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Land-use impacts on biodiversity across spatial scales in a deforestation hotspot

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Abstract

Tropical deforestation due to agricultural expansion is a major driver of the global biodiversity crises. Focusing on the understudied tropical dry forests of the South American Gran Chaco, a global deforestation hotspot, we highlight how biodiversity data is essential to understanding land-use impacts on the environment. We focused on larger mammals and birds as focal taxa and compiled a region-wide database of species' records from camera trapping (mammals) and point counts (birds). This allowed us to build models to quantify land-use impacts on biodiversity from local to regional scale and to identify landscape configurations that maintain biodiversity. Our results show that the expansion of agribusiness cropping and ranching has stark and negative impacts on biodiversity. Locally, we find populations of species to become depleted where land use expands and intensifies. Regionally, many species have lost major shares of suitable habitat (e.g., on average about 40 % for mammals). Across geographic scales, our analyses highlight the value of maintaining trees (local scale) and forest cover (landscape to regional scale), and we find strong evidence for critical thresholds of about 30–40 % tree/forest cover below which biodiversity meltdown occurs. This suggests a multi-scale strategy that fosters more biodiversity-friendly forms of agriculture locally (e.g., silvopastoral ranching systems), combined with landscape-level land-use planning that maintains larger patches of forest is needed to ensure the persistence of the Chaco's biodiversity. Tropical dry woodlands around the globe are under high and rising pressure. Unfortunately, biodiversity data is lacking for most of them. Our analyses show how rapid assessments of focal taxa can help predict biodiversity impact at scale, thus helping to mitigate biodiversity loss.

Keywords: Biodiversity, Gran Chaco, land-use change, South America, tropical dry forests and savannahs