Reference 13

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Background and objective

While existing studies find that organic farming and in-field plant diversification tend to boost abundance and richness of certain taxa, whether these effects are consistent for other biodiversity components such as evenness, for functional groups other than pollinators and natural enemies, and for less-well studied regions of the world (e.g., the tropics and Mediterranean) remains unclear. The objective is to conduct a comprehensive synthesis of studies that explore how organic farming and in-field plant diversification influence arthropod communities across global agroecosystems. Here, we focus on the results obtained on organic farming.

Search strategy and selection criteria

Studies that compared Organic vs. Conventional or High vs. Low plant diversity were identified by 1) searching the reference lists of recent meta-analyses (Batary et al., 2011; Chaplin-Kramer, O'Rourke, Blitzer, & Kremen, 2011; Crowder et al., 2012; Garibaldi et al., 2013; Kennedy et al., 2013; Scheper et al., 2013; Shackelford et al., 2013), 2) searching ISI Web of Knowledge (April and May 2013) using the terms "evenness or richness" and "organic and conventional" or "local diversity," and 3) directly contacting researchers who study arthropods in agricultural systems. 1) sampling was performed in the same crop or crop type (e.g., cereals) for organic and conventional fields, or fields with high and low in-field plant diversity; 2) sampling was conducted at the scale of individual crop fields rather than using plots on experiment stations; 3) the study included at least two fields of each type; 4) all organisms collected were identified to a particular taxonomic level (i.e., order, family, genus, species, or morphospecies), such that no taxa were lumped into groups such as "other,"; 5) at least three unique taxa were collected.

Data and analysis

One-sample ttests were used to determine if the mean effect sizes for abundance, local richness and evenness, and regional richness and evenness differed significantly from 0. For each management scheme comparison (organic vs. conventional or high vs. low in-field plant diversity), these analyses were conducted for the overall arthropod community and for each functional group separately. Correlations were explored between local and regional richness, and between local and regional evenness, to determine if these metrics responded similarly to each of the management scheme. Metaregression was used to examine whether effect sizes were influenced by functional group and other study characteristics. A linear mixed model with eight fixed effect variables was developed: (i) functional group (detritivore, herbivore, predator, and pollinator), (ii) diversity scale (local, regional), (iii) landscape complexity (simple, complex), (iv) biome (boreal, Mediterranean, temperate, and tropical), (v) crop cultivation period (annual, perennial), (vi) functional group x diversity scale interaction, (vii) functional group x landscape complexity interaction, and (viii) diversity scale x landscape complexity interaction. These models included study ID as a random effect. Information-theoretic was used for model selection to determine the set of best-fit models for each response variable.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
60	Studies conducted at the scale of individual crop fields rather than using plots on experiment stations assessing the performance of organic systems in comparison to conventional systems.	Organic systems	Conventional systems	Metric: Biotic abundance, species richness, species evenness; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control.	87.5

Results

- Organic farming increased arthropod abundance (45% change), local richness (19%), and regional richness (11%). These positive effects were stronger for local compared to regional richness. Organic systems had stronger positive effects on local and regional arthropod richness in complex relative to simple landscapes: 26% vs. 9%.
- Arthropod communities on organic farms had significantly but only moderately lower local evenness (-6%) and regional evenness (-8%) than on conventional farms.
- Organic farming increased abundance and richness of both rare and common arthropods at the local and regional scales. At the local scale, organic farming increased arthropod richness by promoting rare taxa (27% increase) more strongly than common taxa (14% increase).
- Organic farming substantially increased the abundance (90%), local richness (55%), and regional richness (32%) of pollinator communities but did not impact pollinator evenness. For predator communities, organic farming increased abundance (38%) and local richness (14%), lowered local (-9%), and regional (-14%) evenness, but did not affect regional richness.
- Organic farming also did not impact abundance, local or regional richness, or local or regional evenness for herbivore, or detritivore communities. For all biodiversity components and functional groups, effect sizes in response to organic farming did not differ between the local and regional scales.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Results suggest that organic farming promotes diverse arthropod metacommunities that may provide temporal and spatial stability of ecosystem service provisioning.