ONE Planet Doctoral Training Partnership

Natural Environment Research Council

Project title: Role of wildfires in carbon sequestration: Determining the retention of recalcitrant pyrogenic carbon in soils after a wildfire

Ref: OP2434

Keywords: Wildfires, pyrogenic carbon, carbon sequestration, charcoal

One Planet Research Theme:
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☒ | Environmental Informatics ☐

Lead Supervisor:
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Key Research Gaps and Questions:

- How much of the pyrogenic carbon (charcoal) is retained on the landscape after a wildfire?
- How long is the pyrogenic carbon retained? If pyrogenic carbon is lost, is it due to degradation or exported from the system?

Project Description: Fires have shaped landscapes since the dawn of terrestrial plants. The fire of evidence is charcoal, a recalcitrant form of pyrogenic carbon that is so resistant to environmental degradation that it can be stable for 420 million years. Charcoal and anthropogenically produced biochar are similar compounds in that they are the residue of partially combusted organic material proposed mechanisms for sequestering carbon. However, our understanding of charcoal's assimilation into soils and/or transport post-fire is limited. For this project, we aim to use the Pine Barrens in Northern Wisconsin, USA, as a model system for understanding the postfire behavior of pyrogenic carbon on the landscape. A 5-20 fire cycle has dominated this unique ecosystem for the past 20,000 years. Working with the local Department of Natural Resources, we will use historical fire records and present-day controlled burns to monitor and determine the changes in soil properties, microbiology, and chemistry pre- and post-fire. Additionally, the soil organic carbon pools will be monitored by quantifying the pyrogenic carbon stocks using chemical markers pyrogenic carbon, including polycyclic aromatic hydrocarbons (PAHs) and benzene polycarboxylic acids (BPCA), to determine their export or decomposition of time. Understanding the role of charcoal in the global carbon cycle is urgent as climate change is driving increased forest fire frequency and intensity. This project will improve our understanding of charcoal's role in the global carbon cycle, which is urgent as climate change drives increased forest fire frequency and intensity.

Prerequisites: Desirable Skills: Familiarity with elemental cycles, general geochemistry knowledge, and basic organic chemistry knowledge. Essential Skills: Strong work ethic, willingness to take on fieldwork, ability to work independently, bring together evidence from differing datasets, and desire to learn more!
For more information, contact Dr Shannon Flynn (shannon.flynn@ncl.ac.uk).

Newcastle University

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