**DENIN Environmental Scholars Internships**

Dates of internship: May 25, 2020 – July 31, 2020

Location: Center for Integrated Biological and Environmental Research, Delaware State University, Dover, DE 19901

Number of positions available: 1

Faculty Mentors: Mingxin Guo and Venu Kalavacharla

Graduate Student Mentor: Antonio Timoteo

Professional Staff Mentor: Antonette Todd

**Project Title:** Biochar amendment-induced soil microbial community shifts and implications

**Research Description:**

Biochar amendment is a promising strategy for everlastingly enhancing soil carbon sequestration and improving soil health. Biochar is charcoal prepared by pyrolytic processing of residual biomass materials and used as a soil conditioner in agricultural and environmental applications. Intensive research has indicated that appropriate biochar amendment ameliorates evidently the physical, chemical, and biological properties of treated soils. Currently substantial knowledge has been accumulated regarding the impacts of biochar amendment on soil respiration, microbial biomass, and enzyme activity, yet the effect on the soil microbial community remains less explored. Soil microorganisms are the most active sector determining soil carbon dynamics and soil health. Understanding the processes and mechanisms through which the soil microbial community shifts in response to biochar amendment will help better utilize this strategy for maximal agricultural and environmental benefits.

**Research Questions:**Relative to control soils without biochar addition, how does the microbial community change in soils amended with different biochars at varied rates?

1. How does the soil microbial community shift in species composition and diversity?
2. How does the soil microbial community change in relative abundance?
3. How are the soil microbial community shifts correlated with biochar-incurred soil physical and chemical changes?

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

This internship provides an opportunity for students to develop the following professional skills and abilities.

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| Broad Professional Skills | Specific Skills |
| Critical thinking ability | Ability to objectively analyze and evaluate information |
| Problem solving ability | Ability to analyze complex problems and develop practical solutions |
| Decision making ability | Ability to identify and choose alternatives based on value and preference  |
| Time management skills | Learn to prioritize daily tasks and keep the deadlines |
| Scientific communication skills | Improve scientific writing and presentation |
| Team spirit | Learn to share resources and work with diverse background members |
| Leadership skills | Learn to develop inspiring vision of future research, motivate others, and organize group efforts. |
| Broad Scientific Research Skills | **Specific Skills** |
| Exposure to frontier agricultural sciences | Learn the technical knowledge of biochar, soil health, and soil biological ecosystems |
| Literature review  | Understand the research advances in biochar application and soil health management  |
| Research skills | Practice experimental design, sample preparation, conducting experiments, and data analysis |
| Laboratory skills | Learn soil DNA extraction and sequencing techniques |
| Use lab equipment | pH meter, conductivity meter, organic carbon and nitrogen analyzer, DNA extraction kits, and DNA sequencers |
| Data analysis and synthesis  | Use EXCEL, Origin, SigmaPlot, and Minitab to analyze and present research data. |

**Prerequisites:**

General chemistry, molecular biology, and laboratory research experience.

**Work Environment and Expectations:**

Laboratory environment: The Soil Health Evaluation Laboratory in the Baker Building and the Molecular Genetics and Genomics Laboratory in the Ag Annex Building. The intern is required to work in the laboratories in workdays from 9:00 am -12:00 pm and 1:00-5:00 pm for 10 weeks. Participation in a research symposium and submission of a project report are necessary to successfully conclude the internship.

**Stipend:**

$3,500 Direct deposit is required.

**Funding Source:**

National Science Foundation, Delaware EPSCoR Track I

**How to apply:** Contact Dr. Mingxin Guo; mguo@desu.edu