

Agroforestry and biodiversity

Reference 6

Chaudhary, A; Burivalova, Z; Koh, LP; Hellweg, S. 2016 Impact of Forest Management on Species Richness: Global Meta-Analysis and Economic Trade-Offs. Scientific reports 6:2394. doi: 10.1038/srep23954

Background and objective

A quantitative understanding of the impacts of different forest management regimes on biodiversity in different regions of the world is crucial to any efforts to reconcile biodiversity conservation and economic interests. To understand the variable impacts of forestry management types (including agroforestry) on local species richness of different taxa, a global categorical meta-analysis is conducted on species richness in managed to unmanaged forest. Here, we focus on agroforestry.

Search strategy and selection criteria

Research articles were searched using the ISI Web of Science database (keywords are listed in Supplementary information). From this list, the selected studies were those that reported species richness comparisons between a managed forest and an unmanaged forest (i.e. forests that had little or no human disturbance) of an equivalent size or equivalent sampling effort in the same region. Studies in forests with a disturbance additional to logging, such as hunting, livestock grazing, mining, burning, etc., were excluded. For clear-cut and slash-and-burn management types, only studies that measured species richness within 10 years of the intervention were retained, as time has a large influence on the recovery of biodiversity.

Data and analysis

For each comparison, the observed mean species richness (X) for both managed (subscript E) and unmanaged groups (subscript C) were tabulated. The natural logarithm $L = \ln R = \ln(XE/XC)$ was used as a measure of effect size for the meta-analysis. Data were analyzed using a fixed-effect model (unweighted). The effects of three factors (continent, taxon, and management type) on the magnitude of change in species richness between unmanaged and managed forests were tested.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
287 (52 on agroforestry)	Forests	Managed forest (ten types of forest management, including agroforestry)	Unmanaged forest.	Logarithm of ratio of species richness in managed forest to species richness in unmanaged forest.	75%

Results

- The overall effect size showed that forest management (all types confounded) leads to a 29% reduction in species richness (95% CI = 26 to 32%).
- Out of the non-timber producing management regimes considered, agroforestry was least detrimental, retaining on average 68% of species richness found in nearby natural forests.
- Compared to natural forests, agroforestry significantly decreased bird and plant species richness, but did not significantly decrease arthropod, amphibian, and mammal species richness.
- For agroforestry, mean effect sizes differed among continents (significantly higher in South America compared to Asia, Africa, and central America).
- For agroforestry, studies in Europe, Australia, and Northern America were missing. Studies on lichens and fungi were also missing.

Factors influencing effect sizes

Regions: lower impact of agroforestry on biodiversity in South America. Taxa: birds and plants are more impacted by agroforestry.

Conclusion

Management regimes not focusing on timber production are in general more harmful to species richness than timber producing regimes. A notable exception is agroforestry, which is associated with lower species loss than timber plantations.