

# Glacial Change on Baranof Island: Quantifying Local-level Impact of Climate Change

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## **Overview**

The glaciers of Baranof Island – the only glaciated island in Southeast Alaska – are small, disparate, and sensitive to climatic change due to the temperate climate in which they are situated. We propose to quantify the change in area of a selection of Baranof Island glaciers over recent history by gathering geospatial data, calculating the perimeter and surface area of the glaciers, using a model to estimate glacial volume, and then comparing our findings against the historical record – historical USGS field measurements, historical aerial photographs, tree core data, and geomorphological indicators such as terminal moraines and trim lines. We will then quantify historical change of surface area and perimeter, and if sufficient historical data points are available, we will also calculate a rate of change (both for surface area and extent of the terminus) and predict future glacial advance or retreat.

## **Methodology**

### Targeted Glaciers

We will gather data for two subsets of glaciers, one subset from mid-Baranof Island, one subset from the South Baranof Wilderness Area.

The first subset of glaciers will consist of two glaciers from mid-Baranof Island, both on or near the Cross-Baranof Island Trail and well known by users of the Sitka Community Use Area. These glaciers are indicated in map attachment 1 – a small valley glacier north of Glacier Lake and a modest icefield north of the Baranof River valley.

The second subset of glaciers will consist of three smaller hanging and cirque glaciers from the South Baranof Wilderness Area (see map attachment 2).

### Access

For the first subset of glaciers in mid-Baranof Island, we will access the glaciers by conventional means: foot and canoe (to cross inland lakes).

For the second subset of glaciers in the South Baranof Wilderness Area, we will approach the glaciers by either floatplane or kayak because of their isolated location. We will continue to the glaciers on foot from our remote access point.

### Data Collection

We will collect latitude and longitude waypoints at regular intervals around the perimeter of a glacier by using a high-precision GPS device (model: Trimble Pathfinder). Additionally, we will photographically document all selected glaciers and georeference our photos.

### Data Analysis

We will input our GPS data into a geographic information system (GIS) program, ArcGIS. We will then calculate perimeter and surface area for all selected glaciers and three-dimensionally model the glaciers in their surrounding topography.

We will then georeference data from the historical record – USGS measurements, photographs, and geomorphological indicators – into ArcGIS and calculate perimeter and surface area differential with current data. Finally, we will calculate the rate of change of the glaciers’ surface areas and perimeters.

### Schedule

Early June: Chandler Kemp and Jonathan Kreiss-Tomkins gather data for the first subset of glaciers, on mid-Baranof Island.

Early August: Jonathan Kreiss-Tomkins and Eli Bildner gather data for the second subset of glaciers, on South Baranof Island.

Mid- to late August: Jonathan Kreiss-Tomkins, Chandler Kemp, and Eli Bildner analyze data and present findings.

### **Deliverables**

- Present-day baseline latitude and longitude data for targeted Baranof Island glaciers
- Exhaustive georeferenced photodocumentation for targeted Baranof Island glaciers
- Historic and predicted rates of retreat/advance for targeted Baranof Island glaciers
- Two- and three-dimensional models of targeted Baranof Island glaciers and animations of their change over time
- Submission of data for targeted Baranof Island glaciers to the National Snow and Ice Data Center’s World Glacier Inventory and GLIMS glacier inventory (no data presently exists for targeted glaciers in either directory)

### **Budget**

#### Expenses

Food: \$300

Fuel: \$30

Gear (wear and tear): \$100

Travel (Chandler to Baranof Island): \$150

Travel (S. Baranof Access): \$1,500

*Total: \$2,080*

#### Income

Yale Richter Fund: \$1,000

Sitka Conservation Society: \$1,000

*Total: \$2,000*

### **Project Continuance**

The value of this project will be enhanced if it is extended over a multi-year or even multi-decade timeframe (much like the Juneau Icefield Research Program, which has been active since World War II). Glacial change analysis is most accurate when many data points are available from many different years. Those data points can be gathered by monitoring the glaciers as infrequently as every decade or as frequently as every year. Although we believe this project is meritorious in isolation, we hope that future monitoring of the glaciers will be made possible and that our conclusions and data can be expanded upon.

