JOSEPH HELPS

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EDUCATION

ROTHAMSTED RESEARCH AND UNIVERSITY OF CAMBRIDGE (2010-2014)

PHD IN PLANT SCIENCES: CULTIVAR MIXTURES AND THE CONTROL OF PLANT PATHOGENS

Explored the potential for mixtures of crop cultivars to suppress disease epidemics. Chapters included analysing an analytical expression for the final size of a disease epidemic, exploring the rate of spread of a disease in a mixture compared with a single variety, and consequences of altering the spatial heterogeneity of varieties within a landscape.

Supervisors: Frank van den Bosch, Stephen Parnell, Chris Gilligan

UNIVERSITY OF ST ANDREWS (2008-2009)

MRES ENVIRONMENTAL BIOLOGY

The Masters aimed at teaching modelling to biology graduates. Courses taught empirical and process-based modelling, taught in R and ArcGIS. A research project supervised by Dr. Lionel Dupuy titled "Next generation individual based model for plant population dynamics" explored the integration of root-shoot allocation on growth rates of a lattice-based simulation of an individual plant, in Python.

YORK UNIVERSITY (2005-2008)

BSC BIOLOGICAL SCIENCES (2:1)

Modules taken focused on ecology and genetics. Final year project was supervised by Prof. Richard Law, exploring the spatial structure of a woodland, involving mapping and analysis of a woodland using spatial point process statistics in R.

HILLS ROAD SIXTH FORM COLLEGE (2002-2004)

A levels in Mathematics, Biology, Chemistry, Geography and Latin.

THE PERSE SCHOOL (1999-2002)

11 GCSEs

EMPLOYMENT HISTORY

IPM DECISIONS (2020-PRESENT)

Post-doctoral research scientist, exploring the value of IPM decision support systems (DSSs) within the H2020 project IPM Decisions. The project involves developing and testing novel methodologies to value DSSs using field trial data.

IWM PRAISE (2020-PRESENT)

Post-doctoral research scientist, analysing how cultural control strategies affect the selection for herbicide resistance in four weed species, using a process-based model of a weed lifecycle. The project requires refining, parameterization, and analysis of a process-based model originally developed by Steve Moss and Paul Neve.

SCP (2017-2020)

Post-doctoral researcher working on smart crop protection, using mathematical models to explore effective methods of disease control. Models were developed and analysed for several pathosystems include soybean rust, septoria leaf blotch, and potato late blight, particularly in relation to slowing the development of fungicide resistance in these pathogens, and the economics of fungicide resistance. Three papers are close to submission, resulting from this work. Additionally, during this time I helped supervise two PhD students, and four Masters students from King Mongkut University, Thailand, and also supervised visits from two visiting works from Brazil and Germany.

INSECTICIDE RESISTANCE STRATEGIES (2014-2017)

Funded by the BBSRC and Levy Boards, the project aimed to identify insecticide application strategies that could delay the development of insecticide resistance in insects. By making a generic insect/insecticide model, the project identified traits that determined which strategies could both effectively control insect pests, while simultaneously delay the development of insecticide resistance to the greatest possible extent.

OTHER ACTIVITIES

- Assistant Editor for Annals of Applied Biology
- Welfare Officer and web administrator for Rothamsted Tennis Club

PUBLICATIONS

- Helps, J. C. *et al.* (2020) 'Determinants of optimal insecticide resistance management strategies', *Journal of Theoretical Biology*, 503, p. 110383. doi: https://doi.org/10.1016/j.jtbi.2020.110383.
- van den Bosch, F. *et al.* (2020) 'Identifying when it is financially beneficial to increase or decrease fungicide dose as resistance develops: An evaluation from long-term field experiments', *Plant Pathology*, 69(4), pp. 631–641. doi: https://doi.org/10.1111/ppa.13155.
- Manning Smith, R. *et al.* (2020) 'Modelling lifestyle changes in Insect endosymbionts, from insect mutualist to plant pathogen', *Evolutionary Ecology*, 34(6), pp. 867–891. doi: 10.1007/s10682-020-10071-z.
- Kema, G. H. J. *et al.* (2018) 'Stress and sexual reproduction affect the dynamics of the wheat pathogen effector AvrStb6 and strobilurin resistance', *Nature Genetics*, 50(3), pp. 375–380. doi: 10.1038/s41588-018-0052-9.
- van den Bosch, F. *et al.* (2018) 'Identifying when it is financially beneficial to increase or decrease fungicide dose as resistance develops', *Plant Pathology*, 67(3), pp. 549–560. doi: 10.1111/ppa.12787.
- Helps, J. C., Paveley, N. D. and van den Bosch, F. (2017) 'Identifying circumstances under which high insecticide dose increases or decreases resistance selection', *Journal of Theoretical Biology*, 428, pp. 153–167. doi: 10.1016/j.jtbi.2017.06.007.
- Carolan, K. *et al.* (2017) 'Extending the durability of cultivar resistance by limiting epidemic growth rates', *Proceedings of the Royal Society B: Biological Sciences*, 284(1863). doi: 10.1098/rspb.2017.0828.
- Kitchen, J. L. *et al.* (2016) 'The evolution of fungicide resistance resulting from combinations of foliar-acting systemic seed treatments and foliar-applied fungicides: A modeling analysis', *PLoS ONE*, 11(8). doi: 10.1371/journal.pone.0161887.