**Project ACTIONS Undergraduate Internship**

Dates of internship: Fall 2023 – May 2024

Location: Harker ISE Lab, University of Delaware, Newark, DE 19711

Number of positions available: 1

Faculty Mentor: Donald L. Sparks

Professional Staff Mentor: Sunendra R. Joshi

**Overview:** **A**nti**c**ipating **T**hreats to **N**atural **S**ystems (ACTIONS) is a collaboration among the U.S. Army Engineer Research and Development Center (ERDC) Environmental Laboratory and flagship universities in coastal states – the University of Delaware and Louisiana State University. Research will involve a combination of laboratory, outdoor field work and/or computational environments. We seek a dynamic undergraduate student to join our team.

**Project Title:** Salinity induced changes in phosphorus biogeochemistry in tidal salt marsh sediments.

**Research Description:**

Climate change induced flooding and rising seas can significantly enhance seawater intrusion and impact physical and biogeochemical properties of soils and sediments in coastal areas. Due to saltwater intrusion, the coastal tidal saltmarsh sediments are subjected to increases in ionic strength, sulfidation, and alkalinization which can impact phosphorus (P) dynamics and thus affect water quality. Further, inundation of seawater and redox oscillations induced changes in redox sensitive elements directly impact P speciation, that largely determine the bioavailability, transformation, and environmental risk in coastal sediments. Thus, the aim of this study is to investigate salinity and redox oscillation induced P transformation in the tidal saltmarsh sediments using conventional geochemical techniques and X-ray absorption spectroscopy analysis.

**Research Questions:**How does salinity and redox oscillation impact P bioavailability and speciation in coastal soils?

1. How does salinity and redox oscillation induced interactions between Fe, Ca, and S affects P mobility?
2. How do microbial communities respond to the change in salinity?

**Student Learning Objectives: Professional and Research Skills**

This internship focuses on the development of the following professional and scientific skills.

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| Broad Professional Skills | Specific Skills |
| Planning and time management | Ability to set and complete specific goals of varying scope |
| Work independently | Independent work ethic - work independently to problem-solve |
| Collaborative skills | Learning to complete tasks efficiently and effectively with others |
| Express ideas in writing and verbally | Communicate with diverse audiences - Development of impactful poster and oral presentations. Honing ability to deliver scientific results/impacts to people of interdisciplinary background. |
| Broad Scientific Research Skills | **Specific Skills** |
| Understand scientific terms | Mechanistic and applied concepts regarding P biogeochemistry and redox chemistry |
| Literature analysis | Ability to effectively find and utilize scientific manuscripts related to environmental chemistry |
| Use scientific tools | X-ray absorption spectroscopy, Infrared spectroscopy, scanning electron microscopy, and additional advanced physical and chemical techniques |
| Recognize simple patterns in research data | Applying soil environmental chemistry concepts to qualitative and quantitative data. |
| Apply research tools and techniques in research experiments | Selective extractions, redox experiments, etc. to investigate P biogeochemistry. |
| Analyze research data | Excel, JMP, Origin, and instrument-specific software utilization to form effective figures and tables. |
| Understand, apply, and explain scientific concepts and theories | Freedom to form questions and plan methods for addressing challenges. Learning to effectively communicate results through oral presentations and manuscript writing. |

**Work Environment and Expectations:**

Laboratory environment: (e.g., Soil chemistry lab, Harker ISE Lab 4th floor, University of Delaware)

Field work environment:

Computational environment:

The internship is part time during the academic year. The exact hours and expectations are established between the student researcher and mentor.

**Stipend:**

$4,500 - Direct deposit is required.

**Funding Source:**

Department of Defense (DOD) project ACTIONS

**Application deadline:**

**How to apply:** [https://ugresearch.udel.edu/PUB\_Program.aspx](about:blank)