FARMING PRACTICE
LANDSCAPE FEATURES

IMPACT: PESTS AND DISEASES

Reference 30

Chaplin-Kramer, R; O'Rourke, ME; Blitzer, EJ; Kremen, C 2011 A meta-analysis of crop pest and natural enemy response to landscape complexity ECOLOGY LETTERS, 14(9), 922-932. 10.1111/j.1461-0248.2011.01642.x

Background and objective

Many studies in recent years have investigated the relationship between landscape complexity and pests, natural enemies and/or pest control. However, no quantitative synthesis of this literature beyond simple vote-count methods yet exists. To examine the effects of landscape-scale complexity on crop pests and their natural enemies. Specifically, we investigate five quantitative questions: 1) How are natural enemies and pests each affected by landscape complexity? 2) How does the measurement of arthropod response (i.e. abundance, diversity, predation, pest control, plant damage) influence conclusions about the impact of landscape complexity? 3) How does the measurement of landscape complexity affect conclusions about its impact? 4) Do specialist and generalist enemies and pests respond differently to landscape complexity? 5) Do enemies and pests or specialists and generalists respond to different spatial scales of landscape complexity? Here, results for objective 3 are reported. In particular, results on the effect of % natural habitat and "other" category (comprised of one study measuring distance to natural habitat and three studies measuring linear features such as length of woody edges at the landscape scale).

Search strategy and selection criteria

Studies were identified through a comprehensive search on Web ofScience last updated in April 2011, using the search string: "landscape AND [agr* OR crop] AND [enem* OR predat* OR parasit* OR pest OR biological control]". 1) A sample size consisting of at least five unique "landscapes", in which a landscape comprises a field and the area surrounding it, separated by a minimum distance of 1 km from anyother field in the study; 2) quantitative measurements of landscape complexity using GIS or other spatial techniques at ≥ 500 m around the farm; 3) statistics reported as the univariate relationship between landscape complexity and arthropod response or the partial contribution of landscape complexity among other factors.

Data and analysis

Effect size was used as the response variable in generalised linear mixed models. Each study question was tested with a different model. The AIC (Akaike information criteria) score was used as a guide for comparing different models, but P-values for each factor were also considered. Likelihood-ratio testing was used as a more robust measure for nested models to determine whether the addition of a variable improved the model. Models were nested hierarchically within the model for question 1 (trophic level). Publication bias was investigated using three different methods: (1) Funnel plots, (2) a Spearman-rank correlation test and (3) Rosenthal's fail-safe number.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
46	Farmlands	1) % natural habitats ; 2) Length woody edges	1) No natural habitats; 2) No woody edges	Metric: 1) Natural enemies; 2) Pests; Effect size: Fisher's Z-transformed r	81.25

Results

- Landscape complexity metrics produced a positive response in natural enemies.
- None of the landscape metrics produced a significant response in pests.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

The positive response of natural enemies does not necessarily translate into pest control, since pest abundances show no significant response to landscape complexity.