

## Project Summary

### Rocky Mountains Cooperative Ecosystem Studies Unit

**Project Title:** Lichen Inventory of Glacier Bay National Park (GLBA) - establishing a lichen diversity baseline in an outer oceanic ecosystem and along glacier chronosequences.

**Discipline:** Natural  
**Type of Project:** Technical Assistance  
**Funding Agency:** National Park Service  
**Other Partners/Cooperators:** University of Montana  
**Effective Dates:** 9/1/2011 - 4/30/2014  
**Funding Amount:** \$170,239

**Investigators and Agency Representative:**

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**Project Abstract:** Lichens are widely recognized as an important part of the ecosystems of Southeast Alaska, whether as rock-coating crusts in the intertidal, covering tree trunks and branches in coastal rainforests, or inhabiting alpine heaths and rock outcrops. The importance of Southeast Alaska as a hotspot for lichens was recently underlined with the documentation of 766 species from Klondike Gold Rush National Historic Park (KLGO), making it the richest park in the U.S. National Park Service system and the richest single local flora to date in North America (Spribille et al. 2010). The discovery of such a rich flora poses several new questions:

- 1) Is such richness generally to be expected in coastal Alaska?
- 2) How specific are regional floras, i.e., how much 'turnover' in species would there be from one fjord to another in southeast Alaska?
- 3) On a gradient from outer coast to inland continental areas, is there a climatic 'sweet spot' that is richest in lichen species?
- 4) How deep potentially is the pool of new species for science in Southeast Alaska, and may some of these species help fill gaps in the fungal tree of life?

There are several reasons to believe that GLBA may have a substantially larger lichen flora than KLGO. First, at 13,287 km<sup>2</sup>, GLBA is 250 times larger than KLGO. More importantly, perhaps, GLBA harbors greater landscape heterogeneity. Whereas KLGO has a relatively uniform climate overlaid on an elevational gradient from sea level to around 1100 m on an almost uniform granite/granodiorite geological parent material, GLBA has parallel different exposures to the Pacific coastal climate varying from hyperoceanic outer coastal areas (Alsek River to Cape Spencer) to sheltered oceanic fjords to highly sheltered deep inland fjords in the rainshadow of the Fairweather Range. Elevations within the Park range from sea level to over 5000 m, and geologic substrates range from acidic granites and granodiorites to strongly calcareous sediments in the outwash of the Alsek River. In particular, the occurrence of both calcareous sedimentary and acidic igneous rocks can be expected to substantially increase the number of species present.

These questions have led us to propose a continuation of a Klondike-style study to GLBA. The specific objectives of the lichen inventory are to:

- 1) Compile information on lichen specimens collected in GLBA from the literature as well as material current accessioned in herbaria (data mining); historical specimens from GLBA are believed to exist in several eastern U.S. herbaria.
- 2) Based on new field work, create a comprehensive list of lichen species collected or detected in the park; because of the large size of the Park and the logistical difficulty of inventorying every area of GLBA, we will conduct focused comprehensive inventories to generate independent species lists for four distinct study areas within the Park and Preserve:
  - 2a) Outer coast (Alsek River to Cape Spencer; forest and alpine sites)
  - 2b) Inner coast: Gustavus area (Beartrack River to Point Gustavus and alpine sites on Excursion Ridge) plus sites in Dundas Bay;
  - 2c) Chronosequence of sites since glacial retreat in Muir Inlet;
  - 2d) Chronosequence of sites since glacial retreat in Glacier Bay proper, extending to the head of Tarr Inlet
- 3) Complete a reference collection of voucher specimens and associated data for the herbaria of GLBA and the University of Alaska, Fairbanks (UAF).
- 4) Collect preliminary distribution and local rarity information and obtain GPS data for each lichen sampling site.

5) Establish long-term climate change monitoring plots at selected alpine sites in Muir and Tarr Inlets using a microplot technique that makes use of lichen sensitivity to snow depth and persistence.

6) Develop for cruise ship passengers a visitor interpretation package on the lichens of GLBA, addressing their diversity and role in the ecosystem, and successional change as glaciers retreat. Specifically, this would involve: a) developing a brochure and/or poster for visitors to the Park explaining the nature of lichens, the common species, why they are abundant in GLBA, and the stories they tell us about the environment; and b) a training session for Park interpreters giving anecdotes about how lichens can be used to "read the forest", for use with the public.

Our study is designed to augment current lichen air quality monitoring studies underway at Bartlett Cove and elsewhere in Glacier Bay intended to monitor the long-term effects of cruise ship stack emissions on the wilderness environment. Specifically, our species list will provide an expanded biodiversity baseline and inform future air quality sampling in terms of localization of plots and species to monitor.

**Outcomes with Completion Dates:** First draft manuscript - November 2013. Main GLBA inventory manuscript submitted for publication and complete specimen database with inventory numbers and main collection delivered to GLBA - March 2014

**Keywords:** Glacier Bay National Park, University of Montana, lichen, baseline, inventory and monitoring