

# Agroforestry and pests and diseases

## Reference 1

Staton, T; Walters, RJ; Smith, J; Girling, RD. 2019 Evaluating the effects of integrating trees into temperate arable systems on pest control and pollination. *Agricultural systems* 176, 102676. doi: 10.1016/j.agsy.2019.102676

## Background and objective

The intensification of arable production in temperate regions has driven declines in biodiversity and associated ecosystem services, such as pest control and pollination. There is a strong and growing pressure to move towards more sustainable intensification of production, through harnessing natural processes to sustain productivity rather than relying on pesticides and managed pollinators. Agroforestry has been proposed as a winwin opportunity for productivity and environmental protection. 1) collate and analyse studies of pollinators, pests and their natural enemies in temperate silvoarable systems, specifically in terms of their potential contribution to pest control and pollination ecosystem services; and 2) develop a framework for future research to predict the factors which influence variation in results, with the aspiration of driving forward a unified research agenda. Here we report only results on pests control and natural enemies of pests.

## Search strategy and selection criteria

Publications were searched in Web of Science. To minimise the risk of publication bias, both peer-reviewed and non-peer-reviewed literature, including theses and reports (British Library EThOS thesis search) and personal communications were sourced. 1. A measure of abundance or activity density of invertebrate herbivores/pests, natural enemies or pollinators, and/or a measure of conservation biological control of animal pests and/or pollination were recorded; 2. Studies were undertaken in a temperate region, defined as latitude > 40° north or south; 3. A silvoarable system, for this purpose defined as trees or shrubs incorporated into an arable field, was compared with an arable control, with the respective arable components comprising annual crops. To minimise the risk of publication bias, we sourced both peer-reviewed and non-peer-reviewed literature, including theses and reports.

## Data and analysis

The significance of effects for herbivore/pest and natural enemy abundances were analysed in a mixed-effects meta-analysis model, using the `rma.mv` function of the `metaphor` package version 2.1-0 (Viechtbauer, 2010) within R version 3.5.2 (R Core Team, 2018). As multiple data points were extracted from some individual studies, study ID was included as a random effect.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
17	Temperate arable systems.	Silvoarable agroforestry systems.	Crop monocultures.	Logarithm of ratio (backtransformed to ratio) of abundance of proxies of pests control (e.g. natural enemies to herbivores, pest mortality rates or pest parasitism rates) in silvoarable systems to abundance in crop monoculture.	94%

## Results

- Invertebrate herbivore/pest abundances were lower in the silvoarable compared with arable systems, with a back-transformed mean effect size of 0.89.
- The abundance of natural enemy of pests was significantly higher in silvoarable compared with arable systems, with a mean effect size of 1.24.
- The abundance of arthropod herbivores/pests was significantly lower in the silvoarable than arable systems, with a mean effect size of 0.75.
- Slug abundance was higher in the silvoarable than arable systems, with effect sizes of 1.12 to 1.53 across two studies.
- NA

## Factors influencing effect sizes

Results can be affected by the proximity of landscape features (forest plots or boundary hedgerows), soil type and alley width

## Conclusion

Evidence was found for significantly enhanced natural enemy populations and significantly suppressed arthropod herbivore populations in silvoarable systems, but molluscan pests were more numerous in the two available studies, compared with arable.