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## Using Dendroecology to Determine Growth Rates of Mahogany and Cedar in Community Forestry in Guatemala

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### Abstract

One of the main technical knowledge gaps for sustainable timber production in tropical forests is the lack of reliable information on tree growth, which is indispensable for defining cutting cycles and estimating harvest volumes. We applied dendroecological methods to measure and model the diameter growth (dbh) of mahogany *Swietenia macrophylla* and cedar *Cedrela odorata* in humid tropical forests of community-managed concessions in the Maya Biosphere Reserve, Petén, Guatemala. The width of growth rings was determined in increment cores from 32 trees of *S. macrophylla* and 27 of *C. odorata* and the annual nature of rings demonstrated using COFECHA software. A standardised chronology derived through comparisons among trees was obtained for 1927–2014 for *S. macrophylla* 1944–2014 in *C. odorata*. Sigmoidal functions were fitted to represent the relationship between stem diameter and tree age. *S. macrophylla* showed a long-term mean annual increment (MAI) of 0.43 cm yr<sup>-1</sup> and tree ages were 40–184 yr. Based on the age at which the MAI curve crosses the curve of current annual increment (CAI), this species reaches its biological rotation at 92 yr, at 48 cm dbh. Estimated long-term MAI for *C. odorata* was 0.65 cm yr<sup>-1</sup> and the ages of the trees sampled were 35–110 yr. This species reaches its biological rotation at 85 yr and 65 cm dbh, as compared to the 60 cm minimum cutting diameter. An attempt to correlate the width of growth rings with precipitation and temperature did not reveal an overriding climate signal in the growth data. Statistically significant correlations were found between precipitation measures from the previous year and current growth for *Swietenia macrophylla*, but not for *Cedrela*. Temperature variables of the previous and current years were both positively and negatively correlated with growth in both species. In conclusion, MAI for *S. macrophylla* is close to the 0.4 cm yr<sup>-1</sup> used by Guatemalan authorities for harvest planning, but our results show that this MAI underestimates growth and yield of *C. odorata*. Biological criteria for the determination of the rotation time of *S. macrophylla* are not consistent with the official minimum harvesting diameter of 60 cm.

**Keywords:** *Cedrela odorata*, community forest management, *Swietenia macrophylla*, timber, tropical rain forest, yield