

# How can silvoarable systems be optimised to deliver ecosystem service benefits from biodiversity?

Tom Staton<sup>1</sup>

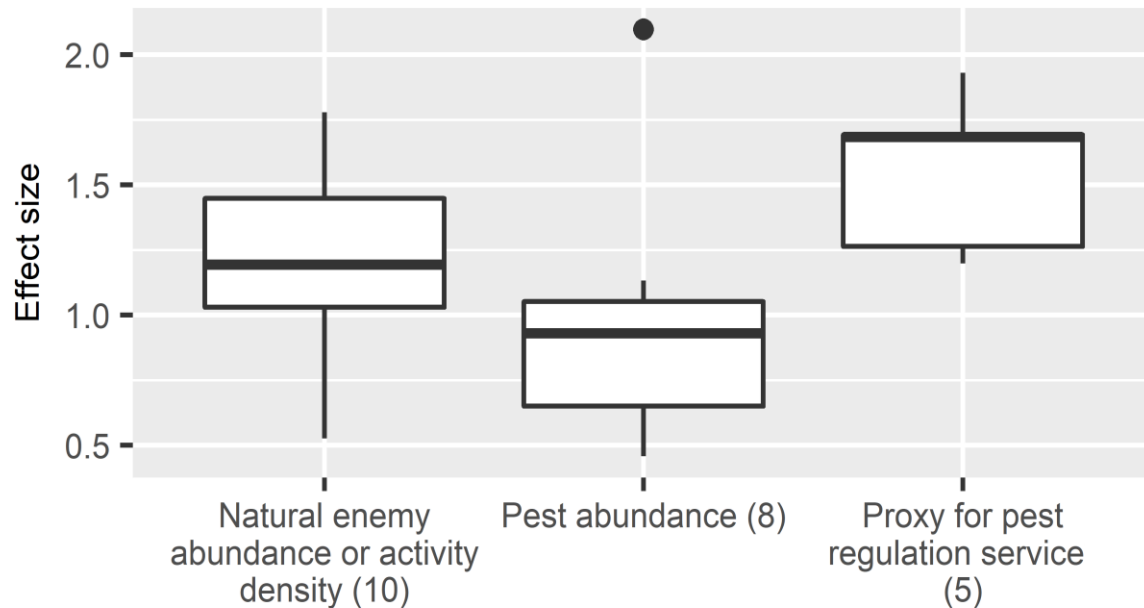
Supervisors: Robbie Girling<sup>1</sup>, Richard Walters<sup>1</sup>, Jo Smith<sup>2</sup>, Helen Chesshire<sup>3</sup>

- (1) University of Reading
- (2) Organic Research Centre, Newbury
- (3) Woodland Trust, Grantham



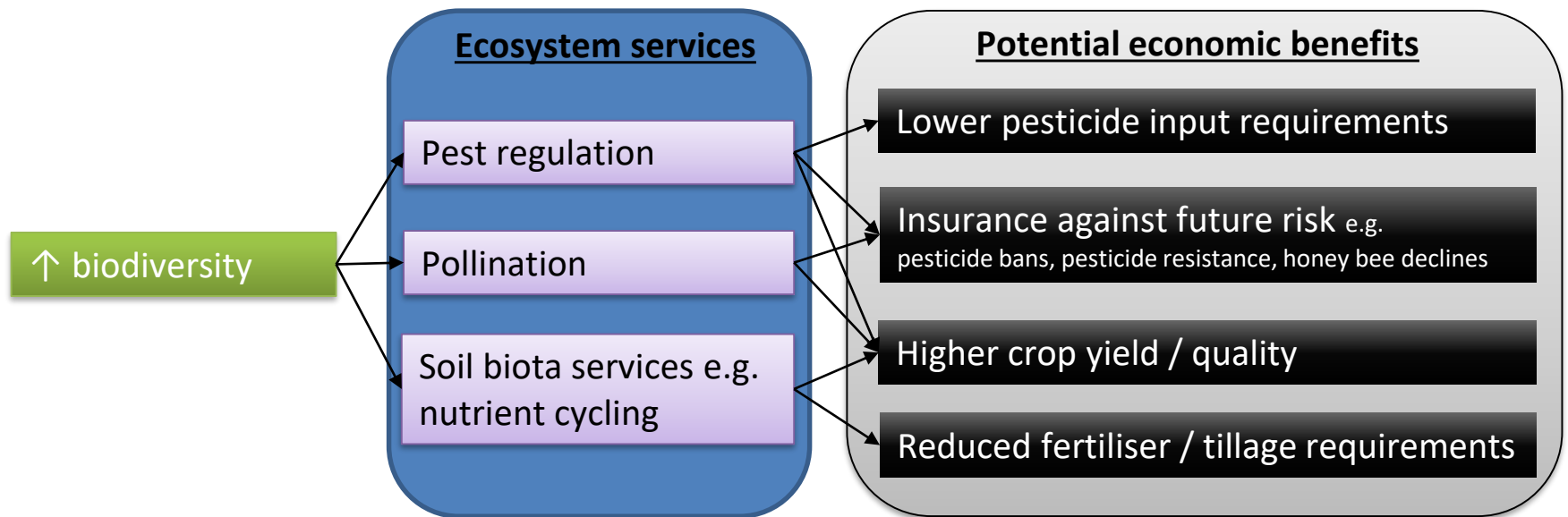
# What do we know about pest regulation and pollination in silvoarable?

- Generally higher abundances of ecosystem service providers, e.g. natural enemies, pollinators
- Pest abundances generally lower
- But:
  - High variability
  - Trade-offs
  - Ecosystem service function?



# PhD Aims

- Beyond biodiversity, towards ecosystem service function
- Trade-offs: ecosystem services vs disservices
- Economic benefits of ecosystem services?
- Optimisation: can understorey management enhance ESS?





# Data Collection

- Three UK silvoarable sites, based on apple-cereal alley cropping
- Pitfall trapping, pan trapping, pollinator transects, pollination phytometers, weed quadrats, yield sampling
- All taxonomic groups, identification of functional groups
- Manipulation experiments, e.g. change mowing timing/frequency



# Initial modelling exercise:

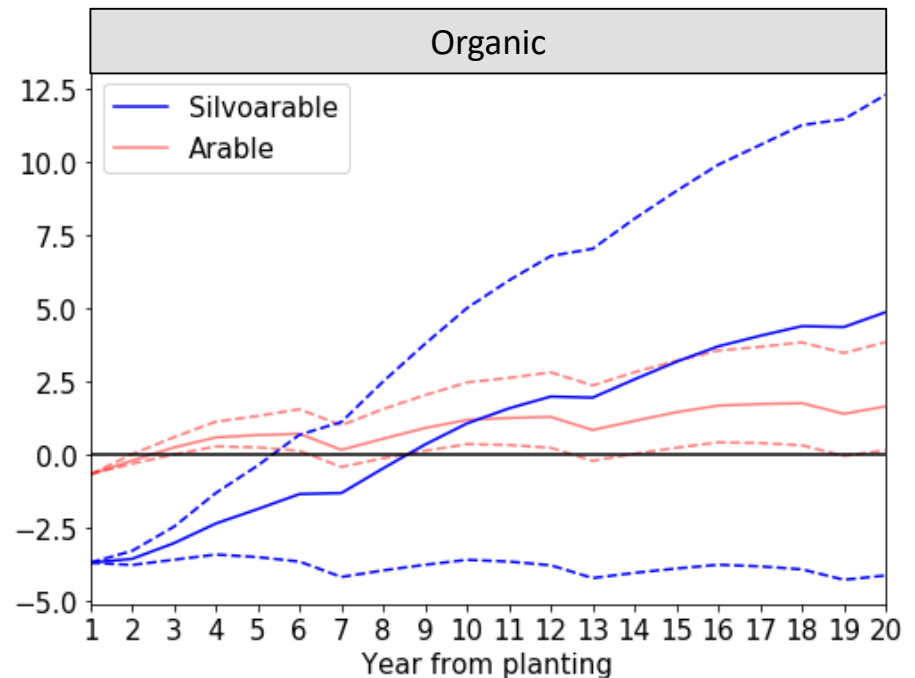
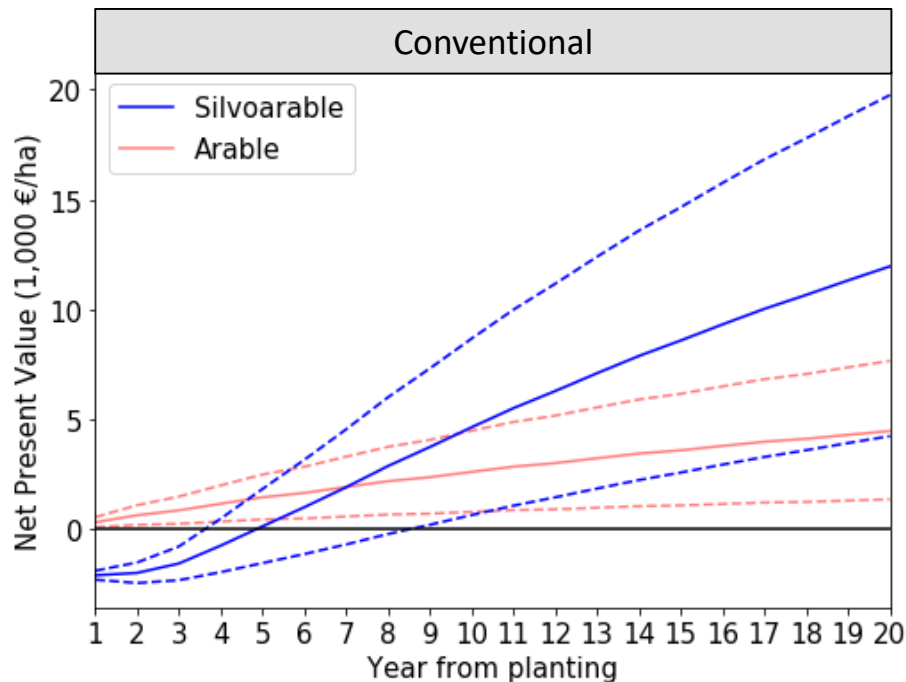
## How can biodiversity contribute to profitability?

- Multiple scenarios run through the Farm-SAFE model<sup>1</sup> using Python scripts
- Modelled system based on apple alley cropping with cereal rotation, 24m wide alleys
- Profitability of apple-silvoarable system at different production levels:
  - Data sourced from farm management handbooks
- Benefit of ecosystem services:
  - Data sourced from studies of analogous systems
- Constraints: shortage of empirical data

1. Graves et al 2016. <https://www.agforward.eu>

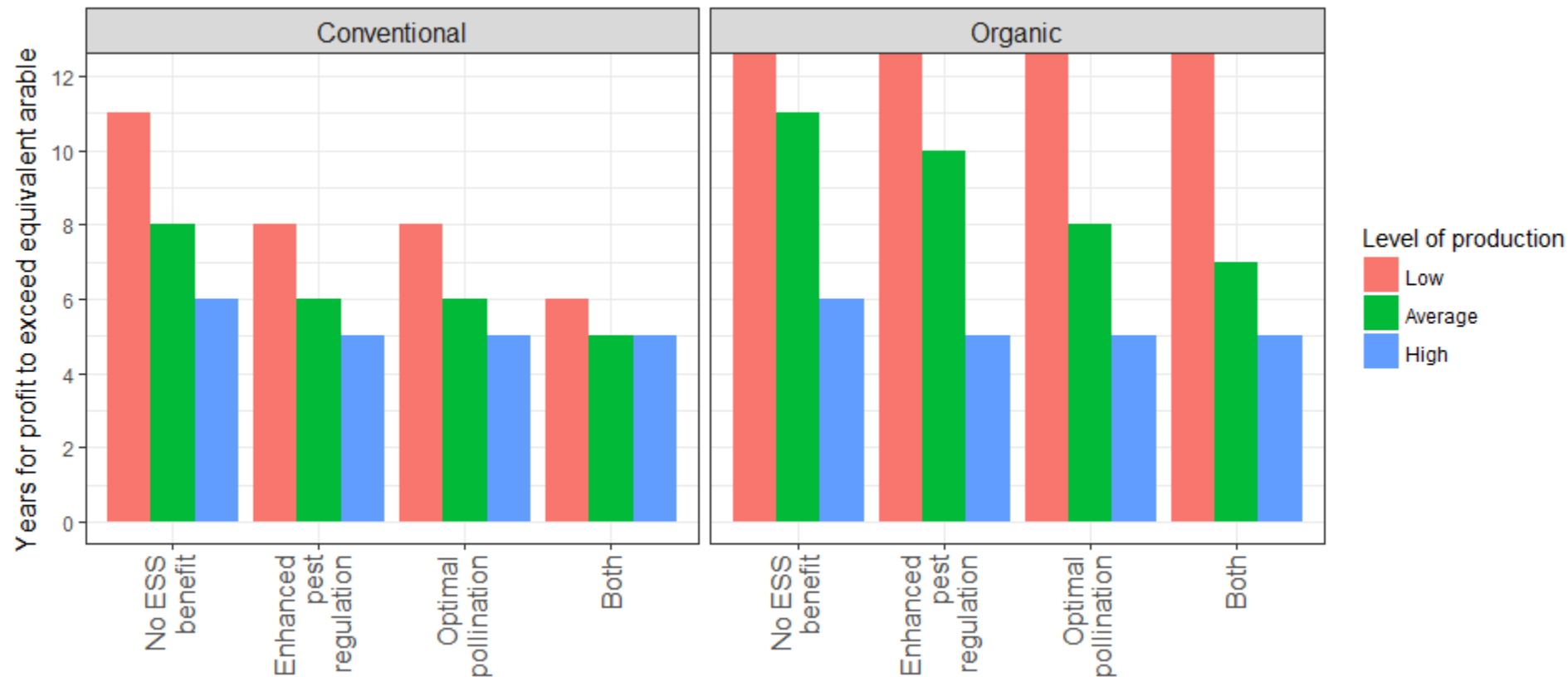
# Initial modelling results: the importance of farm productivity

- Farm-productivity level dependent on soil, climate, farmer expertise
- Conventional farms: time for profit to exceed equivalent arable system ranges from 6 to 11 years
- Organic farms: apple-SA only profitable for farms at average or high production level



# Initial modelling results: potential financial benefits from biodiversity

- Enhanced pest regulation: potential for reduced input costs in conventional, and yield increases in organic
- Enhanced pollination could increase apple yields



# Conclusions and research needs

- Initial modelling results suggest biodiversity can improve profitability in SA
- But can this be achieved in practice?
- Research needed to demonstrate ecosystem service outcome
- How can tree row management optimise ESS?





Any comments or questions?

Tom Staton

T.Staton@pgr.reading.ac.uk