Protecting an artificial savanna as a nature-based solution for restoring carbon and biodiversity in the Democratic Republic of the Congo

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A large share of the global forest restoration potential is situated in "unstable" mesic African savannas, contributing about 23% to the worldwide mismatch between potential and actual terrestrial carbon stocks. However, uncertainty regarding 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 DR Congo. We found a rapid increase in the stem density of pioneer forest species (e.g., *Xylopia aethiopica* and *Albizia adianthifolia*) and a significant decrease in the stem density of savanna species (e.g., *Hymenocardia acida* and *Maprounea africana*). On average, forest species ' above ground carbon (AGC) recovery was 11.97 ± 0.20 Mg C ha^{-1}. We predicted that AGC stocks take 112 ± 3 years to recover to 90% of AGC stocks in old-growth forests. We showed that "unstable" artificial savannas across DR Congo, Congo, and Angola have a total carbon uptake potential of 12.13 ± 2.25 Gt C by 2100. Species richness recovered to 33.17% after 17 years, and we predicted a 90% recovery at 54 ± 2 years. In contrast, the recovery of species composition was much slower, with an estimated 90% recovery after 12 ± 3 years. We conclude that the relatively simple and cost-efficient measure of fire exclusion in artificial savannas is an effective Nature-based solution to climate change and biodiversity loss. However, more long-term and in situ monitoring efforts are needed to quantify variation in long-term carbon and diversity recovery pathways.

Keywords
Forest restoration, Carbon recovery, Biodiversity recovery, Congo basin, Central Africa