How to improve the regeneration of African mahoganies in the northeastern block forest of the Democratic Republic of Congo

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THIS ARTICLE presents a study that assessed management options for African mahogany timber species in the Ituri region of the Democratic Republic of Congo (DRC) through analyses of regeneration ecology and seedling performance in disturbed and undisturbed forests.

DRC contains over 50% of African rainforests and about 8% of the world's remaining tropical moist forests. Although it has large tracts of potentially productive tropical forest, its formal timber production has been extremely low for the past decade (ITTO 2003), due in part to the progressive collapse of the country's road systems and the unstable political landscape (Wilkie et al. 2000). This situation may change soon, as the DRC government has already allocated over 20 million hectares of forest to multinational logging companies and aims to increase formal annual timber production from less than 100 000 m^3 currently to over 1 million m^3 by the year 2006–2007.

African mahoganies, which include species from the genera *Khaya* and *Entandrophragma*, are among the most valuable timber species in Africa. Five species of the group are represented in DRC's Ituri region, including *K. anthotheca*, *E. angolensis*, *E. candollei*, *E. cylindricum* and *E. utile*. These five, along with *Milicia excelsa*, make up nearly 90% of timber currently exported from eastern DRC. The sustainable management of these species is therefore of great importance; continued poor management could pose great environmental and societal risks for the whole of central Africa and beyond.

Objectives

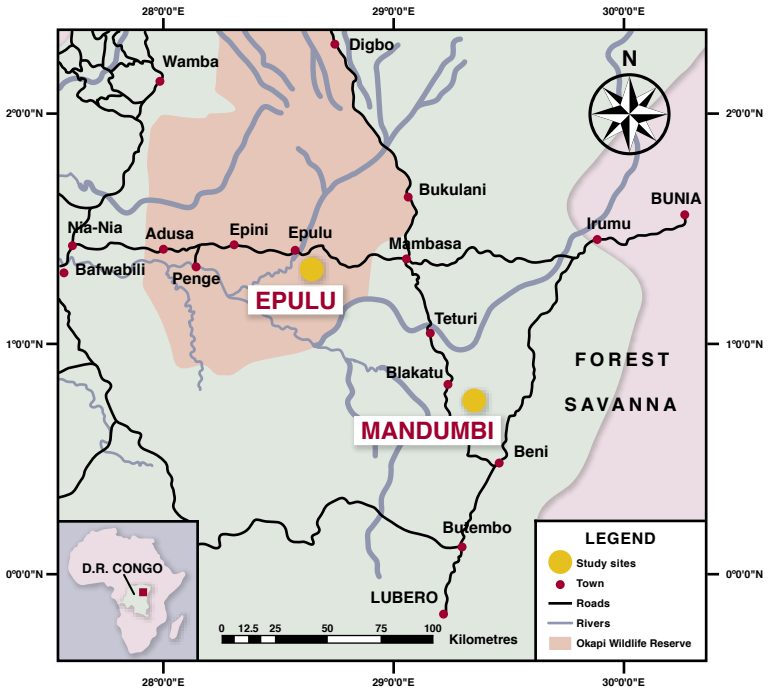
The main objective of this study was to assess management options for African mahoganies (*Entandrophragma* spp and *Khaya* spp) in northeastern DRC. Previous studies have shown that African mahoganies often do not regenerate well after selective logging (Mwima et al. 2001; Hall et al. 2003). The regeneration failure of these major timber species after selective logging has been blamed on insufficient canopy openings, low seed availability and dispersal, and a lack of soil disturbance in logging gaps. In addition, in eastern DRC, logged forests are generally invaded rapidly by landless farmers from the densely populated eastern highlands, who take advantage of logging roads to enter the forest interior and establish agricultural frontiers, eventually leading to large-scale forest degradation and a loss of biodiversity.

Specific objectives of the study were to assess the importance of seed availability, dispersal limitation, soil disturbance, and light availability on the establishment and early growth of African mahoganies and to evaluate the combined impacts of selective logging and shifting agriculture on forest structure, tree species diversity and composition, and timber tree regeneration. The main hypotheses tested were: 1) insufficient seed availability and dispersal limit seedling recruitment in logged forests; 2) soil disturbance promotes seedling establishment; 3) single-tree harvesting provides insufficient light levels for the successful recruitment of African mahoganies; and 4) the combined effects of selective logging and agriculture result in severe degradation and the impoverishment of natural forests.

Race to the top: African mahogany seedlings grow very rapidly in a small clearing in the Ituri forest. This 18-month-old seedling is over 2 m in height. *Photo: J-R. Makana*

Study site

Figure 1: Map locating study sites. The insert shows DRC within the African continent



Methods

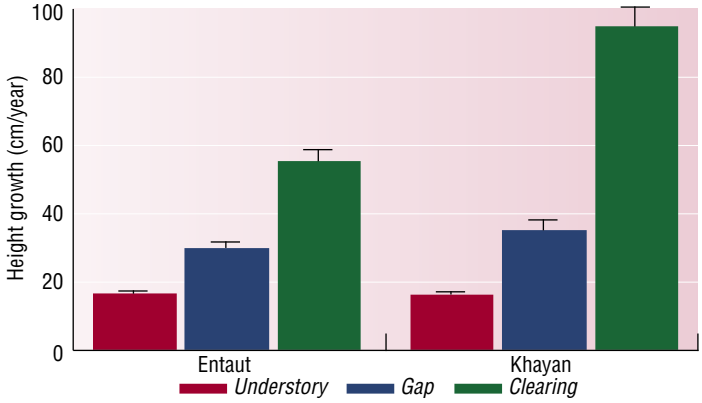
The study was conducted at two sites in the Ituri region *(Figure 1)* in the northeastern part of the DRC forest block. The first site (Mandumbi) was a logging concession and the second site was located at Epulu, in the 1 350 000-hectare Okapi Wildlife Reserve. The elevation in the region is in the range 700–950 m above sea level. Mean annual rainfall is about 1700 mm, average annual daily temperature is 23.5° C and there's a dry season from December to February. The first three hypotheses were tested using a split-plot experiment involving seed addition, litter removal and canopy cover. The fourth hypothesis was evaluated by comparing forest structure and tree diversity and composition between secondary and mature forest stands in logged and unlogged forests.

Results

Three major findings were made in this study. First, although African mahoganies have all been considered to be light-demanding species, the investigation revealed important differences in light requirements between the three species studied. The light-demanding nature of African mahoganies was confirmed for *K. anthotheca* and *E. utile*, whereas *E. cylindricum* was exceptionally shade-tolerant. Second, it was observed that secondary forests resulting from the abandonment of slash-and-burn agriculture offer favourable conditions for the regeneration of most African mahoganies, supporting the hypothesis that large canopy openings associated with some kind of soil disturbance are necessary for the successful regeneration of these species in moist tropical forests *(see Figure 2 and the photo)*. Third, African mahoganies were more abundant in the semi-deciduous forest of Mandumbi in the transition zone between closed canopy forest and eastern savanna woodlands than in the moist evergreen forests of western Ituri (Epulu). In addition, seed availability and dispersal strongly hindered the natural regeneration of African mahoganies in selectively logged forests; seed addition in canopy gaps substantially improved the recruitment of these species. Litter removal did not improve seedling establishment, probably due to high seed and seedling predation on exposed mineral soil. However, the combined occurrence of canopy gaps and litter removal offered the best conditions for seedling survival and growth. Secondary forests had a lower diversity of large trees than mature forests and the dominant species of mature forest were poorly represented in them.

Gap analysis

Figure 2: Height growth rates of seedlings of two African mahogany timber species as a function of canopy cover in the Ituri forest *(ENTAUT = Entandrophragma utile; KHAYAN = Khaya anthotheca)*



Conclusions

These findings suggest that intensive silviculture, perhaps involving the use of shifting cultivation in a taungya-like system, appears necessary to achieve the sustainable management of African mahoganies and other disturbance-adapted timber species. In this context, biodiversity conservation will likely be assured by the zoning of forests into multiple-use, timber production and strict protection areas.

References

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Eligible activities include:

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- promoting sustainable management of tropical forest resources;
- promoting increased and further processing of tropical timber from sustainable sources; and
- improving industry's efficiency in the processing and utilisation of tropical timber from sustainable sources.

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Selection criteria: Fellowship applications will be assessed against the following selection criteria (in no priority order):

- consistency of the proposed activity with the Program's objective and priority areas;
- qualifications of the applicant to undertake the proposed fellowship activity;
- the potential of the skills and knowledge acquired or advanced under the fellowship activity to lead to wider applications and benefits nationally and internationally; and
- reasonableness of costs in relation to the proposed fellowship activity.

The maximum amount for a fellowship grant is US$10 000. Only nationals of ITTO member countries are eligible to apply. The next deadline for applications is 21 April 2005 for activities that will begin no sooner than 1 August 2005. Applications will be appraised in June 2005.

Further details and application forms (in English, French or Spanish) are available from Dr Chisato Aoki, Fellowship Program, ITTO; Fax 81–45–223 1111; fellowship@itto.or.jp (see page 2 for ITTO's postal address) or go to www.itto.or.jp