

POSITION ANNOUNCEMENT:

GEORGE MELENDEZ WRIGHT INITIATIVE FOR YOUNG LEADERS IN CLIMATE CHANGE

The National Park Service (NPS) is pleased to announce the 2017 *George Melendez Wright Initiative for Young Leaders in Climate Change* (YLCC) to provide a pathway for exemplary students in higher education (graduate students, advanced undergraduate students, and recent graduates) to apply their skills and ideas to park-based challenges and solutions. The Initiative offers 12-week paid internships which allow students to gain valuable work experience, explore career options, and develop leadership skills through mentorship and guidance while helping to advance the NPS response to climate change. Successful students may be eligible for non-competitive hire into federal positions for which they qualify following completion of all academic requirements.

VANISHING ICE. UNDERSTANDING THE RATE AND EXTENT OF GLACIER LOSS IN THE OLYMPIC MOUNTAINS

Olympic National Park
Port Angeles, Washington

Analyze aerial images and LiDAR returns of the Olympic Mountains to determine recent changes in the size and thickness of glaciers in Olympic National Park. Combine this data with mass balance measurements to correlate annual climate and glacier contributions to downstream aquatic ecosystems.

INTERNSHIP PROJECT BACKGROUND

Glaciers are rapidly retreating at Olympic National Park. These iconic features form the backdrop to many of the park's most popular vistas, are habitat for unique alpine fauna, and most importantly, are a critical hydrologic resource providing abundant cold, fresh water to lakes, streams and rivers during dry summer months. This melt-water is critical to downstream aquatic ecosystems, as well as use by irrigation districts and public municipalities. Many aquatic and riparian species, including several listed species of salmon and trout, depend on the water released by these glaciers.

A 2010 study of Olympic glaciers found that glacier loss in the Olympic Mountains is significantly higher than the loss observed in other mountainous regions of the Pacific Northwest. The study documented a loss of 82 glaciers and a 34% decrease in glacial extent since 1980. This reduction in glacier area was accompanied by a significant loss in ice thickness, however this has only been measured on 4 of the remaining 184 glaciers in the park. The terminus area of one large glacier exhibited losses of 180 feet of ice thickness. These rates of ice loss illustrate how sensitive the relatively small, low elevation glaciers at Olympic National Park were to recent warming.

INTERNSHIP PROJECT DESCRIPTION

The goal of this project is to better understand the rate and extent of recent glacier loss, including the impact to downstream hydrologic sources. Olympic National Park has a unique opportunity, due to the recent acquisition of LiDAR data and NAIP imagery in 2015, which coincided with the lowest snow year

on record in the Pacific Northwest. Analysis of these data will provide a complete and updated status of Olympic Mountain glaciers and provide park scientists with a baseline to measure future changes. This information is in high demand, and will have many uses to downstream stakeholders: park staff (changes in sediment load affecting downstream facilities), fisheries managers (streamflow amounts, timing/height of spring & summer flows, baseline flows, stream temperatures), tribal communities (fisheries, facilities, water supply) climate scientists (regional trends, education) and water managers (municipal and agricultural water supply).

Finally, small mountain glaciers are great integrators of local climate, quickly responding to changes in temperature and precipitation. Recent glacier responses to warming temperatures have provided a dramatic indicator of climate change, and a clear and meaningful way for the NPS to relate climate change to the public. The intern will co-author a peer reviewed publication, and have opportunities to present results to park management, local stakeholders and public forums such as the NPS science Perspectives series.

Internship Tasks

1. Using 2015 NAIP Imagery, develop a set of glacier outlines to determine the area of all Olympic Mountain glaciers. Assess error and compare to earlier inventories (1982, 2010).
2. Use LiDAR data to create surface elevation models (DSMs) for the 30 largest Olympic glaciers to provide critical data in support of NPS glacier mass balance monitoring. Combine with new glacier outlines and compare to USGS DEMs to estimate changes in glacier volume.
3. Analyze DSMs to develop new glacier hypsometry for the Hoh, Elwha and Dungeness drainages.
4. Apply hypsometry to mass balance data (collected by NPS) and USGS streamflow data to estimate glacial contributions to these Olympic rivers.
5. If desired, intern may participate in field mass balance work in support of Olympic National Park glacier monitoring program.
6. Produce scientific figures, maps and interpretive presentations/products for outreach to park managers, cooperating agencies and other stakeholders.

Internship Products

1. ArcGIS Geodatabase of new glacier outlines derived from 2015 NAIP Imagery for perennial ice features larger than 0.01km^2 . These will be compared to glacier outlines mapped in 1961, 1982 and 2010 to determine the magnitude and rate of glacial retreat.
2. Digital surface models (DSM) of 30 glaciers with a 1 m contour interval. DSMs of select glaciers will be compared to 1987 USGS digital elevation models (DEMs) to estimate changes in thickness and volume changes. Surface elevation changes will be presented as raster based images with ice loss in 1 meter increments across each glacier. The volume of each glacier will be estimated using a standard model.
3. Glacial DSMs will be used to estimate glacier hypsometry (area altitude distribution) of all glaciers in the Hoh, Elwha and Dungeness watersheds.
4. New glacier hypsometry values, existing streamflow, mass balance and temperature data will be combined to model streamflow contributions to downstream drainages.

QUALIFICATIONS

The intern will be a graduate student interested in a career in geography, geology, civil and environmental engineering, atmospheric science, data analysis, climate science, or natural resource management. They should have experience in conducting independent research and synthesizing

complex spatial information into useful and coherent products. They should have the ability to work independently, but also be comfortable seeking advice and direction from professors and NPS mentors. Required skills include:

- An understanding of geography, geology, glaciology, hydrology or climate modelling, including upper division or graduate coursework.
- Demonstrable experience with computer models, ArcGIS, manipulation of spatial data (specifically raster and LiDAR returns), computer programming (Python).
- Experience analyzing LiDAR and remotely-sensed imagery (e.g., Landsat data).
- Above average technical and non-technical writing skills.
- Field experience in remote mountain terrain subject to adverse weather conditions, such as that found in the Olympic Mountains

LEADERSHIP DEVELOPMENT

An NPS physical scientist will directly supervise the intern at Olympic National Park. Work will also occur with guidance and participation from North Coast and Cascades (NCCN) glacier staff and the park's GIS specialist. NPS scientists have experience and are motivated to present new findings in peer reviewed journals and at public outreach forums. They will provide guidance and support and help to see these products through to fruition. Despite this guidance, the intern will be expected to work independently and develop products to be shared with peers.

Data from the project will be used by many in the scientific and resource management community. The intern will collaborate closely with glaciologists from several university programs, the USGS and the National Park Service. The intern will have the opportunity to publish results and present the findings of this study in both scientific and public forums.

DATES OF POSITION

Start and end dates are flexible, depending on availability of student. Approximate start date is July 2nd to September 23rd, 2017.

COMPENSATION

This initiative supports one student at \$15/hour for 12 weeks, or 480 hours.

HOUSING

Temporary housing provided by the park will be available. Rooms may be single or shared with another park employee; kitchen and living areas are always shared. If park housing is not available, numerous rental options are available in Port Angeles.

WORK ENVIRONMENT

The intern will mostly work in a shared office environment in the park's headquarters in Port Angeles, WA. Optional field work is available to aid NCCN staff with mass balance measurements. Glaciers in Olympic National Park are remote by nature and safe access requires backpacking and mountaineering

skills. The Olympic Mountains are particularly rugged, and the work conditions (snowpack, weather, etc.) are often adverse.

CONTACT INFORMATION

Park Service Supervisor: Bill Baccus

bill_baccus@nps.gov

360-565-3061

Project Advisor: Jon Riedel

jon_riedel@nps.gov

360-854-7330

GIS Advisor: Roger Hoffman

roger_hoffman@nps.gov

360-565-3062