



Alagnak

Aniakchak

Katmai

Kenai Fjords

Lake Clark

Air Quality

Nitrogen and sulfur oxides are emitted into the atmosphere mainly through the combustion of fossil fuels. Once airborne, these oxides form compounds that can be transported long distances and then deposited in precipitation (rain, snow, etc.) as pollutants, such as nitrate and sulfate. Arctic and subarctic ecosystems are particularly sensitive to the deposition of excess nitrogen and sulfur. Effects include the disruption of ecosystem processes and the alteration of species composition and abundance. Although concentrations of nitrate and sulfate are relatively low at most sites in Alaska where monitoring occurs, atmospheric pathways capable of transporting pollution to the northwest coast of North America are worth noting. As the global human population grows, so does the likelihood that Alaska air quality will be impaired by increasing emissions from other continents.



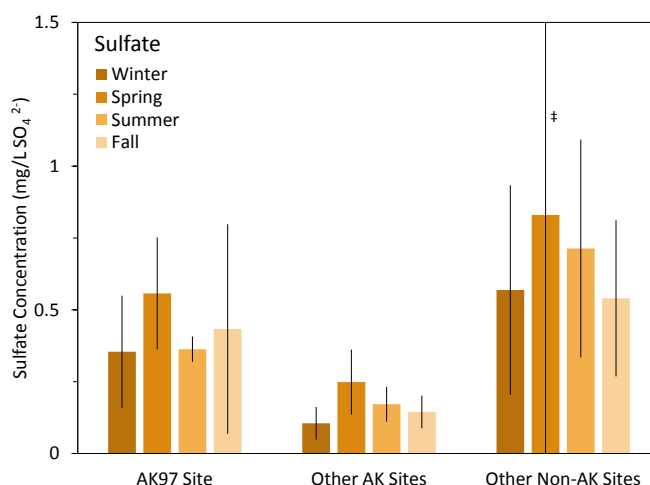
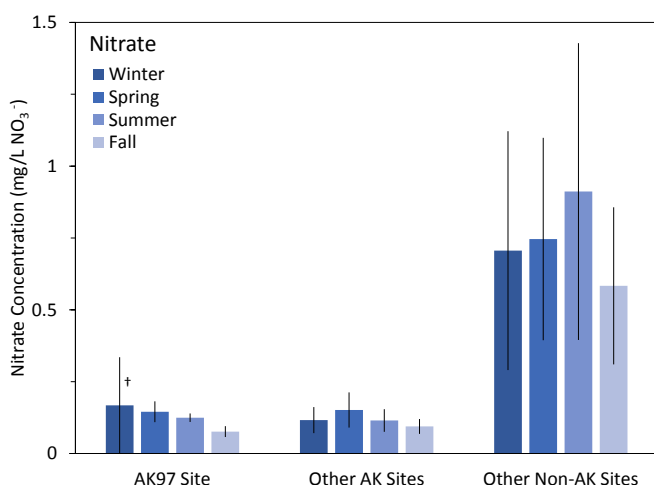
NPS/J Mills

Some ecosystem types, including high-elevation lakes like the one pictured above, are sensitive to the effects of nutrient enrichment and acidification from atmospheric deposition of nitrogen and sulfur (Sullivan et al. 2011).

Findings

Atmospheric deposition is the process by whereby airborne pollutants, such as nitrate and sulfate, reach the earth.

Deposition consists of both wet and dry components. Wet deposition has been monitored in North America



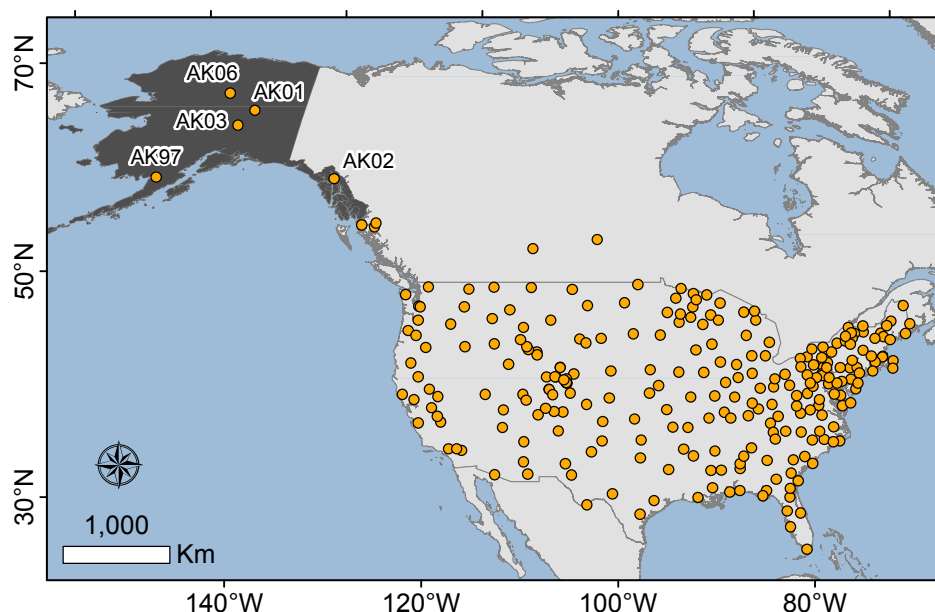
Concentrations of two common pollutants, nitrate (left) and sulfate (right), found in precipitation at the Southwest Alaska Network site, AK97. Concentrations at four other NTN sites in Alaska and 197 NTN sites located elsewhere are shown for comparison. Colored bars represent seasonal averages for the years 2011-2014; black lines indicate standard deviations, where $t=0.17$ and $\pm=2.9$ mg/L. Additional data are available at: <http://nadp.sws.uiuc.edu/data/ntn/>.



NPS/C. Turner

Every NTN site uses two instruments to monitor wet deposition: a rain gage (right) and a precipitation collector (left). In 2015, the AK97 site at Katmai National Park and Preserve (pictured) was converted to telemetry, so rain gage data are available online in real time at <http://nadp.sws.uiuc.edu/siteOps/ppt/default.aspx>.

since 1978 by the National Atmospheric Deposition Program's National Trends Network (NTN). This network currently includes 261 active monitoring sites, one of which is operated by the Southwest Alaska Network (SWAN) and Katmai National Park and Preserve. This site (known as AK97) is located in King Salmon, Alaska, and is one of only five active NTN sites in the state. Recent average nitrate concentrations at AK97 are comparable to those at other Alaska sites, and lower than averages elsewhere on the continent. Average sulfate concentrations at AK97 are more variable, and tend to be intermediate between those at Alaska and non-Alaska sites.



Methods

SWAN began monitoring wet deposition in 2009 in order to characterize trends in precipitation chemistry in southwest Alaska. Monitoring methods follow the NTN protocol. According to this protocol, precipitation samples are collected year-round on Tuesdays and sent to a lab in Illinois. The lab provides centralized chemical analyses of biologically important anions

and cations (such as nitrate, sulfate, and ammonium). It also provides centralized data validation and organization. Centralization is critical for reliable long-term, large-scale monitoring. Without it, there would be no confidence that differences observed over time or between sites are actual trends, rather than artifacts of variation between labs or methods.

Only five of the 261 currently active NTN sites are located in Alaska (shaded dark gray). AK97 is furthest west of all sites within the network.

Reference

Sullivan, T. J., G. T. McPherson, T. C. McDonnell, S. D. Mackey, and D. Moore. 2011. Evaluation of the sensitivity of inventory and monitoring national parks to acidification effects from atmospheric sulfur and nitrogen deposition: Southwest Alaska Network (SWAN). Natural Resource Report NPS/NRPC/ARD/NRR—2011/381. National Park Service, Denver, Colorado.

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