

A tipping point for farmland biodiversity: predicting the recovery of arable plant communities

Project ID: 3641

Supervisory team

Rothamsted supervisor: Dr Helen Metcalfe (Rothamsted Research)

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Other supervisors: Dr David Comont (Rothamsted Research) & Dr Jim Fouracre (University of Bristol)

Registered institution: University of Bristol

Host institution: Rothamsted Research (Harpenden)

Project description: Arable plants sit at the base of the farmland food web; supporting the invertebrates and birds that depend on cropped land. As weeds, they are also a big problem for farmers and threaten our food security. Intensive agriculture aims to limit weed population size, but in doing so diversity has also been lost. Farmers are now paid to reverse biodiversity declines, while climate change, narrow profit margins, and evolving resistance to herbicides keep changing which species can persist. Whether recovery retraces the path of decline remains unknown.



Taking the pressure off after years of intensive farming may not bring the communities back. Seedbanks have been depleted and fragmented landscapes mean the nearest source populations could sit kilometres away. Agricultural systems may have crossed a tipping point beyond which recovery is slow or may need to take a different direction entirely. You will test whether arable plant communities behave this way and explore what it could take to pull them back. This project combines fieldwork, long-term experimental data, and simulation modelling. You will quantify what survives in the soil seedbank under different types of management using a decade of data from Rothamsted's Large Scale Rotation Experiment. You will also measure the amount and types of seed arriving into fields from field margins and semi-natural habitats. These data will feed into a plant community dynamics model, which you will extend to simulate dispersal. With it you will search for signs of tipping points, resilience, and restoration pathways for farmland biodiversity that limit costs to crop production. You will join a team spanning ecology, herbicide resistance, agricultural modelling, and resilience theory at Rothamsted Research and the University of Bristol, with additional input from industry professionals at Syngenta. Training will cover plant identification, field techniques, analysis of long term data, and process-based modelling.

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.