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# Spatio-temporal invasion dynamics of *Maesopsis eminii* in Amani Nature Forest Reserve, Tanzania

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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  $\geq 31$ –50 cm) of *Maesopsis eminii* were most abundant (62%) in invaded plots whereas small trees (DBH  $\leq 10$  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 ( $1.63 \pm 0.49$ ) vs control plots ( $1.87 \pm 0.35$ ;  $t(58) = -2.19$ ,  $p = 0.03$ ). The number of *M. eminii* individuals ha<sup>-1</sup> 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