USGS NSF Internship Opportunity

**Point of Contact Name:** Corey Lawrence

**Point of Contact Email:** clawrence@usgs.gov

**USGS Center:** US Geological Survey

**Project Title:** Quantifying the Terrestrial Flux of Phosphorus to Aquatic Systems in Rocky Mountain Ecosystems

**Summary:**
The overarching goal of this project is to characterize and quantify the terrestrial controls on stream water phosphorus (P) content and cycling in the East River Valley near Gothic, CO. The intern will join a multi-disciplinary team of scientists who are developing process-based understanding of biogeochemical cycling in Rocky Mountains ecosystems. Through this collaboration, the intern will gain insight into complexities of scaling up measurements from complex heterogeneous terrain and will gain hands on experience with field and laboratory-based biogeochemistry. In addition to gaining experience in conducting mission critical collaborative science, the intern will have an opportunity to build their professional network and learn more about the intricacies of conducting research with governmental agencies. The results of this work will have implications for management of terrestrial lands and water quality in the western US.

**Project Hypothesis or Objectives:**
The coupling of terrestrial and aquatic ecosystems dictates that soil processes can be important controls on stream water chemistry. The nature of hydrologic flow paths through soils, the composition of geologic material forming the soil, and the biologically mediated reactions occurring within the soil each have the potential to influence the source of nutrients to streams. In particular, because in natural settings P is primarily derived from the weathering of geologic materials, it should be a nutrient that should be most influenced by terrestrial processes. Within the soil P cycling is tightly constrained by plant and microbial uptake and recycling as well as by inorganic reactions that can lead to chemical occlusion, limiting availability to organisms but also dissolved losses. However, geomorphology is also a factor since physical erosion in steep terrain may move even chemically bound, particulate P to streams or lakes. Additionally, in some systems influenced by the deposition of windblown dust,
including the Rocky Mountains, aeolian sources may contribute to both the terrestrial P cycle and aquatic exports. Given the diversity of factors influencing P cycling in soils, it is particularly unclear how these terrestrial factors combine to shape the source of P to streams. In this project, we seek to explore the dynamics of terrestrial controls on aquatic P in the Montane ecosystems of the southern Rocky Mountains. The diverse but well characterized geologic and biologic heterogeneity of terrestrial ecosystems surrounding the Rocky Mountain Biological Laboratory near Gothic, CO provide an excellent laboratory for exploring how terrestrial heterogeneity drives stream chemistry.

### Duration:
Up to 12 months

### Internship Location:
Denver

### Field(s) of Study:
Chemistry, Geoscience, Life Science

### Applicable NSF Division:
EAR Earth Sciences, DEB Environmental Biology

### Intern Type Preference:
NSF Graduate Research Fellow (GRF) via the Graduate Research Intern Program (GRIP)

### Keywords:
Soils, Streams, Phosphorus, Biogeochemistry, Environmental Change

### Expected Outcome:
It is expected that this project will result in at least 1 peer-reviewed journal publication documenting and interpreting the spatial controls linking terrestrial (and aquatic phosphorus dynamics. However, it is likely that this effort could lead to additional publications, which could leverage geospatial mapping and/or modeling products.

### Special skills/training Required:
Familiarity with basic soil and stream field methods is preferred. Basic analytical laboratory experience is required.

### Duties/Responsibilities:
The intern will work with collaborators from the USGS, Department of Energy, Rocky Mountain Biological Laboratory, and Stanford to design a small study to sample (during the course of a single field season) and analyze soils, dust deposition, and stream waters for P content and composition. Prior to the field season, the intern will use geospatial mapping tools to estimate spatial heterogeneity within the proposed study region and to identify a suitable number of sampling areas to best characterize this heterogeneity. This exercise will require balancing the time and expense of sample collection, processing, and analyses against the expected variability in P cycling dynamics. During the field season, the intern will coordinate and oversee sample collection and preparation, with assistance from other members of the study team. After samples have been collected, the intern will manage sample processing (e.g., extractions and/or fractionation) prior to submitting samples for analyses. Finally, the intern will oversee data analyses, with assistance from team members, and lead preparation of the primary publication.
Internal Information - Not to be posted:

Center Director Name: Eugene Schweig
USGS Responsibilities: Equipment, Facilities, Mentoring, On-boarding, Background Check, Volunteer Agreement Management
Preliminary Approval: This opportunity has my Center's approval
I already have a student in mind: Jared Balik, North Carolina State University
Comments: This opportunity requires fieldwork in remote high-elevation settings