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Long-term changes in land cover, floristics, and structure of Mpanga central forest reserve: Facts from remote sensing and observational plots and their relevance for forest ecology and management

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Abstract

Despite the importance of tropical forests for carbon storage and biodiversity conservation, they are threatened by degradation and deforestation. Monitoring of the remaining forests can help detect adverse anthropogenic disturbances and assess the magnitude of forest alteration. Few studies examine long-term changes in tropical forests. Using data from remote sensing (1990–2022) and plot inventories (1994–2023), we sought to examine long-term changes in land cover, floristics, structure and human activities in Mpanga Central Forest Reserve. Landsat TM and Landsat OLI satellite imagery datasets were accessed from usgs.com and processed in programming interface on the GEE platform. Inventory data (tree species, diameter, and height) were collected using 30 circular plots. Plot conditions (undergrowth, canopy cover, and dead wood) and human-induced disturbances were recorded. Remote sensing showed an increase in settlements and cultivated land, and a decline in natural forest and shrubland. Inventory data showed that tree species composition shifted due to a decline in relative abundance of dominant species. Species richness and structure (stem density, maximum height, basal area, and aboveground biomass) declined. Human activities like cutting of saplings and mature trees increased. Undergrowth density increased while canopy cover and dead wood declined. Tree species used for drum making showed disrupted population structures so their long-term survival is not guaranteed. These changes in land cover, floristics and structure affect ecosystem services and wildlife through reducing forest productivity and habitat availability. In order to recover the historical conditions, the forest could be restored through assisted natural regeneration and active restoration involving native species. The density of preferred tree species can be increased through enrichment planting within the forest. To reduce the pressure on the forest, domestication of preferred tree species through on-farm planting and farmer-managed natural regeneration need to be promoted in forest adjacent communities.

Keywords: Diversity and forest structure, forest degradation, repeated measures, species composition

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