Resource Brief
Southeast Alaska Network

National Park Service
U.S. Department of the Interior

Inventory & Monitoring Program

Airborne Contaminants

Glacier Bay National Park and Preserve
Klondike Gold Rush National Historical Park
Sitka National Historical Park

Importance

Southeast Alaska has among the most pristine atmospheric conditions in the world, which means that even small increases in pollution can have significant impacts. Areas of Southeast Alaska, including Klondike Gold Rush National Historical Park (KLGO), Glacier Bay National Park (GLBA), and Sitka National Historical Park (SITK), are exposed to a number of local airborne pollution sources and a wide variety of modes of regional transportation (cars, buses, helicopters, planes, ferry, trains, and cruise ships), particularly during the summer tourist season. Regional and global sources of airborne pollution include sooty fine particulates, nitrogen oxides, and other pollutants associated with forest fires and wind-blown dust as well as industrial emissions transported from Eurasia. Airborne pollutants are a concern because of the potential adverse effects to human health and sensitive components of national park ecosystems.

Contacts:

Project leaders:
Dave Schirokauer,
dave_schirokauer@nps.gov;
Linda Geiser, lgeiser@fs.fed.us

Coordinator:
Brendan Moynahan,
brendan_moynahan@nps.gov

Left: Deposition samplers set up at Upper Dewey Lake (adjacent to KLGO) above the town of Skagway measure wet deposition of various oxides of nitrogen and sulfur.

Below: *Platismatia glauca* is one of three common and widespread lichen species selected for elemental analysis in airborne contaminant monitoring in SEAN parks. Some lichens are particularly sensitive to certain airborne pollutants, and decline or die when exposed to low levels, while other species thrive in polluted areas.

Program Design

The Southeast Alaska Network (SEAN) is assessing deposition of airborne contaminants using a multi-pronged approach to initiate a program of decadal (every 10 years) monitoring. This study follows-up on a pilot study conducted in KLGO in 1999, refines the original methodology, expands the monitoring study area to include all NPS areas in Southeast Alaska (KLGO, GLBA, and SITK), sites adjacent to KLGO (Skagway) and Sitka, and expands a partnership with the Tongass National Forest (TNF). During the 2008–2009 field seasons, monitoring was conducted at seven sites total throughout all three SEAN park units for ambient atmospheric pollutants (passive membrane samplers), deposition (wet deposition samplers), and elemental analysis (using three common lichen species). In addition, lichen community study plots were established to measure the ecological effects of airborne pollution by examining the changes in the composition of epiphytic (growing on trees and shrubs) lichen species in areas exposed to different levels of airborne pollution. Total deposition of nitrogen, sulfur, and metals was characterized from elemental analysis of the tissues of epiphytic lichens, which was compared to clean site ranges in TNF. TNF managers have maintained a network of about 120 permanent air quality biomonitoring plots since 1989. A goal of the SEAN monitoring program is to create links between the different methods. In 2010, a wet deposition, elemental mercury monitor was installed at Bartlett Cove (GLBA) as one of four Alaskan sites in the national Mercury Deposition Network. Rainwater samples are collected weekly and assessed for mercury concentration.

Reports and Data Access:
http://science.nature.nps.gov/im/units/sean/AC_main.aspx

Updated March 2012

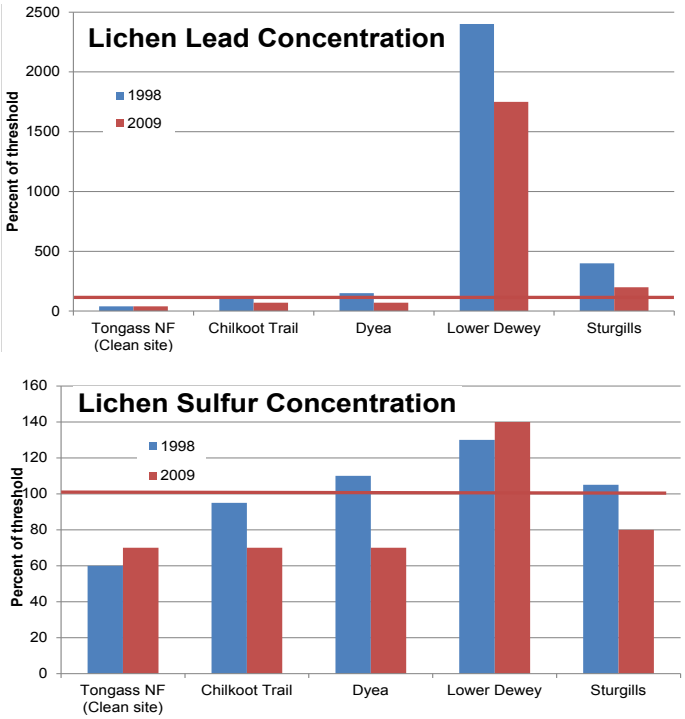

Figure 1. Levels of legacy lead and sulfur in vegetation (epiphytic lichens) samples from Klondike Gold Rush NHP (Chilkoot Trail, Dyea) and the adjacent Municipality of Skagway (Lower Dewey, Sturgills) compared to a 'clean-site' in Tongass National Forest. Horizontal lines indicate clean-site thresholds for the Tongass National Forest established by Dillman et al. 2007.

Status and Trends

Monitoring and efforts to expand data collection are ongoing and some initial results are reported here.

• Lead, nickel, cadmium, and zinc levels in lichens were within background ranges at most sites, but still strongly elevated at Skagway sites (Lower Dewey and Sturgills) that are adjacent to KLGO, a legacy from historic use of the Skagway harbor to transfer mined lead and zinc ore from open rail cars and trucks to barges (Fig. 1).

• Sulfur levels in lichen tissue that may cause adverse effects to sensitive plants were observed at Skagway sites at the Lower Dewey site (Fig. 1) and at SITK (not shown).

• Sulfur dioxide was elevated in Skagway along Dewey Lakes Trail and at Sturgills but not at other sites near or in KLGO, GLBA, or SITK (Fig. 2). Nitrogen oxides were elevated and 5-10 times higher in Skagway lands adjacent to KLGO at Icy Junction and along the lower Dewey Lakes Trail compared to GLBA and SITK.

• Vanadium, a product of diesel combustion, was very high at sites closest to the Skagway ore terminal, especially on the forested fjord walls along Dewey Lakes trail above the harbor.

• The increase in ship traffic over the past 10 years is correlated with small increases in nitrogen accumulated in epiphytic vegetation (lichens) at sites close to Skagway harbor.

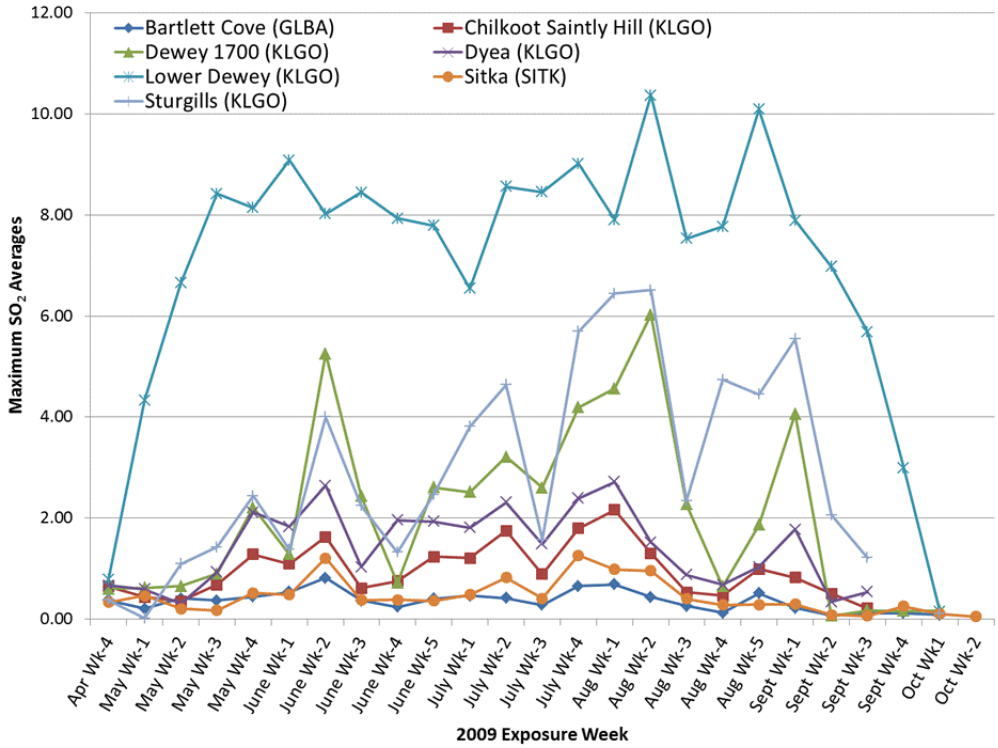

Figure 2. Levels of sulfur oxides (SO_2) attributable to fossil fuel combustion were enhanced in the Municipality of Skagway sites (Lower Dewey, Dewey trail at 1,700', Sturgill's Landing), as well as in Klondike Gold Rush NHP (Dyea, Chilkoot Saintly Hill), but were relatively low at other sites. SO_2 emissions lead to atmospheric deposition of sulfur, a cause of acidification of soils and water.

Southeast Alaska Network Vital Signs

- Airborne Contaminants
- Freshwater Contaminants
- Freshwater Water Quality
- Glacial Dynamics
- Intertidal Communities
- Kittlitz's Murrelets
- Landform and Landcover
- Marine Contaminants
- Marine Predators
- Oceanography
- Streamflow
- Weather and Climate

Reports and Data Access:
http://science.nature.nps.gov/im/units/sean/AC_main.aspx

Updated March 2012