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Enrichment of big-leaf mahogany (*Swietenia macrophylla* King) in logging gaps in Bolivia: The effects of planting method and silvicultural treatments on long-term seedling survival and growth

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ABSTRACT

To insure adequate regeneration and future timber yields of mahogany (*Swietenia macrophylla* King), many logged forests will have to be restocked through enrichment planting and managed using silvicultural techniques that maintain this species' long-term survival and growth. This study compared the effects of planting method and two silvicultural treatments on the survival and growth of mahogany seedlings in logging gaps in Bolivia. We tested the hypotheses that survival and growth will be higher among transplanted seedlings than seedlings established from sown seeds and higher in silvicultural treatments that reduce competing vegetation and increase light. The first silvicultural treatment consisted of gaps logged 6 months prior to planting, gaps logged just prior to planting, and gaps treated with herbicide prior to planting. The second treatment, applied 12 months after planting, consisted of manual vegetation cleaning around mahogany seedlings in half of the gaps. The first hypothesis was supported in terms of initial seedling growth but not survival, which was similar between planting methods during the 12–92 months after planting. Transplanted seedlings grew significantly faster than those established from sown seeds during the first year, but this growth advantage disappeared by the second year. Although transplants were 84 cm taller than seed-sown seedlings by the end of the study, this height gain was probably not worth the cost of growing and transplanting seedlings. The second hypothesis was supported in terms of both survival and growth. A significantly greater proportion of seedlings survived in herbicide (62%) compared to 6-month-old (46%) and recent gaps (18%) and in cleaned (51%) versus control gaps (39%). Seedlings initially grew faster in herbicide and recent gaps than in 6-month-old gaps. These differences among silvicultural treatments were largely explained by canopy cover, which, throughout the study, was at least 14% lower in herbicide gaps and 9% lower in cleaned gaps relative to their respective alternatives. By 64 months growth diminished to near zero and no longer differed among gap treatments, despite lower canopy cover in herbicide gaps. By 92 months, saplings in herbicide gaps were only 145 and 77 cm taller than those in recent and 6-month-old gaps, respectively. To maximize survival and growth of mahogany seedlings in logging gaps while minimizing costs, silvicultural strategies should focus on direct seed sowing and appropriately timed interventions (i.e. manual cleaning) to control competing vegetation.

1. Introduction

As one of the most commercially valuable timber species in Latin America, big-leaf mahogany (*Swietenia macrophylla* King) has been severely locally depleted throughout much of its range. By the mid 1990s in Mesoamerica, deforestation and over harvesting had reduced mahogany's original geographic range to roughly one third (Calvo and Rivera, 2000). In South America, the commercial range of mahogany has been reduced to an estimated 94 million hectares, or 34% of the historic range (Grogan et al., 2010). In both regions many natural populations of mahogany have been so

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