Ecology & Evolution | Nov 19, 2026 | 5 min read | By Bryan White

Sumatra 40,000-Species Survey Shows Tropical Plantations Cut Landscape Biodiversity by Up to 78%

Ecology & Evolution * Biodiversity

Converting lowland tropical rainforests into intensively managed rubber and oil palm monocultures slashes local species richness by roughly 50 percent per plot and eliminates up to 78 percent of biodiversity at the broader landscape scale -- yet restructures ecological communities in sharply divergent ways across different branches of life. Published in Nature in November 2026 by Nathaly Guerrero-Ram rez and colleagues at the University of G ttingen, the multi-trophic survey evaluated approximately 40,000 species across Sumatra, Indonesia, spanning soil bacteria , fungi , vascular plants, insects, spiders, birds, and mammals.

For decades, ecologists often assumed that agricultural intensification drives uniform "biotic homogenization," replacing diverse native ecosystems with nearly identical, simplified biological communities everywhere crops are planted. By sampling organisms from microscopic soil microbes up to vertebrate predators across multiple spatial scales, the Sumatra study reveals that species counts alone hide how differently microorganisms, plants, and arthropods respond to plantation conversion.

Multi-Scale Collapse Across 40,000 Sumatran Species

To capture how land-use intensification alters whole ecosystems rather than isolated charismatic groups, the researchers compared intact lowland rainforest sites on Sumatra against intensively managed rubber and oil palm monocultures. Across individual plots, local species richness dropped by approximately 50 percent following conversion.

Crucially, losses compounded at larger spatial scales. Because intact tropical forests exhibit high species turnover from one hillside or watershed to the next, replacing heterogeneous forest mosaics with monoculture plantations collapsed overall landscape-level diversity by up to 78 percent -- erasing rare, habitat-specialist lineages that never persist across cultivated landscapes.

| Ecological Metric | | Measured Sumatra Finding | | Conservation Implication |

| Taxonomic Scope | | ~40,000 species (microbes to mammals) | | Prevents single-taxon blind spots in impact audits |

| Local Plot Richness | | ~50% decline in monoculture plots | | Severe loss of site-level species diversity |

| Landscape-Scale Diversity | | Up to 78% reduction across landscapes | | Spatial turnover losses exceed plot-level averages |

| Community Composition Shifts | | Microbes/plants uniform; arthropods variable | | Challenges simple uniform-homogenization models |

Why Microbes Homogenize While Arthropods Diverge

Counter to expectations of uniform biotic homogenization, Guerrero-Ram rez and colleagues found striking divergence between belowground/plant guilds and mobile consumer guilds. Soil bacteria, fungi, and certain plant assemblages converged toward predictable, uniform community compositions across plantations -- shaped directly by shared soil disturbance, fertilizer inputs, herbicide regimes, and simplified canopy structure.

By contrast, hyper-diverse arthropod groups such as insects and spiders varied considerably from one plantation plot to another. Localized microhabitats, edge proximity to remaining forest fragments, and stochastic colonization dynamics produced patchy, unpredictable arthropod assemblages even inside superficially identical monoculture stands. Relying on any single indicator taxon -- such as plants alone or beetles alone -- therefore misrepresents how the broader food web is reorganizing.

Rethinking Tropical Biodiversity Monitoring

As accompanied by a Nature Research Briefing, the findings carry immediate practical consequences for tropical conservation policy, biodiversity offsetting, and sustainable agriculture certification. Measuring only local species richness in a handful of plantation plots systematically underestimates the up-to-78-percent landscape diversity collapse -- and ignores structural shifts across trophic levels.

Effective land-use planning in Southeast Asia and other tropical biodiversity hotspots requires multi-trophic, landscape-scale monitoring that preserves intact forest corridors alongside managed agricultural matrices, ensuring that rare spatial specialists are not silently lost behind simplified plot-level metrics.

References & Primary Sources

* [1] Guerrero-Ram rez, N., et al. (2026). Tropical land-use intensification restructures biodiversity. Nature. -- https://doi.org/10.1038/s41586-026-11298-6

* [2] Nature Research Briefing (2026). Tropical plantations reshape biodiversity in ways species counts alone cannot reveal. Nature. -- https://doi.org/10.1038/d41586-026-03602-1

* [3] University of G ttingen (2026). Tropical land-use intensification restructures biodiversity across 40,000 species. -- https://www.uni-goettingen.de/en/