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"Reconcile land system changes
with planetary health"

# Effect of land-use change and climate change on the structure and diversity of woody vegetation: lessons from west africa's woodlands

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**Abstract**

Land-use change in terrestrial ecosystems plays a crucial role in many global change processes and has a considerable effect on biodiversity and ecosystem functioning. In addition to changes in how land is being used, human-induced climate change in the last century has substantially influenced global environmental patterns. Yet, our understanding of how the combined impact of these global change processes will affect ecosystems is still limited particularly in West Africa, where increasing human pressures and climatic change patterns are prominent. In this study, we examined the effects of these interactions (between climate change and land-use change) on the structure and diversity of woody vegetation in West Africa's woodlands. Here, we took advantage of the steep regional gradient of climatic aridity (Humid, Semi-arid) and local gradients of land-use intensification (Forest, Fallow, and Cropland) that exist in West Africa and applied a crossed-space-for-time substitution to capture the isolated and interactive effects of climate change and land-use change. Inventories of woody vegetation were conducted on 120 plots randomly laid out along these varying levels of land-use intensification and climate aridity in Ghana. Using data obtained from an extensive field campaign, our study results demonstrated that land-use intensification and arid climatic conditions significantly impacts the taxonomic diversity of woody vegetation in West Africa as we recorded the lowest species diversity in Croplands from Arid sites, while Forests from Humid sites held the highest species diversity values. A comparison of population densities, the performance of juvenile and adult age classes, and further analysis of size-class distributions of each land-use type revealed a similar pattern for the structure of woody vegetation. Our study demonstrated that with increasing land-use intensification and climate aridity, the health of tree population reduces. Compared to other land-use types, proportions of Juveniles on Croplands were the lowest, leading to an almost flat slope with very little to low recruitment. The importance of our study implies that sustainable land management practices could potentially mitigate the detrimental effects of global ecological change on taxonomic diversity and the health of woody populations in West Africa.

**Keywords:** Global change, size class distribution, structural diversity, taxonomic diversity, West Africa, woody vegetation

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