

## PhD Project Advertisement

**Project No/title:** FBS2026 84 WilliamsP qr / *Biochar Interventions to Improve Soil Health Under Oil Palm : Ensuring Agronomic and Environmental Sustainability of the Fastest Expanding Equatorial Crop.*

**Lead supervisor:** Dr Paul Williams, School of Biological Sciences, Queen's University Belfast

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**Co-supervisors:**

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Dr Selvakumar Dhandapani, Agri-Food Bioscience Institute

Prof Stephanie Evers, Liverpool John Moores University

### Project Details

Oil palm is the world's most productive oil crop, meeting both food and energy needs. However, its expansion drives biodiversity loss, fires, toxic haze, and greenhouse gas emissions. At the end of plantation cycles, slash-and-burn is often used as an easy means to clear land and increase the cultivability of peat by raising pH and nutrient availability. However, these benefits are short lived due to leaching of minerals. On the other hand, retaining oil-palm waste on site to decompose enhances the spread of *Ganoderma* fungi responsible for significant palm losses. Here we propose biochar production from oil-palm and re-application to oil-palm fields as a solution for these intersecting issues. Much of the current oil-palm in Malaysia is transitioning to the 2nd generation plantation cycle, providing an ideal opportunity to assess the potential of this approach.



**Research aims:** To enhance oil palm plantation sustainability by improving biomass management and soil health through biochar interventions.

**Objectives:** Identify suitable biowaste for biochar, test its impact on soil and GHG mitigation, explore underlying mechanisms, and assess farmer adoption to restore ecosystem services and prevent carbon loss.

**What you will do:** The project will begin by identifying biowaste from the oil palm industry that is currently burned or discarded and evaluating its suitability as feedstock for biochar production. Biochar will be assessed for its potential to improve soil health and enhance carbon sequestration. Based on this evaluation, the most effective feedstocks will be selected for field trials to measure the impact of biochar application on soil health and greenhouse gas (GHG) mitigation across different soil types in oil palm plantations. These trials will be complemented by hypothesis-driven experiments in controlled environments to uncover the microbial and physicochemical mechanisms underlying biochar–soil interactions observed in the field. Finally, the project will explore the willingness of farming communities, particularly smallholder oil palm enterprises, to adopt biochar interventions for restoring soil ecosystem services. Together, these activities will build capacity and enable scaling of sustainable practices across the wider region.

#### References:

1. A review of biochars' potential role in the remediation, revegetation and restoration of contaminated soils. DOI: 10.1016/j.envpol.2011.07.023
2. Lack of awareness prevents the use of compost and biochar as soil amendments by Ghanaian cocoa farmers. <https://doi.org/10.21203/rs.3.rs-6534344/v1>
3. Anthropogenic Impacts on Lowland Tropical Peatland Biogeochemistry. <https://doi.org/10.1038/s43017-022-00289-6>
4. Spatial variability of surface peat properties and carbon emissions in a tropical peatland oil palm monoculture during a dry season. <https://doi.org/10.1111/sum.12741>

#### Student profile

**Essential for project:** A background in a relevant environmental, biological, agriculture or soils based discipline. Candidates must be prepared to undertake overseas fieldwork.

**Desirable for project:** Previous knowledge or experience working in Malaysia or with oil palm plantations is highly desirable.

**Minimum requirements for all FoodBioSystems applicants:** An upper 2nd class degree (or equivalent) in a subject relevant to the project. Candidates with a lower class of Bachelors degree, but merit or above at Masters level will also be considered. Demonstrable skills in problem-solving, team-working, communication and time management.

#### Training

**Project specific training opportunities:** The student will receive comprehensive training for international fieldwork, supported by supervisors with extensive experience in Malaysian sites and stakeholder engagement. The supervisory team offers expertise in soil biogeochemistry, soil-plant interactions, nutrient cycling, GHG emissions, sustainable agriculture, and carbon sequestration. Training will include advanced soil chemical analyses (DGT, ICP-MS), gas monitoring using portable analyzers (LGR, FTIR-based GASMET), and PFLA profiling of soil microbial communities. Specialist instruction in data analysis and interpretation, including qualitative evaluation of stakeholder responses, will complement technical skills. Additionally, the student will benefit from Queen's University Belfast Graduate School programs covering experimental design, scientific writing, and ecosystem-level data interpretation. This integrated training will equip the student to address questions on soil health, sustainability, and land-use change, ensuring readiness to deliver impactful research and contribute to global efforts in sustainable agriculture.

**FoodBioSystems training opportunities:** Throughout their studentship, all FoodBioSystems doctoral researchers participate in cohort training that covers four key themes: food systems, big data (data analytics and modelling), business, and research fundamentals. All doctoral researchers complete a placement: either project-related with a non-academic (CASE) partner, or unrelated to the project and outside the academic environment (PIPS). Details of training are available on the DTP website: <https://research.reading.ac.uk/foodbiosystems/training/>.

#### Project supervision style

The student will be supported initially with weekly meetings with the primary supervisor at the start of the project for the first 6-months. Thereafter, fortnightly or monthly, depending on the preference of the student. The full-supervisory team will convene once every month, but the student will also have the opportunity to meet with individual co-supervisors on an ad-hoc basis. When on fieldwork, the expectation is for weekly meetings with field and home project team members. The supervisors will operate an open-door policy to address concerns and issues in the project and the

student will join active research groups at QUB (Williams) and AFBI (Dhandapani) that also run regular group/lab meetings also on a bimonthly cycle. The student will be invited to join the Soil Biogeochemistry Group online seminar series hosted by TS at UoR and the Interpeat research group and associated research meetings in LJMU.

### Stipend (Salary)

FoodBioSystems DTP students receive an annual tax-free stipend (salary) that is paid in instalments throughout the year. For 2025/26 this is £20,780 and it will increase slightly each year at rate set by UKRI.

### Equity Diversity and Inclusion

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups who also meet academic eligibility criteria and the student profile essential for the project.

These are opt-in processes.

Our studentships can be offered to home students on a part-time basis, and studentship end date and stipend payments will be amended to reflect the part-time registration. The minimum registration for DTP funded part-time students is 0.5 FTE (studying an average of 20 hours per week over 8 years). We regret that part time registration is not available to international students due to complexities of visa restrictions.

### Funding note

We welcome applications from candidates with Home/ROI fees and international fees status. This studentship is funded by UKRI and covers stipend, fees at Home/ROI rate, and research costs. The host university will not charge UKRI funded international students the difference between Home/ROI fees and international fees.

**Costs that must be found from other sources or met by the individual student include:** visa fees, healthcare surcharge, relocation costs and guarantor services.

**For up to date information on funding eligibility, studentship rates and part-time registration, please visit the [FoodBioSystems website](#).**