2024_03_Understanding litter decomposition dynamics in UK agroforestry systems: the role of soil animals.

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(a) Motivation for the project

In their roles as ecosystem engineers, biological controllers, and nutrient recyclers, soil meso- and macrofauna (> 0.2mm in width) play an essential role in delivering ecosystem services which underpin human well-being. Consequently, addressing the loss of soil biodiversity driven by agriculture (which covers 70% of the UK's land surface) can be considered imperative to the development of sustainable agricultural landscapes which preserve and enhance vital soil functions. Alley-cropping, the integration of tree rows on to farmland, has proven to be a promising strategy to improve soil biodiversity alongside myriad other benefits. However, we still know very little about how this practice influences UK soil meso- and macrofauna or the functions they generate. This is particularly true for nutrient cycling functions, which could contribute substantially to efforts to mitigate climate change, pollution, and soil degradation. This lack of information hinders decision-making by policymakers and land managers at a pivotal time for UK agriculture.

(b) Context and background

This project will further our understanding of alley-cropping's potential to enhance key soil fauna-mediated processes by looking at the first stage of nutrient recycling: decomposition. This suite of processes has major implications for the carbon sequestration and storage capacity of farmlands, as well as potential to reduce mineral fertiliser use. Consequently, this project aligns with the NERC remits of Conservation Ecology and Soil Science. It will involve working with a subset of litter samples collected from a year-long decomposition experiment established across five alley-cropping farms in East Anglia and Nottinghamshire in November 2023. The work produced will directly contribute to a study that will be submitted for publication.

This project presents an exciting opportunity to gain hands-on experience in a soil science lab, develop technical skills in soil analysis, and receive training in data analysis. The student will be fully integrated into the Biodiversity Futures Lab at The Natural History Museum in London, with the opportunity to attend research group meetings/events/training as well as networking and educational events (e.g., coffee mornings and seminars) with researchers and staff from across the museum.

(c) Objectives and methodology

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The aim of this project is to quantify how tree rows influence the decomposition activities of soil meso- and macrofauna on UK farms. The two main objectives are:

1.Quantify the contribution of soil meso- and macrofauna to litter decomposition rates.

2. Determine if the presence and proximity of tree rows influences the contribution of soil meso- and macrofauna to litter decomposition dynamics.

The primary goal of the student will be to calculate rates of mass loss for litter samples, a key part of which will be quantifying soil contamination of the litter samples to attain accurate litter weights. The student will be responsible for each part of this process: weighing the samples, preparing them for analysis, and calculating contamination via the loss-on-ignition technique. The student will also receive training to analyse soil samples (collected from the same experiment) for physicochemical properties. Using statistical techniques applied to the data generated from their lab work, the student will compare (i) decomposition rates between bags which have or have not permitted access to meso- and macrofauna, and (ii) how the contribution of soil fauna to observed decomposition rates varies with the presence and proximity of tree rows.

Project length:

6 weeks