**Summer 2021 Undergraduate Internships**

Dates of internship: Summer 2021

Location: Harker ISE Lab, University of Delaware, Newark, DE 19716

Number of positions available: 1-2

Faculty Mentor: Professor Yan Jin

Professional Staff Mentor: Dr. Mohammad Z. Afsar, Dr. Jing Yan

**Project Title:** Soil hydraulic properties in vulnerable natural terrestrial ecosystems influenced by flooding and sea-level rise

**Research Description:**

Flooding as result of intense precipitation events and sea level rise can significantly alter coastal terrains by changing morphological, physical and biogeochemical properties of the affected soils. These changes can have significant but unknown impact on military installations and maneuverability in coastal regions. As part of a multi-institutional project, we will focus our investigation on elucidating the mechanisms by which increasing salinity affects soil hydraulic properties (e.g., saturated hydraulic conductivity, soil water retention curve) and water evaporation rate from soils. These properties and processes have significant effects on water infiltration, contaminant transport, soil erosion, vegetation and associated ecosystem functions. Better understanding and accurate assessment of these effects will provide predictive insights on the utility and suitability of fragile coastal terrains for military operations. We plan to conduct well-controlled laboratory experiments to quantify changes in saturated conductivity, soil water retention curve and water evaporation rate as we systematically vary salinity levels that are representative of critical weather events and other real-world scenarios. Students working on this project would be a member of a multi-institutional team with opportunities to interact with scientists and fellow students from multiple disciplines. Detailed project goals will be formed to cater to students’ interests.

**Research Objectives:**

* + - 1. To quantify changes in saturated hydraulic conductivity, soil water retention curve and water evaporation rate as a function of salinity in different textured soils;
      2. To elucidate the mechanisms involved in the effect of salinity and soil textures on soil hydraulic properties and the evaporation process;
      3. To test and improve current models of water retention and evaporation.

**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 solve problems |
| Collaborative skills | Learn 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 interdisciplinary audience. |
| Broad Scientific Research Skills | **Specific Skills** |
| Understand scientific terms | Mechanistic and applied concepts regarding saturated and unsaturated hydraulic conductivity of soils, water retention curve. |
| Literature analysis | Ability to effectively find and utilize scientific manuscripts related to environmental soil physics. |
| Use scientific tools | Ksat, hydraulic property analyzer, HYPROP system, WP4C dewpoint potentiometer, x-ray computed tomography, and additional advanced physical and chemical techniques |
| Recognize simple patterns in research data | Apply environmental soil physics concepts to analyze data. |
| Apply research tools and techniques in research experiments | Evaporation experiments in soil columns under different salinity regimes and soil textures to investigate their effects on saturated hydraulic conductivity, soil water retention curve, and evaporation rate. |
| Analyze research data | Use Excel, Origin, and instrument-specific software to make effective figures and tables. |
| Understand, apply, and explain scientific concepts and theories | Freedom to form questions and plan methods for addressing challenges. Learn to effectively communicate results through oral presentations and manuscript writing. |

**Prerequisites:**

Introductory background in physics and chemistry. Knowledge in soil science is desirable but not required.

**Work Environment and Expectations:**

Laboratory environment: Harker ISE Lab 4th floor. Hours are flexibly determined between student and mentor. Students will work full time during summer. Students will also join the NSF EPSCoR summer cohort for professional development opportunities, such as ethic training, communications workshop, career retreat and end of the year summer symposia.

**Stipend:**

$4,000 Direct deposit is required.

**Funding Source:**

Department of Defense (DoD)

**How to apply:** <https://ugresearch.udel.edu/PUB_Program.aspx>