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Abstract

Globally, invasive plant species cause negative impacts to human livelihoods and natural ecosystems, particularly in biodiversity hotspots. Maesopsis eminii invasion in Amani Nature Forest Reserve, Tanzania, was considered an ecological disaster in the 1980s. After >50 years have elapsed since the species was first introduced in the reserve, there is yet little information available on its invasion progress. We assessed spatio-temporal invasion dynamics using forest inventory data collected in 1998 and resurveyed 60 (20 m × 50 m) sample plots in 2018. Among resurveyed plots, 30 had been invaded by M. eminii in 1998 and other 30 sample plots as control, which had no M. eminii in the year 1998. We also assessed vegetation cover change over a 20 year period between 1998 and 2018 using Landsat satellite images. Over the last 20 years, 23% of control plots were newly invaded by M. eminii. Tree species richness was 25% lower in invaded versus control plots ($U = 1490$, $z = 2.9$, $p = 0.04$). Large trees (DBH ≥ 31–50 cm) of Maesopsis eminii were most abundant (62%) in invaded plots whereas small trees (DBH ≤ 10 cm) were most abundant (>50%) in control plots, indicating that the tree species might be prone to self-thinning. Woody species diversity was significantly lower in invaded (1.63 ± 0.49) vs control plots (1.87 ± 0.35; $t(58) = -2.19$, $p = 0.03$). The number of M. eminii individuals ha−1 was positively associated with higher altitudes ranging above 800 masl ($\rho = 0.33$, $P = 0.011$) but there was no correlation with distance away from the forest reserve boundary ($\rho = 0.11$, $P = 0.394$;) nor with distance away from village centers ($\rho = -0.08$, $P = 0.502$). Change detection analysis indicated about 1,108 ha of non-forest vegetation had regrown into forest over the last 20 years, particularly in the south - western region of the reserve. The region included 4 sample plots newly invaded by M. eminii. We conclude that there is an increase in spatial distribution of M. eminii individuals between the year 1998 and 2018. Furthermore, M. eminii has low regeneration potential in already invaded sites of high invasive density and only slowly invading gaps in uninvaded sites.

Keywords
Biodiversity hotspot; Invasive tree; Regeneration potential; Remote sensing; Distributional range; Population structure