



Alagnak

Aniakchak

Katmai

Kenai Fjords

Lake Clark

Air Quality and Contaminants

Resource Brief
October 2011

Importance

Air quality in SWAN park units is considered pristine by national standards, but airborne pollutant loads associated with increasing global and regional industrialization, as well as wildfire and volcanic activity have the potential to affect ecological processes in the Network. Increased nitrogen deposition associated with human activity may result in soil acidification and changes in plant communities. Particulate sampling conducted in King Salmon (1987-1992) found that elements associated with human activity were proportionately greater than in other parks surveyed in Alaska. In addition, current-use and historic-use pesticides as well as some heavy metals (e.g., mercury) were found in low concentrations in most Alaskan parks in the Western Airborne Contaminants Assessment Project. These contaminants are stored in lake sediments, vegetation, fish tissue and snowpack.



Hylocomium splendens (upper) is a common moss found throughout the Network. SWAN established an NADP precipitation collection site in King Salmon in 2010 (left).

Long-term Monitoring

Several contaminant monitoring protocols are being developed for both aquatic and terrestrial environments within SWAN park units to establish baseline contaminant concentrations that can be tracked over time. Of particular concern are trace elements also known as heavy metals (e.g., zinc, copper, lead and mercury), which are toxic in high concentrations, and prevalent pollutants (e.g., sulfate, nitrate and ammonium). Terrestrial contaminants will be tracked by monitoring trace

elements in *Hylocomium splendens*, a common long-lived moss, using a protocol established in the Arctic Network (ARCN). Use of moss as a biomonitor is a well-established technique because it retains trace elements of ecological concern. Preliminary samples were collected across SWAN park units during the 2008 and 2009 field season and analyzed for a suite of trace elements. In 2010, the SWAN began monitoring precipitation chemistry using the National Atmospheric Deposition Program (NADP) protocol. Weekly bulk precipitation samples are collected and sent to the NADP lab for analysis of a suite of water chemistry metrics including prevalent atmospheric pollutants.

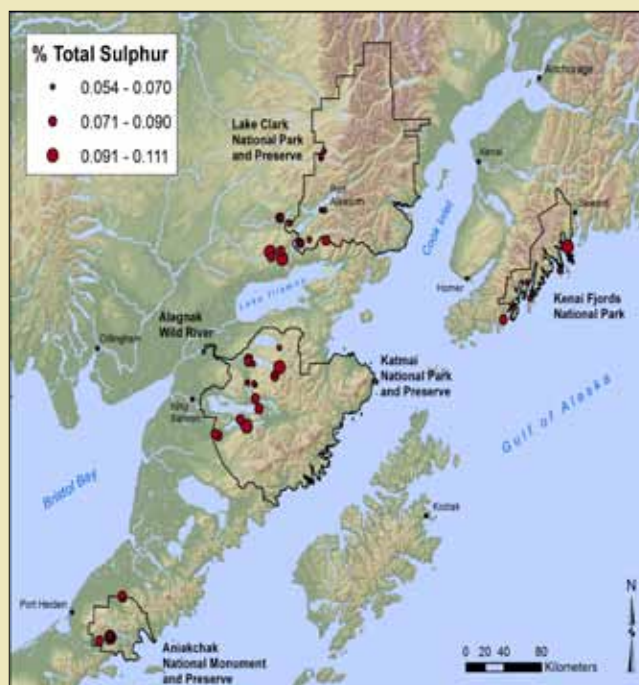
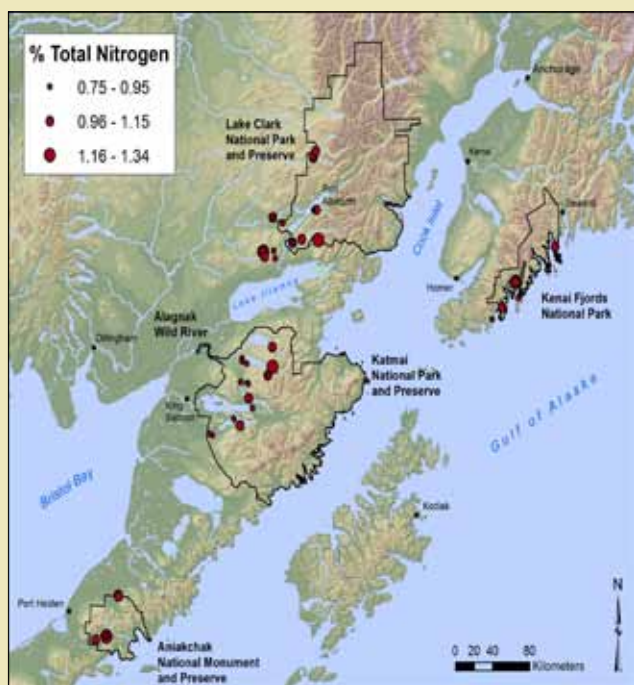
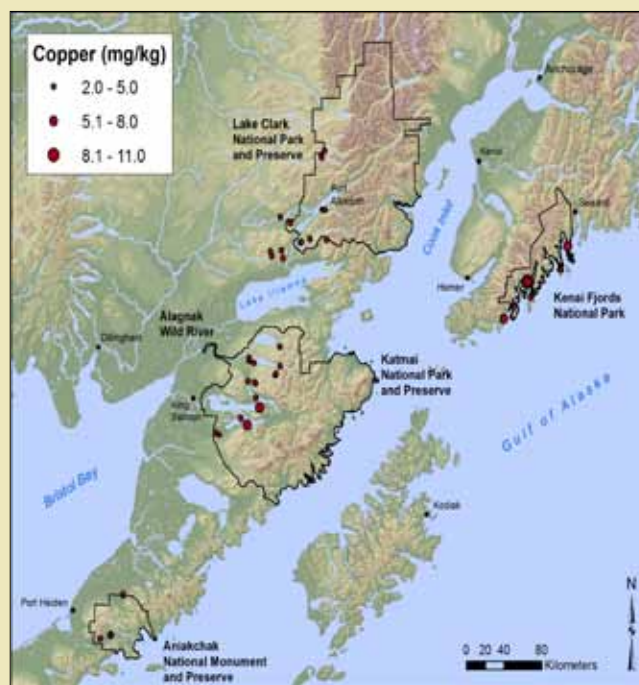
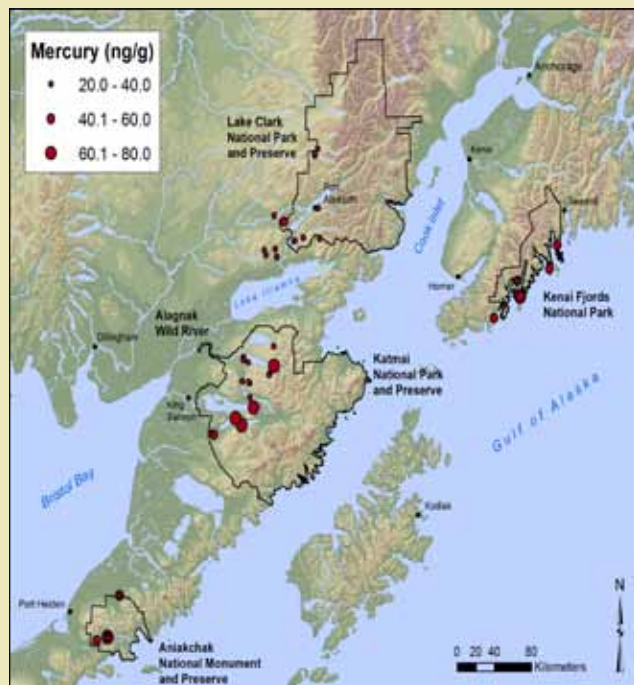


Typical Hylocomium splendens habitat, Fishtrap Lake, Lake Clark National Park and Preserve, 2010

Discussion

Preliminary baseline concentrations of trace elements found in *Hylocomium splendens* indicate that values fall within what are considered background levels in other studies across Alaska. While subtle distribution patterns appear for several elements, further research is needed to control for sources of variability, including the influence of lithologic sources such as volcanism. Precipitation samples also indicate that concentrations of sulfate and nitrate, atmospheric pollutants associated with smog and ozone, are very low. Ammonium

levels, a chronic pollutant associated with agriculture, is near the detection limit – indicating extremely low concentrations. This baseline information will provide a starting point for monitoring contaminants over time. Changes in local land use that may affect contaminant levels in the future include industrial activities that generate dust contaminated with trace elements, which can bioaccumulate in local populations of long-lived plants and animals.



These maps show the concentrations of copper and mercury (upper) and total nitrogen and total sulfur (lower) found in moss samples collected in and around the SWAN. These trace element levels are consistent with background concentrations likely derived from natural sources. Nitrogen and sulfur are important nutrients for plants, but can also bond with oxygen resulting in particulates associated with smog. Establishing baseline levels for these elements will inform park managers of emerging air quality issues.