

## Air Quality

**Goal:** Maintain the current air resource condition to protect the Forest's ecosystems from on- and off-Forest air emissions sources.

**Objective:** Attain national and state ambient air quality standards Forest-wide.

**Air Monitoring Question: Is air quality being maintained? To answer this monitoring question, both annually and every five years, several other factors must first be considered. Ultimately, we want to know how to protect resources from deleterious effects from air contaminants from on and off- Forest emission sources.**

**ADEC and EPA review for 2009:** (Is air quality for human health concerns being maintained and if not, how will non- attainment of certain pollutants impact natural resources on adjacent NSF lands?)

In 2006, the Environmental Protection Agency (EPA) strengthened its air quality standards for fine particulates to 35 µg/m<sup>3</sup> (PM<sub>2.5</sub>). As federal standards became stricter, the City of Juneau also tightened ordinances that date from the 1980's and increased public education and compliance efforts. The Alaska Department of Environmental Conservation, Division of Air Quality, Air Non-Point and Mobile Sources Program is responsible for mobile and area sources of air contaminants for human health concerns. The 1970 Clean Air Act established air quality programs to regulate air emissions from stationary, mobile and other sources which pose a risk to human health and the environment. The City of Juneau monitors air quality from a station located on the roof of the Floyd Dryden Middle School in the Mendenhall Valley. EPA data from 2006-2008 indicate that Juneau has met federal air quality standards for PM<sub>2.5</sub> (ADEC 2009). In the EPA national list of "nonattainment areas" for fine particulates, Juneau was removed from this list in 2009. The sources of fine particulates for the Juneau area include power plants, vehicles and wood burning stoves. The ADEC is currently requesting that the EPA reclassify the Mendenhall Valley to "attainment" status for PM<sub>10</sub> (course particulate matter). Sources for course particulates include dust from mining, unpaved roads, and construction sites. At this time, Juneau air quality is being maintained under EPA standards for human health concerns.

**Contaminant thresholds in lichens for 2009:** (How to determine the current air resource condition?)

Air quality lichen biomonitoring in non- wilderness was conducted in three new areas on the Tongass National Forest (NF) in FY 2009 (Table 1). No previously established non-wilderness biomonitoring plots were revisited. Six new lichen biomonitoring plots were established in wilderness. Two wilderness plots were revisited and lichen samples collected for analysis.

TNF plot #	General location	Lichen species collected for contaminants
TNF 543	Laughton Glacier Trail, Skagway, Juneau RD	<i>Hypogymnia enteromorpha</i> , <i>Platismatia glauca</i> , <i>Alectoria sarmentosa</i>
TNF 551	Near Craig Cemetery, Craig RD	<i>Alectoria sarmentosa</i> , <i>Hypogymnia enteromorpha</i>
TNF 550	Hyder, Titan Trail, Ketchikan/Misty RD	<i>Platismatia glauca</i> , <i>Alectoria sarmentosa</i>
TNF 544	Denver Glacier Trail, Skagway, Juneau RD	<i>Hypogymnia enteromorpha</i> , <i>Platismatia glauca</i>
TNF 513	Coronation Island, Thorne Bay RD	<i>Hypogymnia enteromorpha</i> , <i>Platismatia glauca</i>
TNF 510	Warren Island, Thorne Bay RD	<i>Alectoria sarmentosa</i> , <i>Platismatia glauca</i>
TNF 547	Sawyer Island, Juneau RD	<i>Platismatia glauca</i>
TNF 545	Rudyard Bay, Misty Fiords, Ketchikan RD	<i>Platismatia glauca</i> , <i>Alectoria sarmentosa</i>
TNF 546	Pt. Louise, Misty Fiords, Ketchikan RD	<i>Alectoria sarmentosa</i> , <i>Platismatia glauca</i> , <i>Hypogymnia duplicata</i> , <i>Lobaria oregana</i>
TNF 548	Maurelle Islands, Anguilla Is., Thorne Bay RD	<i>Alectoria sarmentosa</i> , <i>Platismatia glauca</i>
TNF 554	Maurelle Islands, Anguilla Is. southern tip, Thorne Bay RD	<i>Alectoria sarmentosa</i> , <i>Platismatia glauca</i>
TNF 549	Maurelle Islands, Hole in the Wall, Thorne Bay RD	<i>Alectoria sarmentosa</i> , <i>Platismatia glauca</i>

Table 1. Locations for lichen tissue collection for air quality on the Tongass National Forest in 2009.

**Non-wilderness:** Air quality and visibility in Skagway is of particular concern to residents, even though levels are within attainment standards set by EPA. The calculated annual average for PM<sub>2.5</sub> in Skagway from 2004-2005 was 5.9 µg/m<sup>3</sup>, which was well below the *annual* state and federal ambient air quality standard of 15 µg/m<sup>3</sup> (ADEC 2007). Similarly, all of the particulate monitoring data was well below the *daily* state and federal ambient air quality standard of 65 µg/m<sup>3</sup> (standard in place at the time of the study, see above for new standard). However, the narrow river valley continues to capture particulates and air contaminants emitted from the cruise ships docked downtown and other vehicles in the area, such as trains and buses hauling visitors throughout the summer (Figure 1). Over 800 lbs per hour of nitrogen oxides (NO<sub>x</sub>) and sulfur dioxide (SO<sub>2</sub>) are emitted during the summer season by cruise ships alone (Graw & Faure 2010). Other air particulates and contaminants that impact visibility and air quality in the valley originate from the city incinerator and also forest fires in nearby Yukon and British Columbia. The purpose of establishing lichen biomonitoring plots on National Forest System lands near Skagway was to augment the current study conducted by the National Park Service (NPS) of air quality using lichens. This cooperative study will be used to determine if air contaminants emitted from cruise ships and other diesel engines are impacting the natural resources on NPS and NFS lands. NO<sub>x</sub> and SO<sub>2</sub> are contaminants that can damage the ability of the algal component of the lichen to photosynthesize (Fields 1988, Nash, Nash & Gries, 1991).

The town of Hyder is in an isolated part of the Tongass NF on the mainland south of Misty Fjords National Monument Wilderness. One biomonitoring plot was established along the Titan Trail above the Salmon River. Threats to air quality in Hyder consist of dust from unpaved roads, gold and copper mining in nearby British Columbia (Figure 2), and forest fires.

With the help of Tongass NF recreation specialist Tory Houser, an additional biomonitoring plot was established in Craig as a training session for local high school students in lichens and biomonitoring. The threats to air quality in the Craig area are from dust from unpaved roads, wood smoke and emissions from boats.



*Figure 1. Diesel engines on the Yukon-White Pass railroad in Skagway near the Laughton Glacier Trail, Tongass National Forest. Photo by K.Dillman*



*Figure 2. Upriver from Hyder, AK, copper and gold mining operations and reclamation along the Salmon River in British Columbia. Photo by K.Dillman*

**Wilderness:** Two plots were revisited in 2009 on Coronation and Warren Islands. These two locations previously contained lichens that exceeded the thresholds established for NO<sub>x</sub>, SO<sub>2</sub> and some other contaminants in lichens (Dillman 2007). Therefore, more lichen tissue was collected in 2009 to establish trends in contaminant accumulation and to attempt to determine sources of contaminants. Three new plots in wilderness were established on the Tongass NF due to concerns voiced by wilderness managers of Misty Fjords and Tracy Arm/Fjords/Terror wilderness areas. These areas receive many cruise ships during the summer tourist season. Two plots were established in the Rudyard Bay area in Misty Fjords. One plot was established on Sawyer Island in Tracy Arm (Figure 3). Before 2009, the Maurelle Islands wilderness did not have permanent air quality biomonitoring plots established. Therefore three new biomonitoring plots were established in this wilderness (Figure 4). The major threat to air quality in Tongass wilderness is emissions from cruise ships and moored vessels during the summer season.



*Figure 3. First cruise ship of the season in Tracy Arm wilderness in May 2009. Photo was taken from Sawyer Island, site of air quality biomonitoring plot. Photo by K.Dillman*



*Figure 4. Ecologist Kristin Lease collecting lichen tissue for air quality monitoring in the Maurelle Island wilderness. Photo by K.Dillman*

**Methods:** In all plots, lichen tissue was collected using the protocol described in Geiser *et al.* (1994) and Geiser (2004). Lichen tissue samples were processed in Petersburg and sent to the University of Minnesota Soil Laboratory in October 2009. This laboratory is the same facility the Tongass NF and other NFS Regions have used for over twenty years. Lichen species collected for community information from these areas are presently being identified by Karen Dillman and contract lichenologists Trevor Goward and Katie Glew.

Contaminant thresholds were established for target lichens on the Tongass NF (Dillman *et al* 2007). Results for the 2009 tissue analysis are not available at this time as it takes several months for completion. The 2008 ( from Sitka area) and 2009 results from the laboratory analysis will be compared to Tongass NF thresholds to determine if lichens are accumulating contaminants above established thresholds, thus indicating that contaminants are entering the ecosystem and impacting the natural resources of an area in some way. The degree to which the contaminants are impacting the natural resources will be determined through further monitoring of lichen communities. Contaminant results from the 2008 and 2009 tissue analysis will be entered into the Region 6 Air Quality and Lichens database (USDA 2006) and reported in FY2013.

## Citations

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