Carbon and biodiversity restoration potential in an artificial savanna in the Democratic Republic of the Congo

T3.9 Forest landscape restoration (FLR) and SDG Goals from the lens of forest policy and governance

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Abstract

A large share of the global forest restoration potential is situated in 'unstable' mesic African savannas, contributing about 23% to the global mismatch between potential and actual terrestrial carbon stocks. However, uncertainty on Central African forest recovery rates impedes science-informed implementation of forest restoration efforts. Here, we quantify the forest restoration success of 17 years of fire exclusion within a mesic artificial savanna patch in the Kongo Central province of the Democratic Republic of the Congo. Since 2005, the local community of the Manzonzi village has conserved an 88-ha artificial savanna with support from World Wildlife Fund. In 2010, we established 101 permanent plots (total area of 40.4 ha) and remeasured them (at the threshold of 10 cm DBH) in 2014 and 2022, by considering two species categories: savanna and forest specialists. Between 2010 and 2022, mean stem density switched from 122.3 ± 9.0 to 27.0 ± 3.8 tree/ha and from 45.8 ± 7.5 to 178.6 ± 10.1tree/ha for savanna specialists (*e.g. Hymenocardia acida* and *Maprounea africana*), and forest specialists (*e.g. Xylopia aethiopica* and *Albizia adianthifolia*) respectively. We found that aboveground carbon (AGC) recovery of forest specialist after 17 years was on average 11.9 ± 0.2 Mg C ha^{-1}. Using a model fitted to the data, we predicted that AGC stocks take 110 ± 3 years to recover to 90% of AGC stocks in old-growth forests. Applying this recovery trajectory, we show that 'unstable', artificial savannas across DRC, Congo, and Angola have a total carbon uptake potential of 13.5 ± 1.6 Gt C by 2100. Species richness recovered to 33.1% after 17 years and we predicted a 90% recovery at 57 ± 1 years. In contrast, the recovery of species composition was much slower, with an estimated 90% recovery after 125 ± 3 years. We conclude that carbon and biodiversity recovery trajectories are indispensable to developing policies promoting forest restoration in artificial African savannas. However, more long-term, *in situ* monitoring efforts are needed to quantify variation in carbon and diversity recovery owing to resource availability (rainfall and soil fertility), prior vegetation and land-use history, and surrounding forest cover.