Does pollinator diversity moderate ecosystem function in agroforestry systems?

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Intensive agricultural approaches have resulted in significant declines in invertebrate biodiversity on a global scale, resulting from, amongst other things, habitat loss, homogenisation of farming landscapes, and increased use of insecticides. These declines have caused a reduction in the ecosystem services that those invertebrates provide, for example pollination. Our latest research has indicated potentially severe pollinator deficits in arable farming systems in eastern England and that inadequate pollination is having negative impacts on apple production/yields in southeast England.

During this studentship you will conduct studies using field, laboratory and computational modelling approaches to investigate the potential for agroforestry, broadly defined as the integration of trees into farming systems, to be adopted more widely to mitigate pollination deficits in temperate farming systems. You will conduct ecological field studies, during which you will visit a series of commercial farms that operate agroforestry systems. At these sites you will sample and study the traits of pollinator populations, to investigate how agroforestry systems can influence the functional traits of insect communities and contribute to pollination.

You will use the outcomes of these experiments and our pre-existing field data to augment our latest computational model for pollination so that it realistically incorporates the impacts of agroforestry on pollinator communities. You will then apply this improved model to investigate whether agroforestry could help mitigate pollination deficits whilst maintaining farm profitability.

Left: Sampling pollinator populations using colored pan traps during apple blossom season in a commercial apple-arable agroforestry system in Eastern England (Image: T. Staton)
Right: A bee visiting a phacelia flower and providing pollination services (Image: R. Casebow)

This PhD project has been designed to be flexible and the precise balance of your studies (i.e., whether you take a more field-based experimental approach or a more desk-based computational modelling approach, or a blend of both) can be modified to match your own interests and circumstances. The supervisory team will be here to support you throughout.

Training opportunities:
This project enables you to gain experience across the full academic skill spectrum, spanning fieldwork, labwork and computational modelling. The project will provide you with significant opportunities to develop your fieldwork skills in insect biodiversity sampling, related laboratory skills in the measurement of functional traits, and will provide training in insect taxonomic identification, ecosystem service economics, data analytical approaches in R, process-based modelling and computer programing. You will have the opportunity to visit and spend time at the Natural History Museum (NHM) where you can gain taxonomic identification skills, learning from world-class experts in the field. You will also benefit from the NHM's public engagement expertise, gaining experience communicating with the public by talking at NHM 'Lates' or on NHM webcasts and blogs. You will also receive training at CEH Wallingford, where you will have the opportunity to develop highly sought-after transferable skills in computational modelling. You will also be given training in developing impact materials (e.g. infographics) to take your findings to a wider audience.

Student profile:
The studentship is suitable for a student with a first or upper second-class degree in the biological/ecological sciences. Experience of fieldwork, invertebrate sampling or use of ecological approaches would be beneficial, however these skills are not essential because significant training opportunities will be provided. Prior computer modelling experience is not essential – students who do not yet have experience of this but are interested to learn these skills are encouraged to apply.

References:
Staton, T., Breeze, T. D. , Walters, R. J., Smith, J. and Girling, R. D. (2022) Productivity, biodiversity trade-offs, and farm income in an agroforestry versus an arable system. Ecological Economics, 191. 107214. doi: https://doi.org/10.1016/j.ecolecon.2021.107214

Staton, T., Walters, R. J., Smith, J., Breeze, T. D. and Girling, R. D. (2021) Evaluating a trait-based approach to compare natural enemy and pest communities in agroforestry versus arable systems. Ecological Applications. e02294. doi: https://doi.org/10.1002/eap.2294

Staton, T., Walters, R. J., Smith, J. and Girling, R. D. (2019) Evaluating the effects of integrating trees into temperate arable systems on pest control and pollination. Agricultural Systems, 176. 102676. doi: https://doi.org/10.1016/j.agsy.2019.102676

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