Biotic stress and yield stability in English organic silvoarable

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Introduction
In-field trees are thought to buffer arable crops from climate extremes through the creation of microclimates that may reduce the impacts of heat, wind, and cold (1). Much less is known about how trees and their biotic associations (e.g., with natural enemies of pests and wild understory plants) impact crop yield stability to biotic stresses such as crop pests and disease.

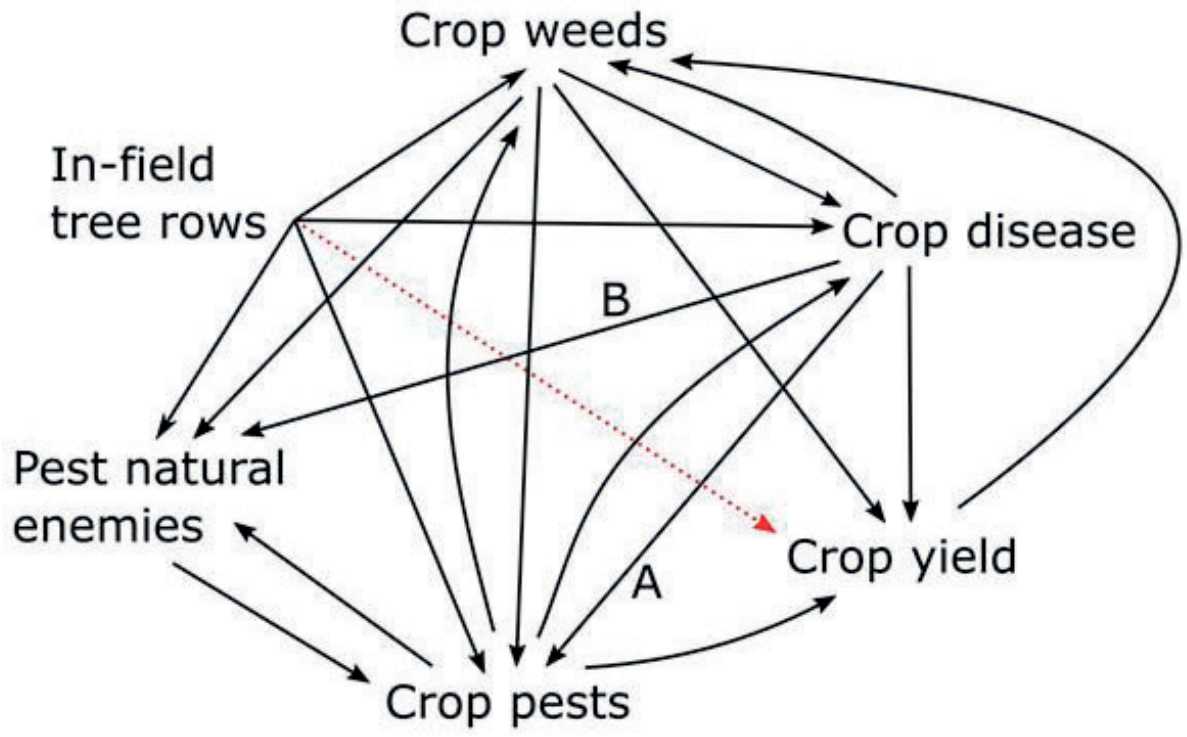
Methods
Modelling these interactions using conventional approaches is complex and time consuming and we take a simplified approach, representing the agroecosystem as a Boolean regulatory network (2) and parameterising Boolean functions using expert opinion. This allies our approach with decision analysis (3), which is increasingly finding applications in agriculture.

Results
Despite the naivety of our model, we demonstrate that it outputs complex and realistic agroecosystem dynamics. It predicts that, in English silvoarable, the biotic associations of in-field trees boost arable crop yield overall but they do not increase yield stability to biotic stress in the form of short perturbations of crop pests and disease. Sensitivity analysis shows that arable crop yield is very sensitive to disease and weeds and insensitive to natural enemies.

Discussion
We suggest that the focus of studies and debate on ecosystem service provision by English agroforestry needs to shift from natural enemies and pests to these ecosystem components. We discuss how our model can be improved through validation and parameterisation using real field data. Finally, we discuss how our approach can be used to rapidly model systems (agricultural or otherwise) than can be represented as dynamic interaction networks.

Keywords
Socioeconomic status, yield, natural pest control, Agroforestry, disturbance, agroecology, biodiversity, biotic interactions, modelling, resilience, pollination, ecosystem services, silvoarable

Aditional Attachment II.



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