

Modelling tree height-diameter and biomass growth relationship of planted *Melia volkensii* (Gurke.) stand in drylands of Kenya

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Abstract

Melia volkensii tree growing in drylands of Kenya have a potential of reversing environmental degradation and at the same time improved farmer's livelihoods through sale of high quality timber. *Melia* planted on-farms support smallholder farmer's livelihoods and play an important role in global carbon cycle because of its short rotation. However, reducing emissions of greenhouse gases from deforestation and forest degradation (REDD) require stringent carbon measuring, reporting and verifying methods which is lacking especially for indigenous species. This study aims to evaluate the distribution of above- and below-ground-biomass and carbon stocks of *Melia*, an important indigenous species that is being promoted for reforestation of degraded lands by developing robust allometric equation for estimating biomass and carbon using easy to measure growth parameter like diameter at breast height (DBH) and height. Five to ten trees were sampled and their height, DBH and aboveground biomass destructively harvested from trees of ages 5, 7.9 and 11 in Kibwezi site and 10, 12, 14 and 25 in Tiva site. Roots from sampled trees were subsequently excavated and weighed for estimation of root biomass. At Tiva site, 14 years *Melia* tree had attained a height of 10.0m, a DBH of 20.0cm, and accumulated total biomass of 252 kg DM kg/tree and 125 kg carbon/tree which is equivalent to 157 tons DM/ha and 78.68 tons carbon/ha respectively at tree density of 625 tree/ha. At Kibwezi site, 11 year old *Melia* had attained a height of 8.6m, a DBH of 23.4cm and accumulated total biomass of 274 kg DM kg/tree and 136.8 kg carbon/tree which is equivalent to 171 tons DM/ha and 86 tons carbon/ha respectively. Belowground to aboveground ratio was 0.21. Diameter at breast height alone provided reliable prediction of belowground biomass ($R^2=0.97$), aboveground biomass ($R^2=0.93$) and total biomass ($R^2=0.94$). This study recommends diameter at breast height as the basis for estimating biomass in drylands landscapes for estimating carbon sequestration potential of *Melia* planted on farms. Reforestation of degraded farmlands with *Melia* can contribute climate change mitigation and REDD++ initiative.