

# Natural regeneration increases ecosystem production and functional diversity in an abandoned Afrotropical moist forest landscape

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## Abstract

The growing trend of agricultural abandonment necessitates understanding the development of regrowth forests on old fields in the context of forest restoration. However, the successional patterns of ecosystem functioning and functional diversity of afrotropical regrowth forests are rarely examined. We assessed whether aboveground biomass (AGB) and functional diversity (FD) vary with restoration age and proximity to old-growth forests, compared AGB and FD between regrowth and old-growth forests to measure restoration success and investigated the FD – AGB relationship. We sampled trees in 63 plots (2000 m<sup>2</sup> each) in a regrowth forest and 5 plots in an old-growth forest in 2011, 2014 and 2017. We calculated AGB using diameter, height and wood density. We collated species functional traits (dispersal modes, habitat types, fruit sizes and regeneration guilds) and computed FD measures (richness, evenness, dispersion, divergence and RaoQ's entropy). AGB and FD measures (richness, dispersion and RaoQ) increased with restoration age. Functional divergence declined with increasing distance to the old-growth forest. Within 22 years, regrowth forests regained 22% of the AGB and recovered all FD measures of the old-growth forest. We found positive, negative and quadratic relationships between AGB and FD depending on the FD measure and forest type. We demonstrate that regrowth forests increase ecosystem production and functional diversity in abandoned areas, however they cannot substitute old-growth forests. Considering multiple measures of functional diversity in different habitats provides a better understanding of the influence of functional diversity on ecosystem functioning.

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