

E5 NERC Summer Research Experience Placements 2026

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A. Supervisor (s) - Name, email and affiliation
<p>I. Alfy Gathorne-Hardy</p> <p>II. Barbara Smith</p> <p>III. Saran Sohi</p>
B. Student Mentor (current PhD student) Name, email and affiliation
<p>Daisy Martinez. Daisy.Martinez@ed.ac.uk Geosciences</p>
C. Department/School
<p>School of Geosciences</p>
D. Placement Project Title
<p>Can we have our trees and eat too: How to plant trees on agricultural land without reducing food production</p>
E. Job purpose
<p>This novel project aims to generate real world solutions to food system sustainability through a combination of modelling and a glasshouse trial:</p> <ol style="list-style-type: none"> 1. Developing a simple model to explore if we can: (i) maintain farm-scale agricultural production while (ii) improving biodiversity and (iii) sequestering carbon through planting alleys of trees on farmland to make biochar. 2. Glasshouse trial, growing a crop in sandy soil with different levels of biochar amendment to explore the potential yield gains under different levels of environmental stress
F. Host and project outline
<p><u>Project approach</u></p> <p>The student will be seen as an equal member of the project team, who's views are valued and opinions respected.</p>

Conceptual background

The rapid pace of environmental change necessitates a fast and smart response to meet net zero, maintain food security, and promote biodiversity at the local and global scale.

All UK governments have ambitious tree-planting aims, and most trees will be planted on agricultural land. This threatens food production, and drives overseas agricultural expansion – most likely in tropical regions.

This project tests the hypothesis that trees can be integrated into farmland without reducing food supply. We hypothesise that strips of short rotation coppice woodland, within fields, can provide biomass for biochar, maintain food production and deliver multiple environmental benefits:

- The coppice will provide biomass for biochar
- The biochar would sequester carbon and improve yields.
- The willow strips and associated ground flora will provide for a range of habitats, supporting functional biodiversity such as pollinators and natural enemies, to further to increase yields and the need for insecticides

A back-of-the-envelope calculation suggests that, if adopted across all UK arable and improved pasture land, the proposed landscape could mitigate approximately 40.0% of current agricultural emissions (17.2 MtCO₂eq). Biochar alone could sequester 14.7 Mt CO₂ equivalent every year, biochar could mitigate 2.5 Mt CO₂eq through avoided N₂O emissions, and the coppice-associated biodiversity could mitigate 0.11 MtCO₂eq emissions every year from reduced insecticide use.

Activities:

Working closely with the supervisors, the student will: generate more robust figures for the potential carbon storage, pull together wider data on potential functional biodiversity gains, and explore the potential for yield gains from biochar through glasshouse trials.

1. A conceptual model will be developed to test the hypothesis that strategically planted trees in farmland can generate ecosystem benefits without reducing production, while also storing carbon and increasing biodiversity.
The data behind this model will come from peer-reviewed and grey literature, and expert interviews.
2. Working in the KB glasshouses the student will establish a pot trial exploring the potential of biochar to improve the yields of crops, focusing sandy soils which already require relatively high levels of irrigation and are already likely to leach nutrients and pesticides. Beyond establishment and harvest, the pot trials will need relatively little attention during the placement, enabling the student to focus on Task 1.

The outcomes will be used to co-design a field trial for rolling out when funding is available.

Timeline:

Week 1. Meet the team, familiarisation with the project, establish the pot trial.

Weeks 2-4: working closely with the supervisors to generate a model, collating material from the literature, the supervisors, and other experts.

Week 5: Harvest pot trial, dry and weigh the biomass. Begin to pull together the results from the conceptual model

Week 6-7: Analyse pot trial data. Generate final report. Present the report to the supervisors and other interested individuals from the research groups and others

Supervisors:

- Dr Alfie Gathorne-Hardy.
Expertise in Natural Resource Management and agricultural systems. University of Edinburgh
- Dr Barbara Maria Smith
Expertise in Landscape design and Landscape ecology, Central Saint Martins, University of the Arts, London
- Prof Saran Sohi
Soil scientist and director of [UK Biochar Research Centre](#), University of Edinburgh

G. Main responsibilities

- **Model development: 80%**
- **Pot trial: 10%**
- **Mutual development of ideas with supervisors: 10%**

Key contacts and relationships

- The supervisory team (Alfy Gathorne-Hardy, Barbara Smith, Saran Sohi)
- Daisy Martinez, a PhD student of Alfie and Barbara who's a field ecologist, and exceptionally approachable, friendly and wise!

H. Knowledge, skills and experience required for the role

Attribute	Essential	Desirable
Education, Qualifications & Training	<ul style="list-style-type: none">• Basic biology/ecology• Interest in the sustainability concerns surrounding food production	<ul style="list-style-type: none">• Understanding of agricultural ecology
Knowledge & Experience	<ul style="list-style-type: none">• Enthusiasm and willingness to be wrong	<ul style="list-style-type: none">• Familiarity with excel or a similar numerical programme

I. Planning and organising

- The student should be self-motivated and happy to take control of their own time.

J. Problem solving

- This project is about pulling together material from diverse fields, and so the student will need to be happy playing in areas of uncertainty. Undoubtedly problems will arise – from data gaps to glasshouse issues. We'd encourage the student to suggest solutions to problems, but the wider team will be there to assist and guide whenever needed.

K. Decision making

- The student will be able to make key decisions, but with a supportive supervisory team to bounce these ideas off. It's likely that the student will need to be flexible and dynamic in decision making, as the team decide which areas of research need to be prioritised.

L. Length and timing of placement

7 weeks. Start date to be agreed.

M. Budget

Glasshouse. 2sq m, 6 weeks = £300
 £100 for meeting stakeholders (local travel plus coffee)
 £60 for biochar, seeds, soil
Total £460

N. Location and Equipment

The base of the project will be Kings Buildings.
 The glasshouse work will be in Kings Buildings.
 Meetings will likely be hybrid, as Barbara Smith works off site.
 For the model development, the student is welcome to work where they feel most comfortable, but the the 4th year study room in Crew building, KB, is available, which is on the same corridor as Alfie and Saran.
 We will expect to have regular contact with the student throughout the project, meeting at least once a week, and more during key periods.

O. Health & Safety requirements

N/A

P. Job hazards specific to the role

The main hazards will be long periods spent at a desk. The student will be working in a glasshouse, and will have to follow standard protocols there – including wearing appropriate clothing when handling biochar, but full training will be given, and once that is in place there are no specific job hazards associated with this.

Q. Alternative/adjusted placement (remote placement only).

If a covid equivalent event happened, the pot trial would be abandoned and the model development would be the sole part of the project.