



USGS NSF GRIP, GSP Opportunity

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USGS Center: Oregon Water Science Center

Project Title: Upper Klamath Basin: Method Development for Sediment Fingerprinting

Summary: The upper Klamath River Basin in south central Oregon is a scenic wonderland that has been severely altered by over 150 years of western settlement. In the shadow of Crater Lake, the basin was draped with ash from the eruption of Mt. Mazama 7500 years ago. Upper Klamath Lake, naturally enriched from geologic nutrient sources, became hypereutrophic following land use alterations ranging from wetland diking and draining, to stream channelization, cattle ranching, commercial forestry, and extensive irrigation. The lake is home to two species of critically endangered suckers considered sacred to the Klamath Tribes, and water quality and sedimentation are key threats to their survival. The potential removal of 4 dams blocking fish passage in the lower Klamath River, which would restore salmonids to the upper basin, adds impetus for water quality improvements. Much upland restoration is envisioned, but resources and opportunities are scarce. Our project seeks to help managers prioritize restoration by adding knowledge about major sediment and nutrient sources to baseline data from existing water quality monitoring programs.

A successful NSF Intern will bring initiative, curiosity, cultural awareness, and a love of the outdoors, together with a geochemistry background, to help the project's PI to research, develop, and test different methods to best differentiate sediment and/or phosphorus sources to the lake (aka "sediment fingerprinting"). We envision a month or more of planning and literature review, with 3-6 weeks of field work throughout the basin, during summer 2017 and under the guidance of the PI. Depending on the Intern, the internship could include the laboratory analysis of the collected samples to help test the methods. We would provide funding to pay for field and laboratory supplies.

Southern Oregon has many natural resources and beautiful areas. During the Intern's free time, many opportunities exist for camping, hiking, fishing, birding, cycling, or other activities.

- Project Hypothesis or Objectives:** This is a funded pilot study to develop and/or test methods for identifying primary sources of sediment and/or phosphorus contributing to loading to Upper Klamath Lake, Oregon, with the long term goal of helping prioritize restoration plans. Similar work has been done elsewhere but not in this basin, which has much different geology (volcanic) and land uses (primarily rural, agricultural, and forested) than many previous studies. The specific objective for this pilot study is to determine if it is possible to use a sediment fingerprinting technique to differentiate sediments originating in sub-basins in the Upper Klamath Basin, specifically the Lower Sprague River and the Upper Williamson Rivers. Depending on funding constraints, this could be expanded to other sub-basins including the Wood River basin as well.
- Duration:** Up to 12 months
- Internship Location:** Portland or Klamath Falls, OR. Could be part time in both. Final location TBD, depending on student.
- Field(s) of Study:** Chemistry, Geoscience, Life Science, Geochemistry, Hydrology, Geomorphology,
- Applicable NSF Division:** EAR Earth Sciences, CBET Chemical, Bioengineering, Environmental, and Transport Systems, CHE Chemistry, PHY Physics
- Intern Type Preference:** NSF Graduate Research Fellow (GRF) via the Graduate Research Intern Program (GRIP)
- Keywords:** Sediment, phosphorus, nutrients, geochemistry, soil science, field investigations, eutrophication, restoration, laboratory analysis, stable isotopes, mineralogy, mixing models, resource management, research, US Geological Survey, Klamath
- Expected Outcome:** This pilot study is expected to lead to a followup study to collect similar data in fluvial and depositional sediments, and ultimately to a mixing model that will help identify significant sources of sediment and phosphorus to upper Klamath Lake. Ideally these results would inform decisions about restoration at the subbasin level.

Anticipated products from this pilot study would include datasets of sediment geochemistry, presentations at local or national scientific meetings, a proposal for extending the study to sample fluvial materials and/or develop mixing models for delineating sources, and hopefully a report or paper on the initial results.

● **Special skills/training
Required:**

Required: Driver's license, undergraduate background in geology and chemistry; pre-employment physical; ability to work independently; collaborative spirit; embracing diversity and cultural differences.

Desired: Graduate background in geochemistry or similar; advanced laboratory analytical methods; interest in learning new skills.

● **Duties/Responsibilities:**

The GRIP Intern will be part of a team of 3-5 people evaluating locations and methods for the sediment fingerprinting work. The team will be lead by a PI located in the USGS Klamath Falls office, who will also handle most administrative aspects. Beginning in Spring, 2017 (actual dates TBD), the Intern will be asked to conduct an informal literature review including such topics as: available information on sediment fingerprinting studies completed elsewhere and the techniques used; Upper Klamath Basin geology and available geochemistry and sediment or nutrient transport data; and plans for restoration in the basin that might overlap with areas of likely sediment erosion. At least one or two tours of the upper basin for basic reconnaissance, with other team members, would most likely be conducted during summer 2017 and prior to source sampling. The Intern would work with the PI to develop a workplan and sampling strategy, and to develop plans for laboratory analysis, within available funding. Additional field work for other, unrelated projects in the Klamath Basin could be available for the Intern depending on timing and the Intern's interest and to help familiarize the Intern with local geography, staff from other local agencies or tribes, and natural resource issues.
