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“Reconcile land system changes
with planetary health”

Species diversity and biomass across land-use types in the fragmented Dry Chaco forest

AXEL GUALDONI-BECERRA, NATHALY GUERRERO-RAMIREZ, HOLGER KREFT

University of Göttingen, Dept. of Biodiversity, Macroecology & Biogeography, Germany

Abstract

The Dry Chaco forest, the largest continuous dry forest in the world, spans tropical and subtropical zones across Argentina, Bolivia, and Paraguay – with Argentina containing approximately 60% of the Chaco – and is currently the most deforested subtropical forest globally. In some regions, deforestation rates reach up to one hectare per minute, primarily driven by land-use change for soybean cultivation and cattle ranching. This extensive land conversion has generated a highly fragmented landscape, with forest remnants embedded within large agricultural matrices and thin forest strips left between croplands to mitigate soil erosion. All this fragmentation poses serious challenges for biodiversity conservation. Along a 400 km gradient of mean annual precipitation (1200 mm to 400 mm) in northern Argentina, we sampled woody plant diversity and aboveground biomass in 400 m² plots. Sampling was conducted across three contrasting land-use categories: (1) narrow forest strips (100 m wide) left between croplands to mitigate erosion, (2) forest edges (up to 250 m from the border of the forest patch), and (3) forest interiors. Our results show that species diversity and biomass do not follow a simple relationship with precipitation. For example, the most humid and driest sites exhibited similar alpha diversity ($S = 30$). However, we detected marked differences among land-use categories: forest interiors consistently had higher species richness than edges or strips. These findings suggest that local habitat conditions and land-use history may play a stronger role than climate alone in shaping biodiversity patterns in the fragmented Chaco landscape. This study underscores the importance of integrating ecological knowledge into land-use planning. By identifying patches of higher biodiversity and biomass, we provide relevant insights for prioritising conservation and ecological restoration efforts in one of the world’s most endangered dry forest ecosystems.

Keywords: Aboveground biomass, Dry Chaco forest, forest fragmentation, land-use change, woody species diversity