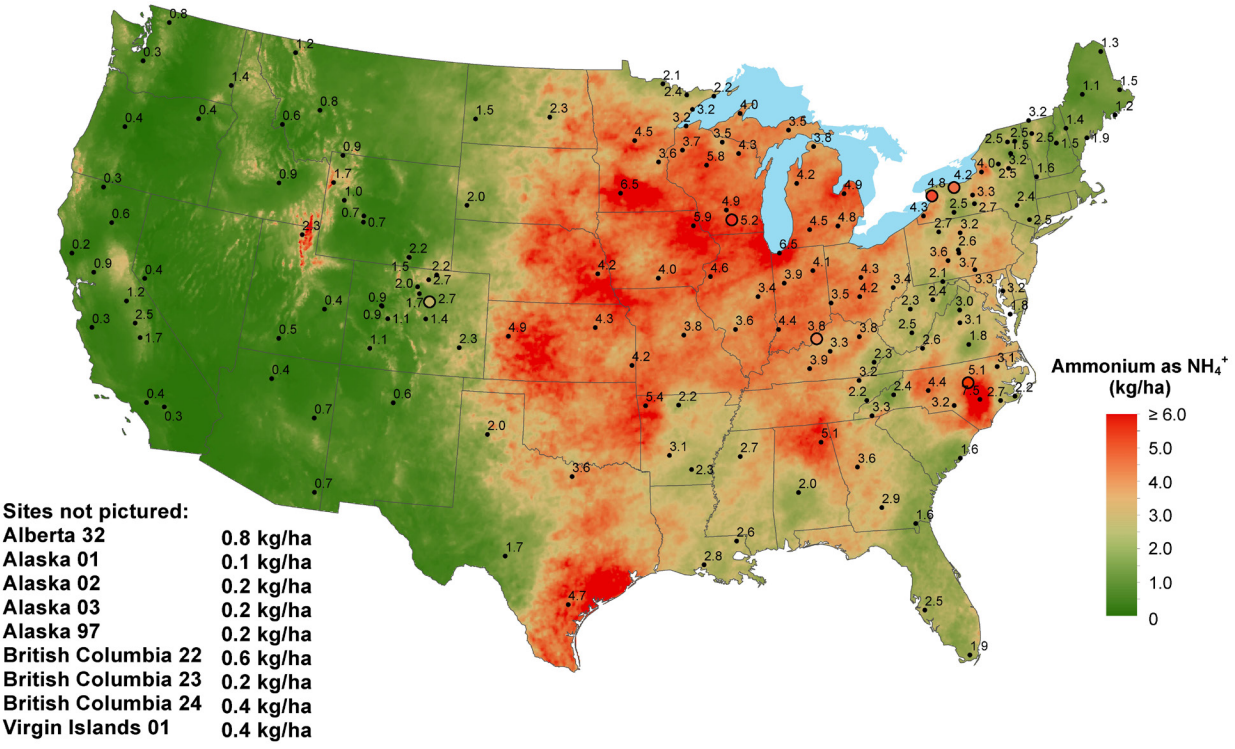


Sites not pictured:

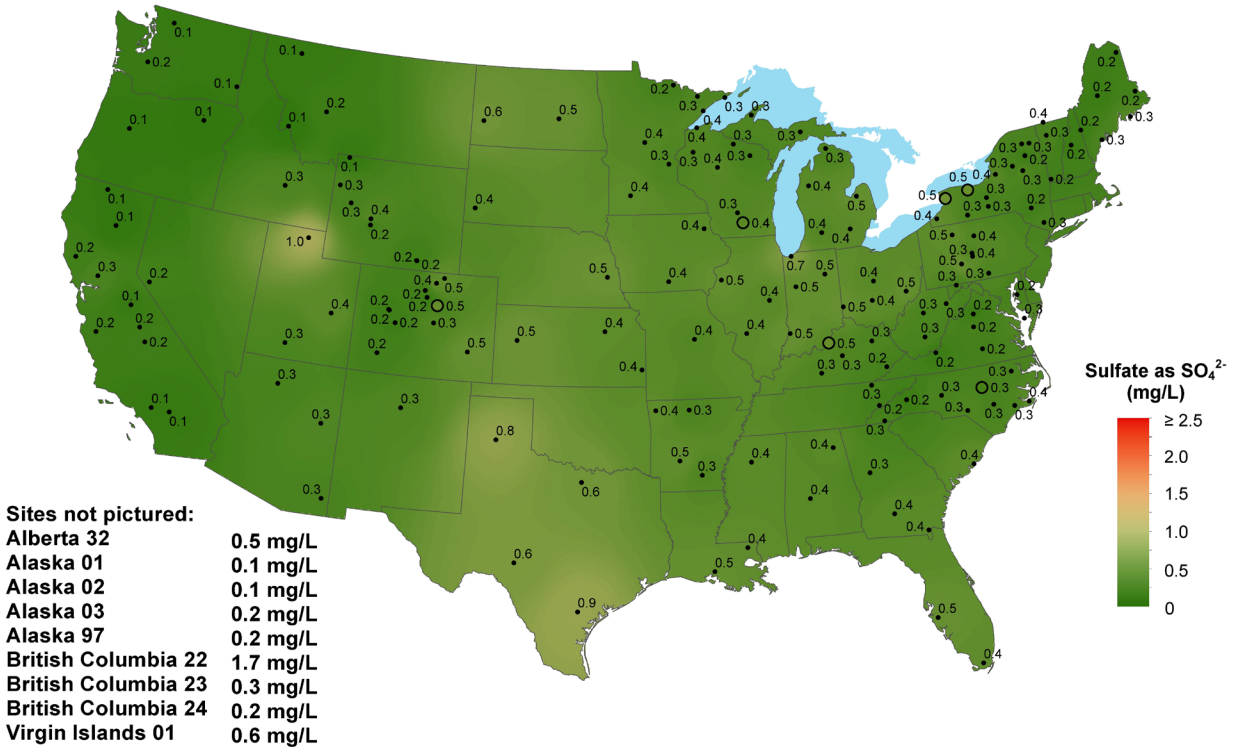
Alberta 32	2 kg/ha
Alaska 01	1 kg/ha
Alaska 02	1 kg/ha
Alaska 03	1 kg/ha
Alaska 97	1 kg/ha
British Columbia 22	2 kg/ha
British Columbia 23	2 kg/ha
British Columbia 24	3 kg/ha
Virgin Islands 01	2 kg/ha

Nitrate ion concentration (top) and wet deposition (bottom), 2020.



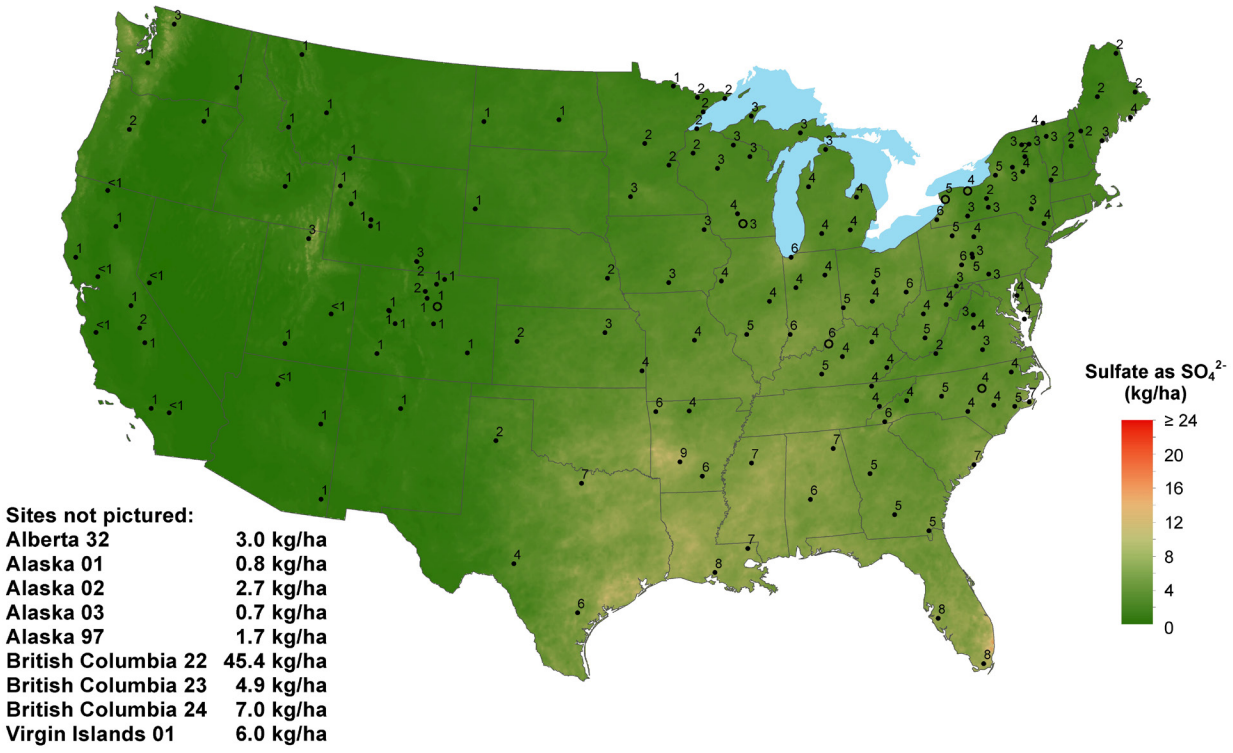


Ammonium ion concentration (top) and wet deposition (bottom), 2020.



Sites not pictured:

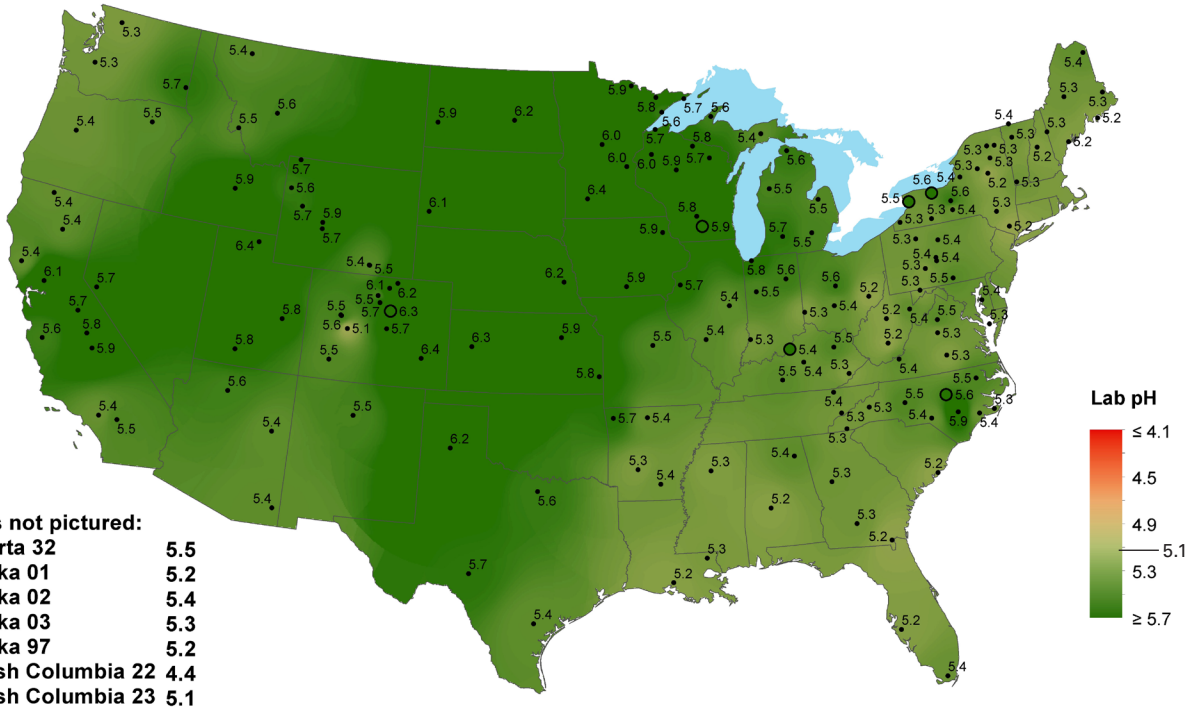
Alberta 32	0.5 mg/L
Alaska 01	0.1 mg/L
Alaska 02	0.1 mg/L
Alaska 03	0.2 mg/L
Alaska 97	0.2 mg/L
British Columbia 22	1.7 mg/L
British Columbia 23	0.3 mg/L
British Columbia 24	0.2 mg/L
Virgin Islands 01	0.6 mg/L



Sites not pictured:

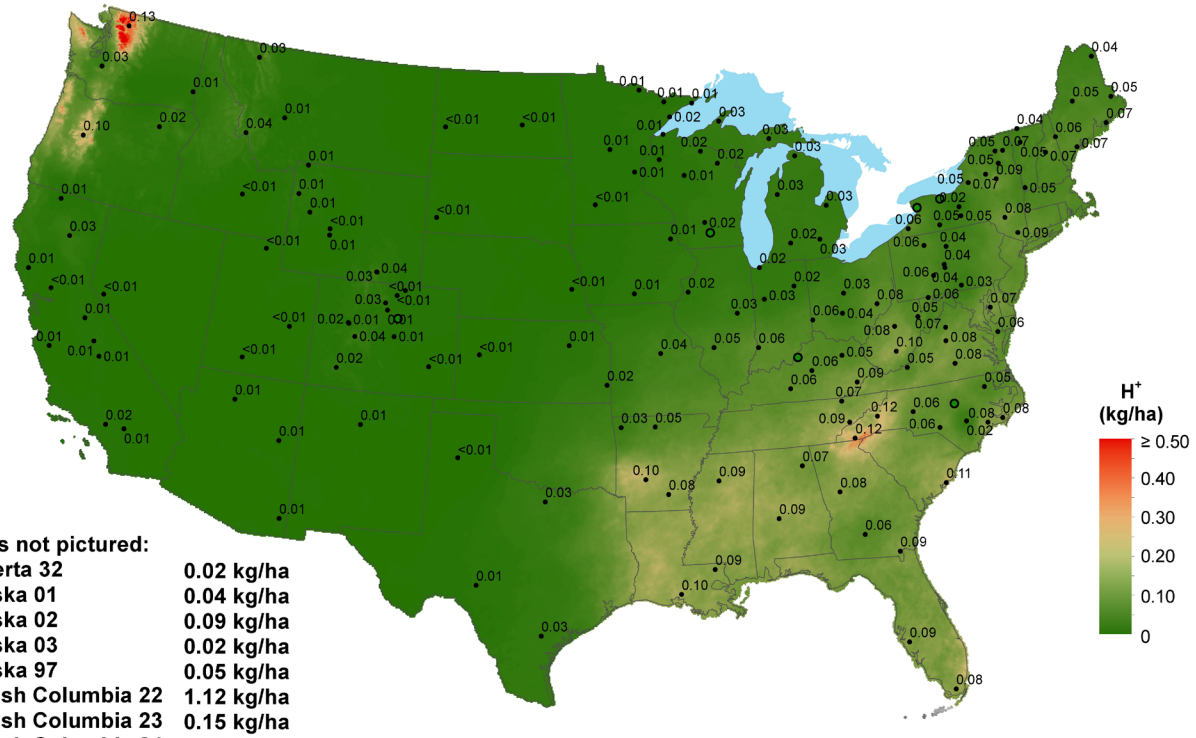
Alberta 32	3.0 kg/ha
Alaska 01	0.8 kg/ha
Alaska 02	2.7 kg/ha
Alaska 03	0.7 kg/ha
Alaska 97	1.7 kg/ha
British Columbia 22	45.4 kg/ha
British Columbia 23	4.9 kg/ha
British Columbia 24	7.0 kg/ha
Virgin Islands 01	6.0 kg/ha

Sulfate ion concentration (top) and wet deposition (bottom), 2020.



Sites not pictured:

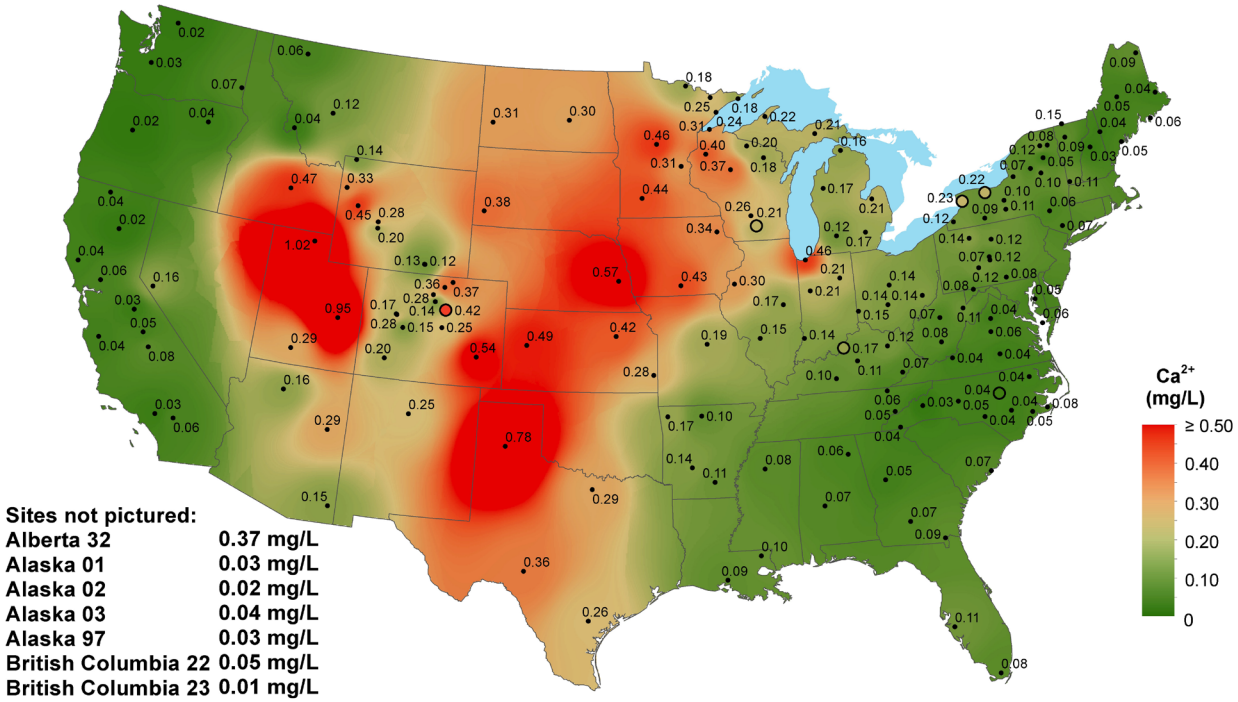
Alberta 32	5.5
Alaska 01	5.2
Alaska 02	5.4
Alaska 03	5.3
Alaska 97	5.2
British Columbia 22	4.4
British Columbia 23	5.1
British Columbia 24	5.3
Virgin Islands 01	5.4



Sites not pictured:

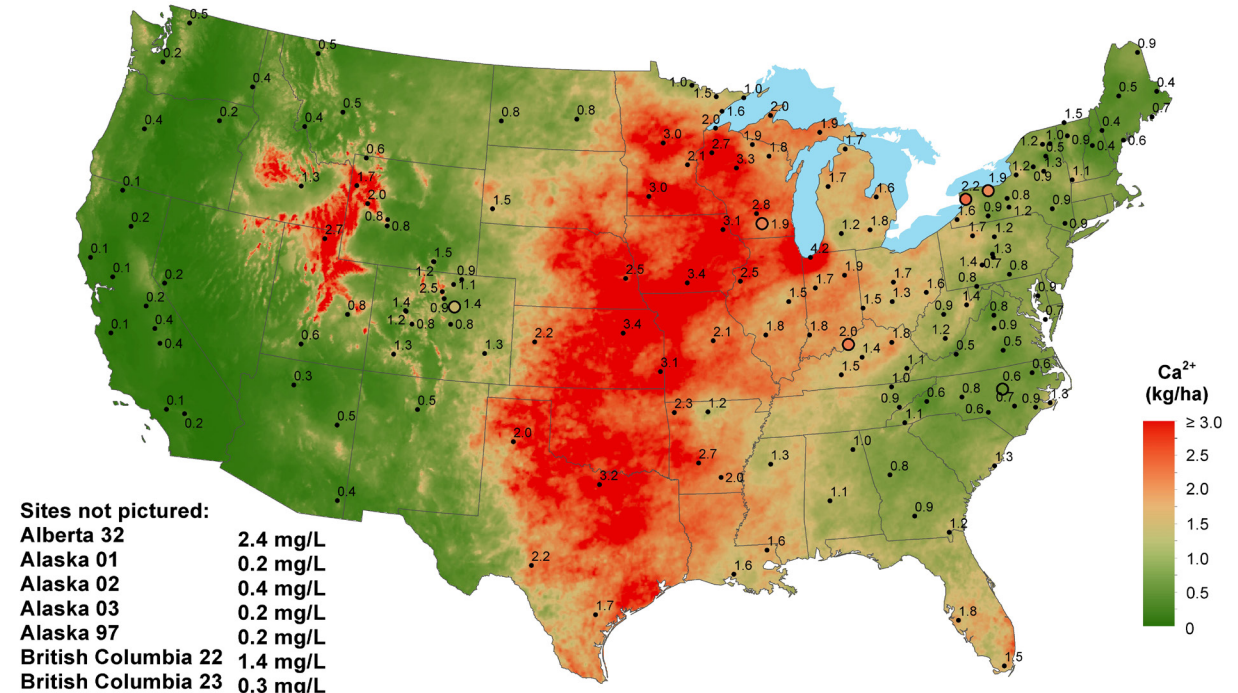
Alberta 32	0.02 kg/ha
Alaska 01	0.04 kg/ha
Alaska 02	0.09 kg/ha
Alaska 03	0.02 kg/ha
Alaska 97	0.05 kg/ha
British Columbia 22	1.12 kg/ha
British Columbia 23	0.15 kg/ha
British Columbia 24	0.17 kg/ha
Virgin Islands 01	0.05 kg/ha

Hydrogen ion concentration as pH (top) and wet deposition (bottom), 2020.
Typically, a precipitation pH of less than 5.1 is considered acidic precipitation.



Sites not pictured:

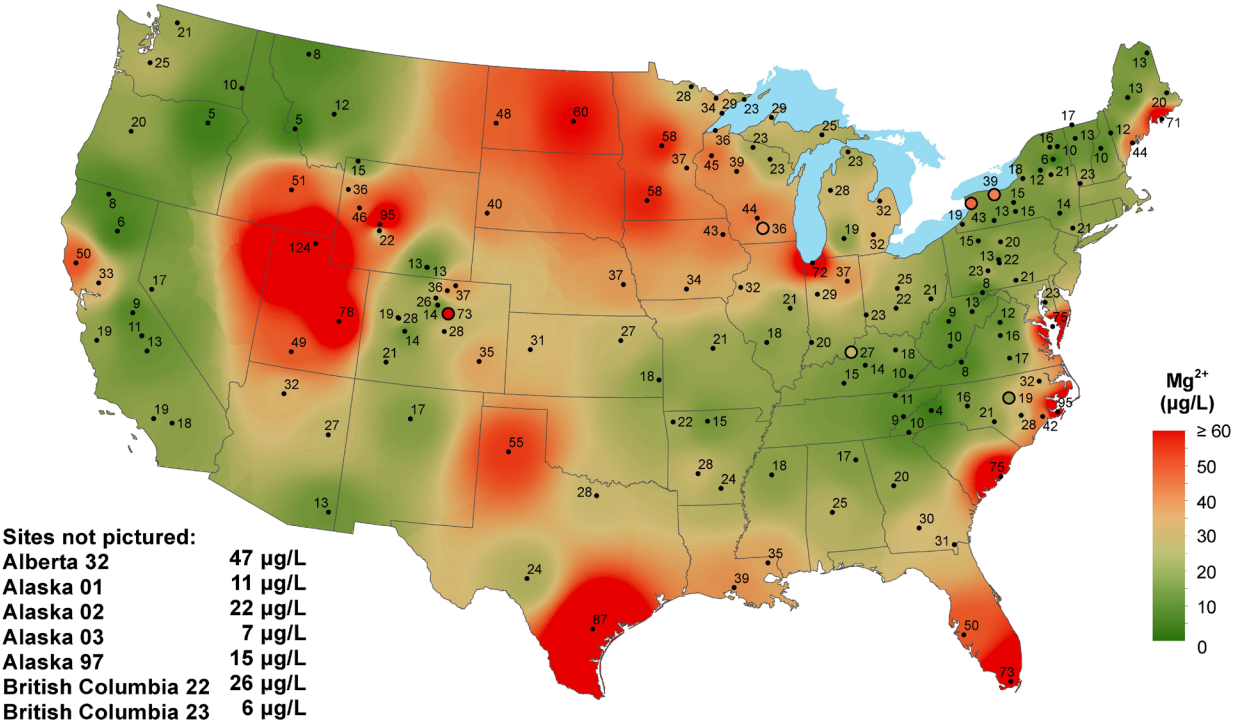
Alberta 32	0.37 mg/L
Alaska 01	0.03 mg/L
Alaska 02	0.02 mg/L
Alaska 03	0.04 mg/L
Alaska 97	0.03 mg/L
British Columbia 22	0.05 mg/L
British Columbia 23	0.01 mg/L
British Columbia 24	0.03 mg/L
Virgin Islands 01	0.16 mg/L



Sites not pictured:

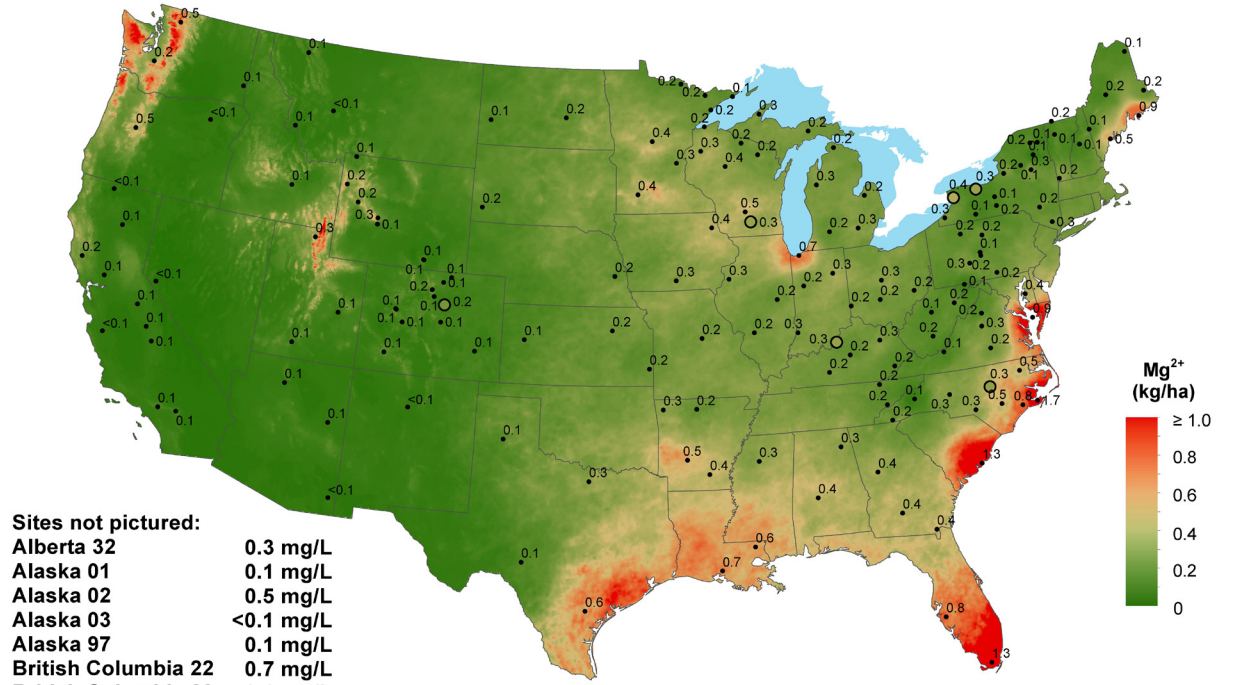
Alberta 32	2.4 mg/L
Alaska 01	0.2 mg/L
Alaska 02	0.4 mg/L
Alaska 03	0.2 mg/L
Alaska 97	0.2 mg/L
British Columbia 22	1.4 mg/L
British Columbia 23	0.3 mg/L
British Columbia 24	1.0 mg/L
Virgin Islands 01	1.7 mg/L

Calcium ion concentration (top) and wet deposition (bottom), 2020.



Sites not pictured:

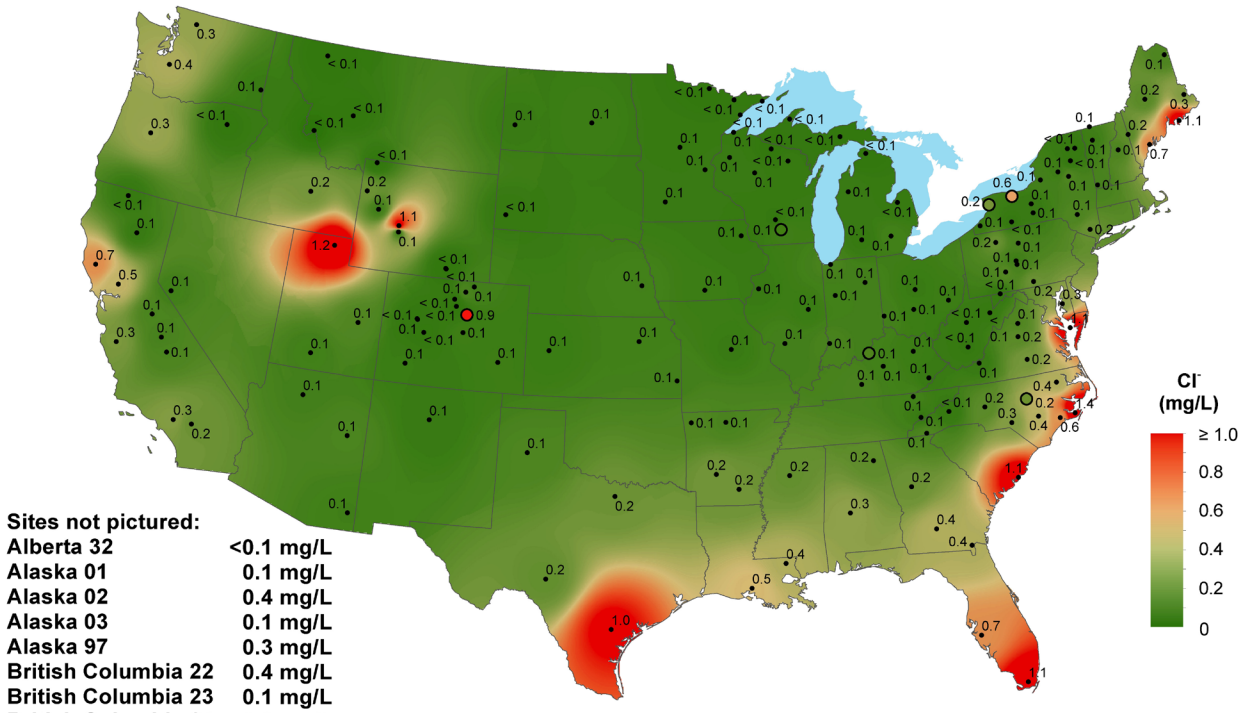
Alberta 32	47 µg/L
Alaska 01	11 µg/L
Alaska 02	22 µg/L
Alaska 03	7 µg/L
Alaska 97	15 µg/L
British Columbia 22	26 µg/L
British Columbia 23	6 µg/L
British Columbia 24	48 µg/L
Virgin Islands 01	173 µg/L



Sites not pictured:

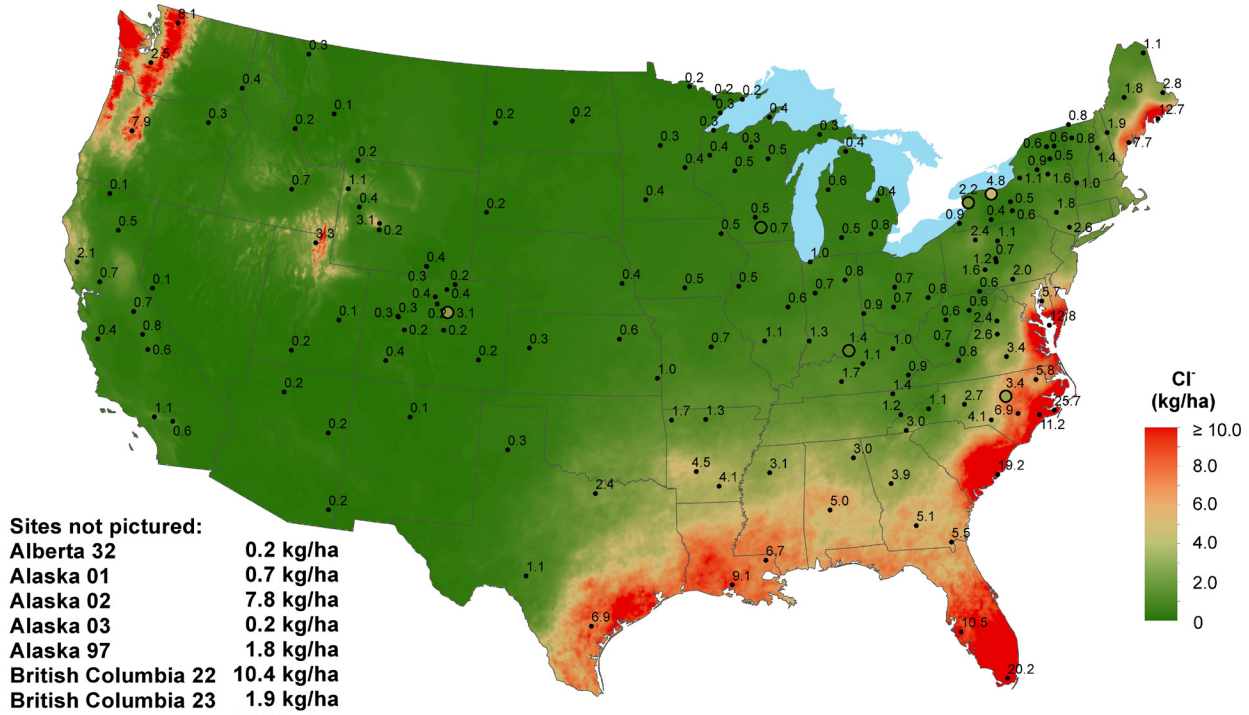
Alberta 32	0.3 mg/L
Alaska 01	0.1 mg/L
Alaska 02	0.5 mg/L
Alaska 03	<0.1 mg/L
Alaska 97	0.1 mg/L
British Columbia 22	0.7 mg/L
British Columbia 23	0.1 mg/L
British Columbia 24	1.6 mg/L
Virgin Islands 01	1.8 mg/L

Magnesium ion concentration (top) and wet deposition (bottom), 2020.



Sites not pictured:

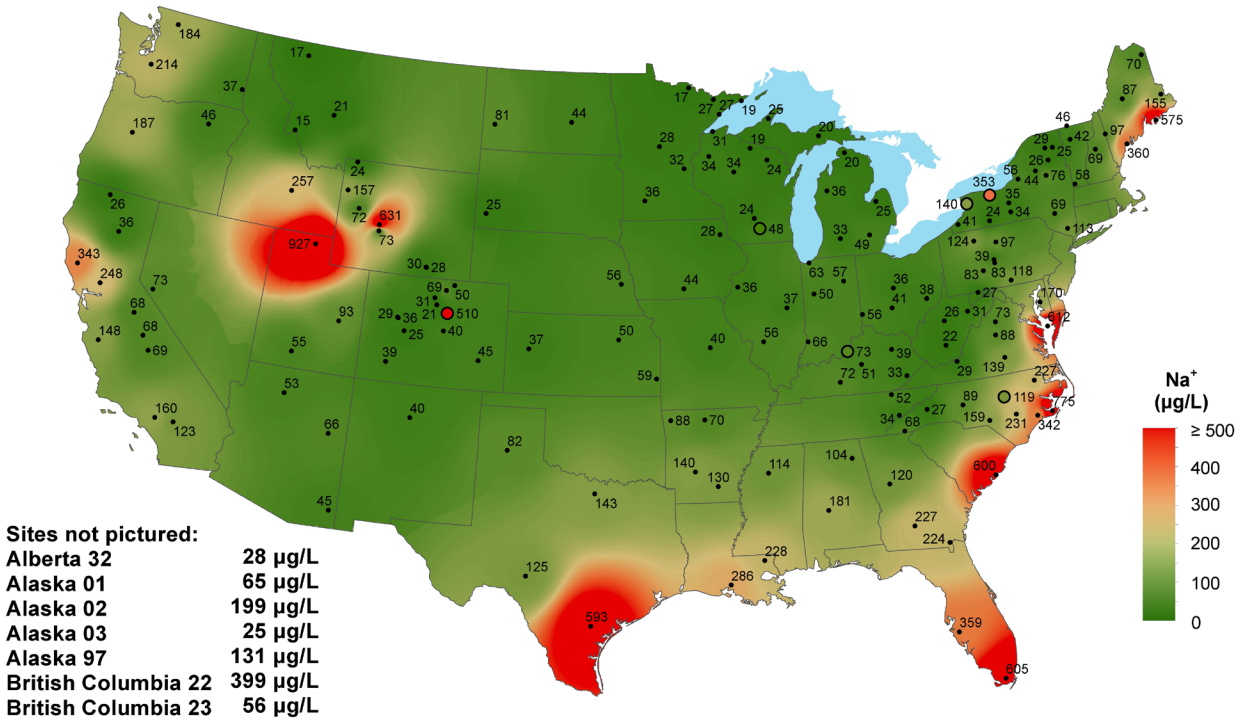
Alberta 32	<0.1 mg/L
Alaska 01	0.1 mg/L
Alaska 02	0.4 mg/L
Alaska 03	0.1 mg/L
Alaska 97	0.3 mg/L
British Columbia 22	0.4 mg/L
British Columbia 23	0.1 mg/L
British Columbia 24	0.8 mg/L
Virgin Islands 01	2.5 mg/L



Sites not pictured:

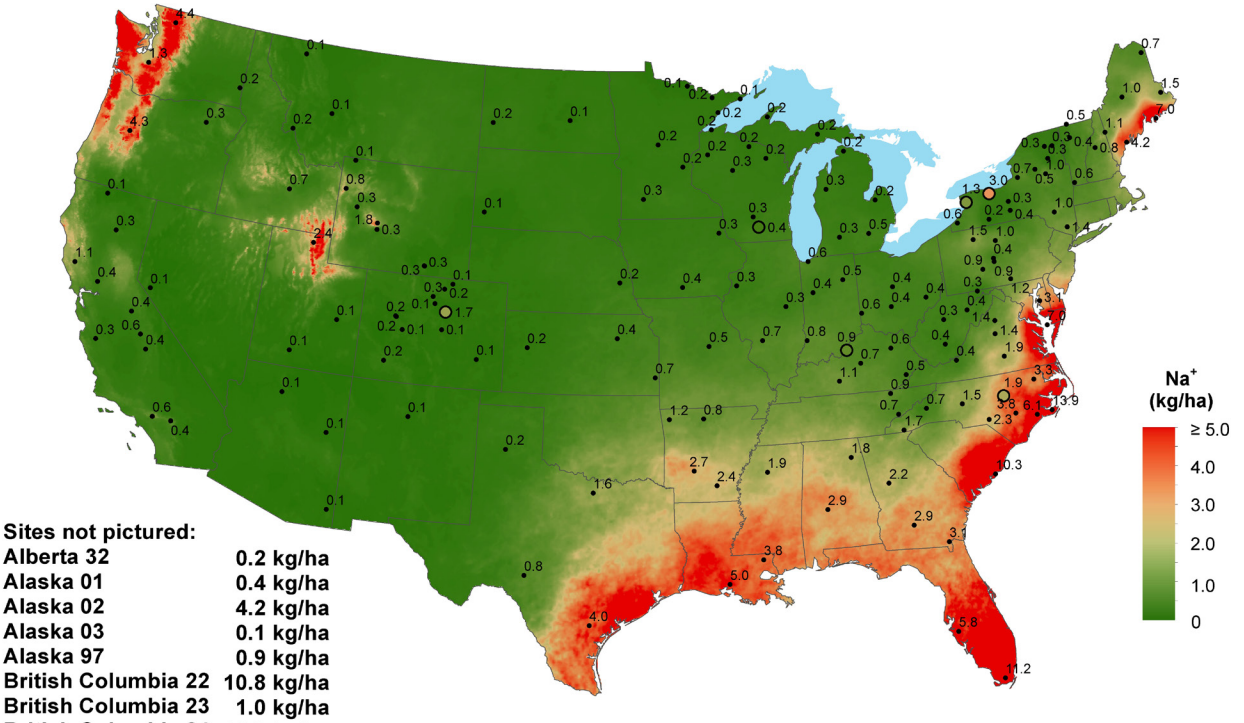
Alberta 32	0.2 kg/ha
Alaska 01	0.7 kg/ha
Alaska 02	7.8 kg/ha
Alaska 03	0.2 kg/ha
Alaska 97	1.8 kg/ha
British Columbia 22	10.4 kg/ha
British Columbia 23	1.9 kg/ha
British Columbia 24	25.6 kg/ha
Virgin Islands 01	26.1 kg/ha

Chloride ion concentration (top) and wet deposition (bottom), 2020.



Sites not pictured:

Alberta 32	28 µg/L
Alaska 01	65 µg/L
Alaska 02	199 µg/L
Alaska 03	25 µg/L
Alaska 97	131 µg/L
British Columbia 22	399 µg/L
British Columbia 23	56 µg/L
British Columbia 24	405 µg/L
Virgin Islands 01	1373 µg/L



Sites not pictured:

Alberta 32	0.2 kg/ha
Alaska 01	0.4 kg/ha
Alaska 02	4.2 kg/ha
Alaska 03	0.1 kg/ha
Alaska 97	0.9 kg/ha
British Columbia 22	10.8 kg/ha
British Columbia 23	1.0 kg/ha
British Columbia 24	13.9 kg/ha
Virgin Islands 01	14.1kg/ha

Sodium ion concentration (top) and wet deposition (bottom), 2020.

Mercury Deposition Network (MDN)

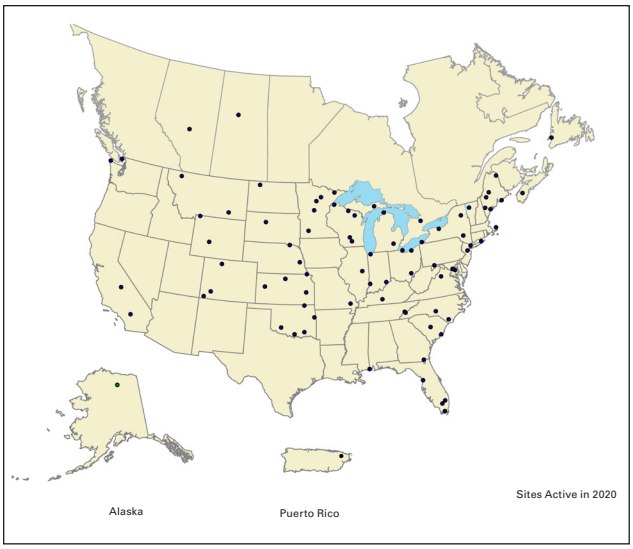
The MDN is the only network providing a long-term record for the concentration of mercury (Hg) in precipitation in North America. MDN sites follow standard procedures and use approved precipitation collectors and rain gages. The automated collector is similar to the NTN collector, but it is modified to preserve mercury. Site operators collect samples every Tuesday morning. Chemical analysis of the MDN samples is performed by the WSLH.

All MDN samples are analyzed for total mercury concentration. The HAL reviews field and laboratory data for accuracy and completeness, and identifies samples that were mishandled, compromised by equipment failure, or grossly contaminated.

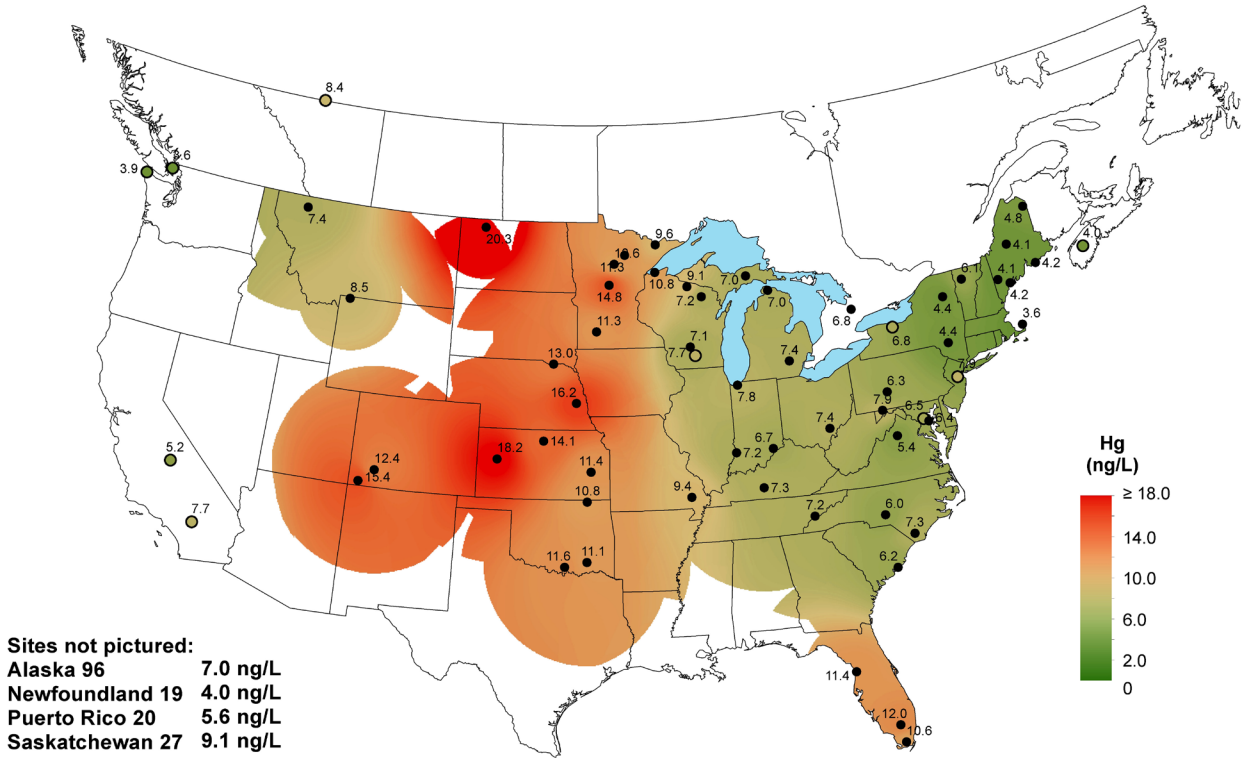
As of December 2020, there were 80 active MDN sites. Data from the MDN is available on the NADP website (http://nadp.slh.wisc.edu). Subsamples of MDN precipitation were analyzed for methyl mercury (MeHg) at 10 NADP sites. Details about sample collection and analysis are available on the NADP website.

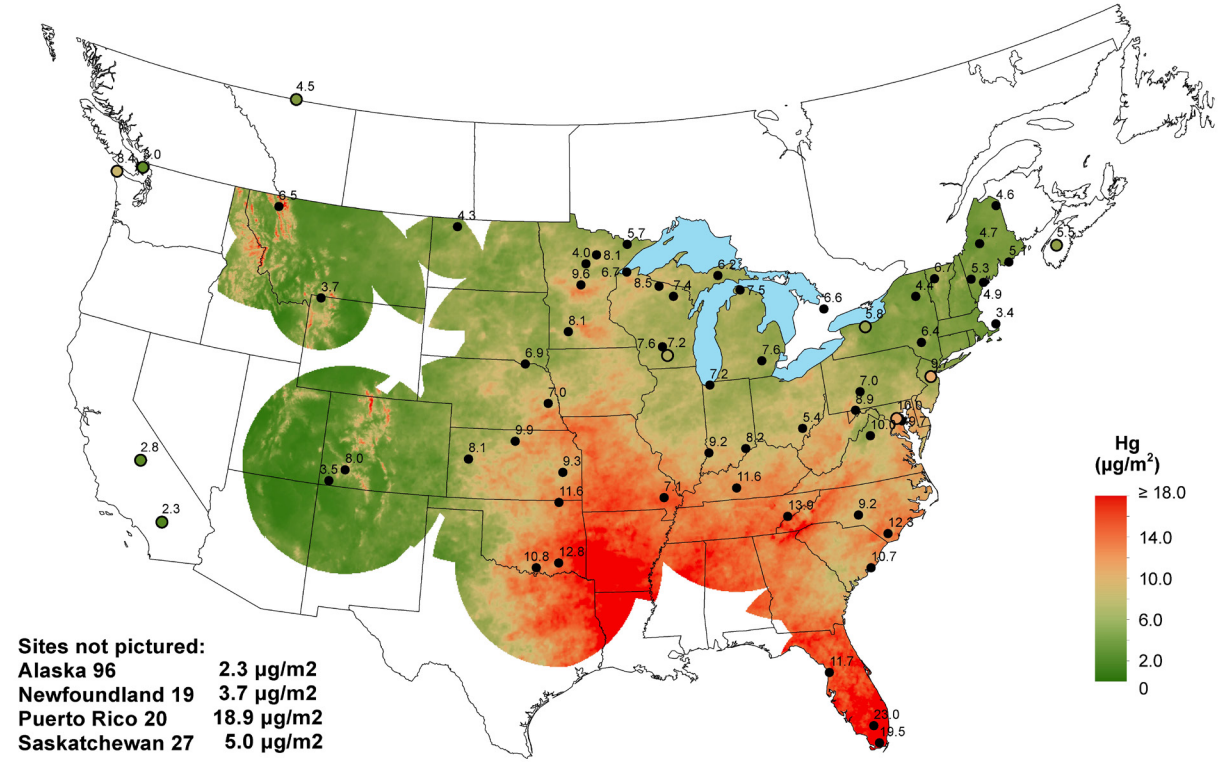
MDN Maps and Graphs

The maps on page 23 show spatial variability in the precipitation-weighted mean concentration and wet deposition of total mercury across the United States.



Only sites meeting NADP completeness criteria are included. In 2020, 66 of 80 active sites met these criteria. Large variations in both mercury concentrations and wet-deposition are observed across the nation.





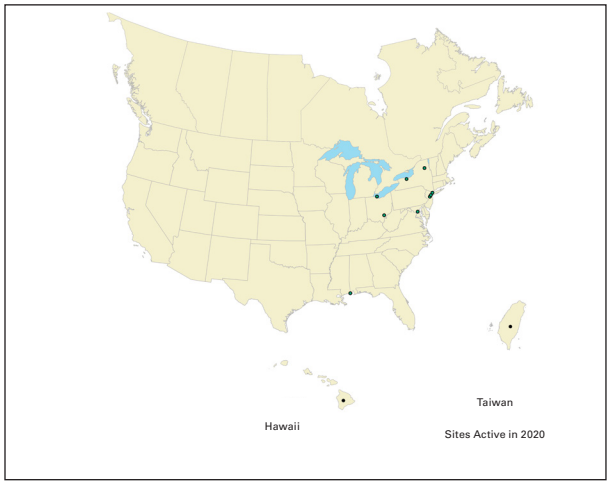
Total mercury concentration (top) and wet deposition (bottom), 2020.

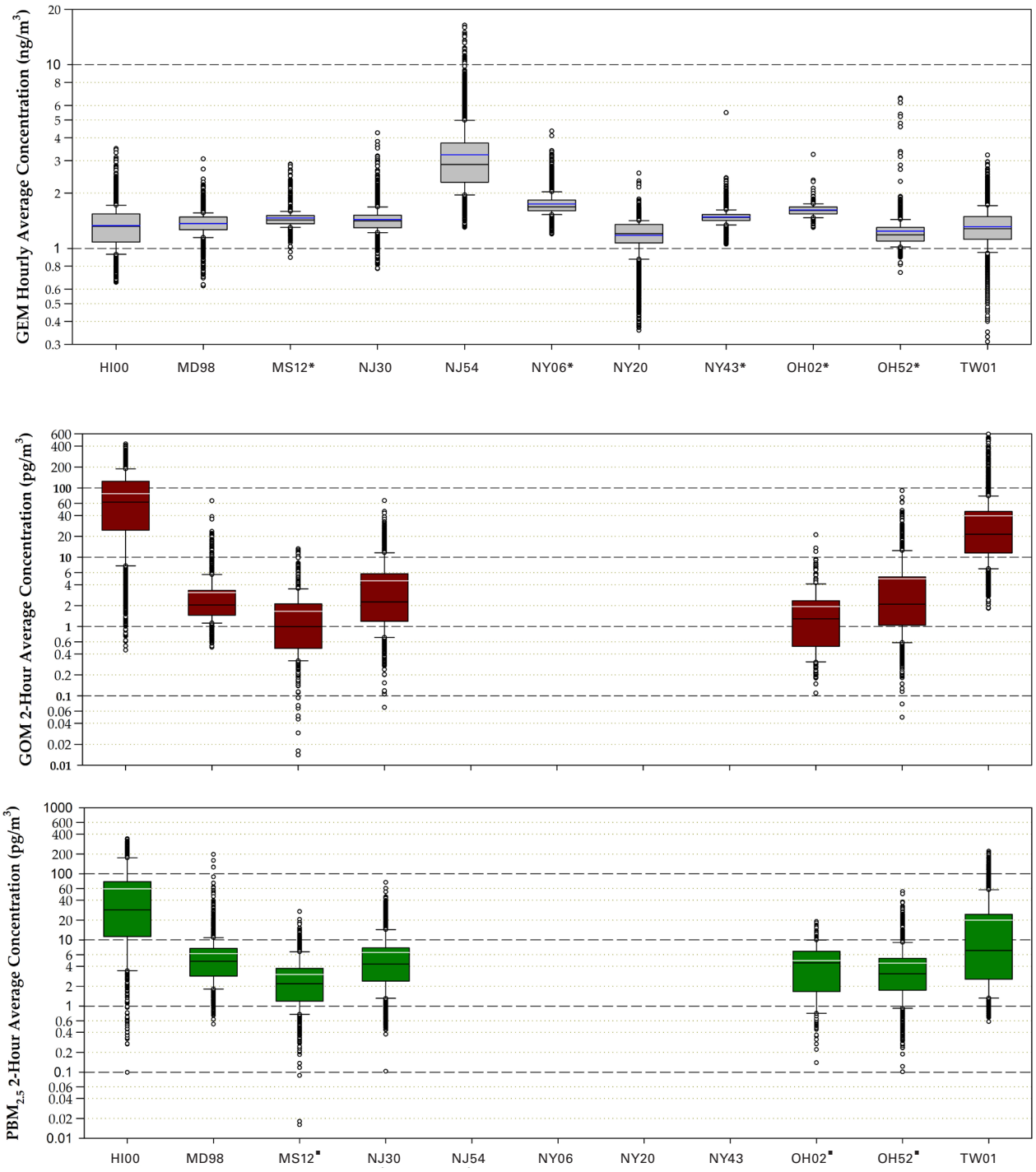
Atmospheric Mercury Network (AMNet)

AMNet sites measure ambient atmospheric mercury using automated, continuous measurement systems in order to understand the impact of atmospheric mercury on deposition. Quality-assured measurements are made using NADP standardized methods.

AMNet measurements are made continuously (five minute and two-hour averages). Data is qualified and averaged to one-hour (gaseous elemental mercury, GEM) and two-hour values (gaseous oxidized mercury, GOM, and particulate bound mercury, PBM2.5). As of December 2020, there were 10 AMNet sites. Data from the AMNet are available on the NADP website (http://nadp.slh.wisc.edu).

The figures on page 25 show the distribution of atmospheric mercury concentrations for each site. The top figure shows the distribution of GEM (shaded grey area) for all sites reporting data. GEM is reported in nanograms per cubic meter (ng/m^3). The middle figure shows the distribution of two-hour atmospheric concentrations of GOM (red shaded area) and the bottom figure shows PBM2.5 (green shaded area) in picograms per cubic meter (pg/m^3). Concentrations are plotted logarithmically, and with different scale ranges, to highlight the range of measured values for each site.





Hourly GEM concentration in ng/m3 for each AMNet site (top) and 2-hour GOM and PBM2.5 concentrations in pg/m3 for each speciating AMNet site (middle and bottom) in 2020. For each data set, the mean value is indicated as a blue (GEM) or white bar (GOM and PBM2.5) and the median is indicated as a black bar. Sites with no GOM and PBM2.5 data shown did not monitor for speciated mercury. Distributions with less than 75% completeness are marked with a "*" for GEM, and a "▪" for GOM/PBM distributions.

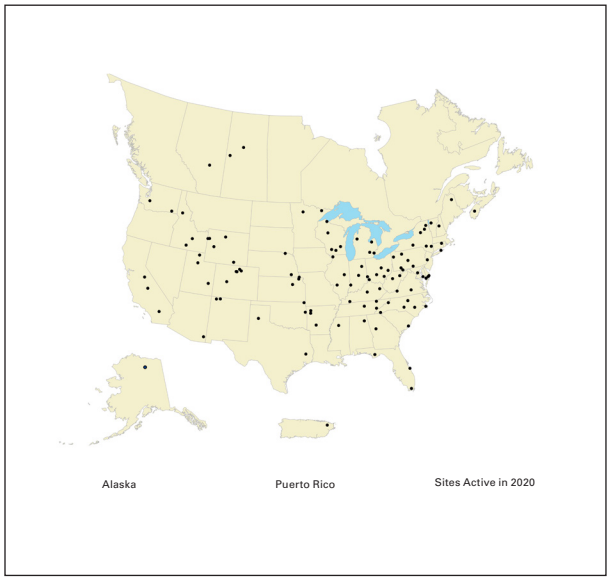
Ammonia Monitoring Network (AMoN)

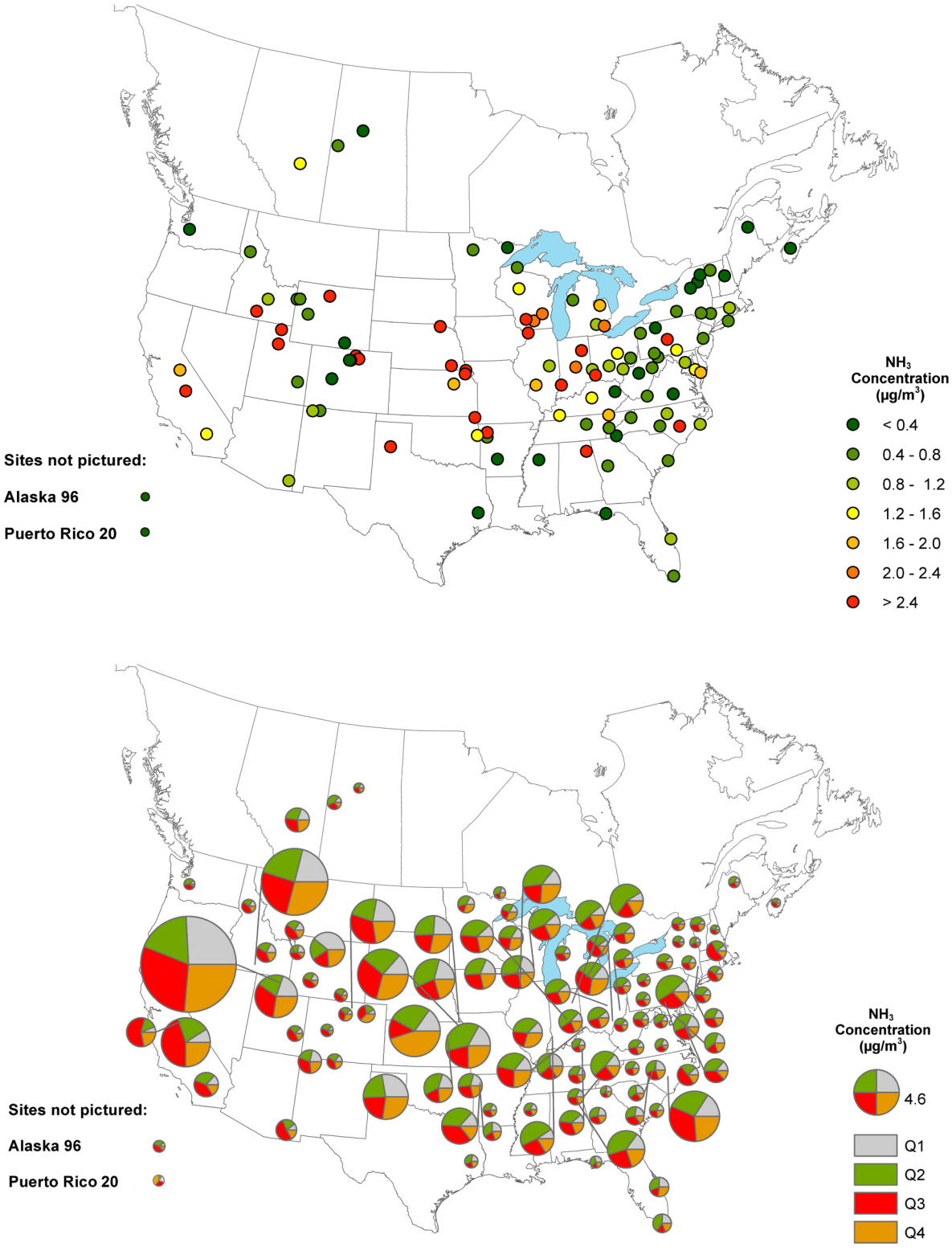
The AMoN measures atmospheric concentrations of ammonia (NH_3) gas. The network uses a passive diffusion-type sampler that provides cost-effective, accurate, and time-integrated measurements.

Sampling occurs over a two-week period, and all sites collect additional quality assurance samples on a rotating basis. This data is used to assess long-term NH_3 trends and changes in atmospheric chemistry, and to provide information for model development and verification.

As of December 2020, there were 115 AMoN sites. Data from the AMoN are available on the NADP website (http://nadp.slh.wisc.edu).

The figures on page 27 show the distribution and seasonality of gaseous ammonia concentrations for each site meeting completeness criteria. In 2020, 105 of 115 active sites met these criteria. In the top figure, circles represent annual average concentrations in micrograms per cubic meter ($\mu g/m^3$) at each site. In the bottom figure, the relative concentration for each site is shown for each calendar quarter. The size of the wedge is the relative percentage for the quarter. The area of the pie chart is proportional to the annual average for the site.





Average ammonia concentrations as measured by AMoN (top), and quarterly relative percentage (Q1 = January, February, March, etc.) for each AMoN site (bottom), 2020. Size of the symbol in the bottom plot is relative to the annual concentration.

National Atmospheric Deposition Program

The NADP is the National Research Support Project-3: A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition. More than 250 sponsors support the NADP, including private companies and other non-governmental organizations, universities, local and state government agencies, State Agricultural Experiment Stations, national laboratories, Native American organizations, Canadian government agencies, the U.S. Geological Survey, the U.S. Environmental Protection Agency, the National Park Service, the National Oceanic and Atmospheric Administration, the U.S. Fish & Wildlife Service, the Bureau of Land Management, the U.S. Department of Agriculture - Forest Service, and the U.S. Department of Agriculture - National Institute of Food and Agriculture under agreement no. 2019-39132-30121. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the program sponsors or the University of Wisconsin-Madison.

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Madison, WI: October 2021

http://nadp.slh.wisc.edu

All NADP data and information, including color contour maps in this publication, are available free of charge from the NADP website: http://nadp.slh.wisc.edu. Alternatively, contact: NADP Program Office, Wisconsin State Laboratory of Hygiene, 465 Henry Mall, Madison, WI 53706, Tel: (608) 263-9162, E-mail: nadp@slh.wisc.edu.

The NADP Program Office is located at the Wisconsin State Laboratory of Hygiene (WSLH), at the University of Wisconsin–Madison.