Agroforestry and pests and diseases

Reference 2

Background and objective

Despite of being structurally simpler and species-impoverished than natural forests, agroforestry plantations can act as a secondary habitat for native species and sustain some biodiversity. This meta-analysis assesses the provision of ecosystem services by insectivores in agroforestry systems compared to natural systems.

Search strategy and selection criteria

A directed search for scientific publications was performed in the ISI Web of Knowledge and EBSCOhost databases using combinations of the search terms insectivor, *primary product* and trophic cascade. Publications explicitly studying at least one of the following variables: arthropod abundance, plant herbivory and plant productivity. To examine the effects of predation upon arthropods, only studies comparing scenarios through experimental manipulations (exclusion or enclosure) of natural predators were included. Insectivore type subject to exclusion or enclosure treatments were classified as birds, lizards, ants and predatory arthropods in general, the latter including ants, spiders and others, as there were studies that assessed the effect of ants alone as insectivores, while other studies considered the whole group of predatory arthropods for the same purpose.

Data and analysis

To assess the effect of predators upon arthropod abundance, herbivory and plant productivity, only studies reporting on mean, standard deviation or standard error, and sample sizes were used and analyzed through Hedge unbiased standardized mean difference. Confidence intervals (CI) of effect sizes were estimated from effect sizes and their variance by bootstrapping (4,999 iterations), and P-values were estimated by using a randomized effect categorical model, as we cannot assume there is one true effect size shared by all studies. Heterogeneity of the effect size within variables was examined using the Q-statistics. Publication bias was assessed through Spearman rank correlation test and Rosenthal s fail-safe number.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
39	Agroforestry (productive plantations, as well as non-commercial plantations and city parks or gardens) and natural systems (native forests, shrublands or grasslands).	Presence of insectivores (birds, lizards, ants and predatory arthropods in general, the latter including ants, spiders and others).	Absence of insectivores.	Hedge's d (standardized difference) of the effect of insectivorous species on arthropod abundance and herbivory, between intervention and control.	75%

Results

- The presence of insectivorous species significantly reduced arthropod abundance, in both, native forests and agroforestry systems. No significant difference exists in the effect size between these two environments.

- Insectivores significantly reduced plant herbivory. Agroforestry and natural systems did not differ in effect size on damage to plants through herbivory.

- Birds were the only insectivores that had a significant effect decreasing herbivory.

- Insectivores significantly increased plant productivity, both in agroforestry systems as well as in natural ecosystems, with no significant difference between both environments. Total biomass and stem basal area are significantly larger in the presence of insectivores while shoot extension tended to decrease, not significantly.

- No comparison was made with cultivated systems.

Factors influencing effect sizes

NA

Conclusion

Insectivorous species reduced arthropod abundance and plant herbivory, and increased plant productivity in both natural and agroforestry systems.