

Metapopulation dynamics of pollinating bees under pesticide pressure

Project ID: 216

Supervisory team

Lead supervisors: Dr Miguel Lurgi (University of Swansea) and Dr Christopher Clements (University of Bristol)

Other supervisors: Prof Michael Fowler (Swansea University), Dr Harry Siviter (University of Bristol)

Host institutions: Swansea University / University of Bristol

Project description: Mutualistic interactions between plants and their animal pollinators are fundamental to their survival and the persistence of important agricultural ecosystem services. A cornerstone example of this are bees and the wildflowers and crops that depend on them. These systems are threatened by multiple anthropogenic factors, but of particular concern is exposure to agricultural pesticides (which represent a risk to bee health and survival) and the increasingly fragmented habitats in which bee populations reside. Therefore, understanding the synergistic effects of these anthropogenic disturbances on bee populations is key to safeguarding the crucial ecological services they provide. In this project the student will develop a mechanistic framework to better understand the anthropogenic impacts of pesticides and habitat loss on bee-plant interactions across spatial scales. The project will bring together empirical data analysis, experiments, and development of ecological theory to provide a holistic view of pollinator systems under human disturbance. The specific objectives of the project are: 1. Synthesise global patterns – Review and analyse existing studies to uncover how bee populations respond to pesticide use and habitat loss worldwide. 2. Experimentally test impacts – Use lab experiments to measure how pesticides affect bee movement, decision making, and pollination efficiency. 3. Develop predictive models – Build a mathematical model of bee population dynamics that incorporates the effects of pesticides (from the above experiments) as well as spatial processes such as dispersal and species interactions. 4. Bridge data and theory – Test model predictions against real-world ecological patterns to identify key factors driving bee performance across scales. 5. Forecast future risks – Use the integrated framework to predict how combined pressures from pesticides and habitat loss affect bee populations, refining our understanding of bee-plant interactions and movement. This project offers an exciting opportunity for a PhD candidate interested in ecological modelling applied to the interface between conservation and agriculture. The candidate will develop skills in experimental design, development of ecological theory, analysis of large datasets, and programming of computer simulations. Transferrable skills from this project will open opportunities to develop collaborations with organisations such as Bristol City Council or the West of England Nature Partnership which are both collaborators of Dr Clements.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.