Abstract

SELECTIVE LOGGING AND SUSTAINABLE SILVICULTURE AT THE RIO BRAVO CONSERVATION AND MANAGEMENT AREA IN NORTHWESTERN BELIZE

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On a 100-ha logging compartment in the Rio Bravo Conservation and Management Area's Timber Extraction Zone in NW Belize, 15 commercial species were selectively harvested in an experimental logging operation in April 1997. The goals of this Master's Project were to evaluate felling gaps and damage to the residual forest resulting from the logging operation, and to assess the degree to which silvicultural objectives were achieved.

Two different studies were undertaken within the 100-ha experimental logging area. The first evaluated the potential of commercial logging to open canopy gaps in the residual forest, providing light necessary for shade-intolerant mahogany seedlings. Felling gap areas were measured, canopy openness and gap light levels were quantified, and felling gap area in mahogany regeneration areas (seed shadows 2800 m each) was assessed. The second study evaluated residual damage from commercial harvesting to trees> 10 cm in diameter.

On the average, single-tree felling gaps measured 129m (n = 24) while multiple- tree gaps were 343m (n = 13). Total area in felling gaps was 2.4 ha. On average, 6% of seed shadow areas were opened by logging, and 14% of all gaps were inside seed shadows. Canopy openness was 39% in the single-tree gaps and 44% in the multiple-tree gaps, and photosynthetically active radiation (PAR) was higher by 17% in the multiple- tree gaps (average 11.4 moles/m than in the single-tree gaps (avenge 9.8 moles/m

Damage to residual trees was separated into five categories: 1) scraped, 2) bent, 3) with broken branches, 4) with snapped trunk, and 5) uprooted. In felling gaps highest damage was from broken branches (a total of 252 and 35 trees for single and multiple- tree gaps, respectively) and snapped trunks (171 and 63 trees for single and multiple-tree gaps, respectively). In skid trails, highest damage was from scraped trees (86 and 38 trees/km trail for primary and secondary skid trails, respectively) and uprooted trees (21 and 29 trees/trees/km trail for primary and secondary skid trails, respectively). Approximately 8.8 trees were damaged per tree removed.

Conclusions

The PfB plans to implement post-harvest silvicultural treatments to further open up the experimental seed shadows for a mahogany regeneration study. Nonetheless, they had hoped that felling gaps would create substantial canopy openings in the seed shadows to reduce the need for additional treatments to create favorable regeneration conditions for intolerant species. Although efforts to maximize felting gaps inside mahogany seed shadows did result in 14% of their felling gaps falling inside regeneration areas, these gaps only opened between 0 and 16% of the seed shadow canopies. These numbers are significantly lower than had been expected, so costs for the next silvicultural treatment will be higher. This study reveals that commercial logging, as carried out by the Ff8, does not open a substantial amount of the seed shadow canopy (average 6%), and this has costly implications for the P18 regarding their silvicultural plans for the area.

Concerning natural regeneration in the gaps, the PfB's average single-tree gap was 129 m^2 and the average multiple-tree gap was 343 m^2 . In 1996 Gullison et al. conducted a study in the Chimanes Forest in Beni, Bolivia and found that only 7 to 9% of felling gaps, which ranged in size from 450 m^2 to 1000 m^2 had any natural regeneration twenty years after logging. Although mahogany seed sources had been removed from this site, the authors attributed lack of regeneration to a rapid canopy closure, which reduced light available for shade-intolerant seedlings such as mahogany. Given that PIE logging gaps are substantially smaller than those measured by Gullison et al.. we can assume an even quicker canopy closure process will take place in Belize, which would probably not provide adequate conditions for mahogany regeneration in the absence of additional silvicultural treatments.

PfB might consider making some changes concerning their commercial species list. They chose to harvest 15 species, and later realized that about one-half of these species were not paying their way out of the woods (Wilson 1997). It might be preferable to harvest more of the commercially valuable species, such as mahogany and chicle macho and leave standing some of the less valuable species. The PfB harvested only 52% of the available mahogany trees >50cm in diameter (52 of 120). Even if they had taken all 120, they would have still left 556 mahoganies >20cm in diameter, a large stock which will provide many harvestable trees by the next cutting cycle in 40 years (Stock survey, PfB). They also harvested only 41% of the available chicle macho >40cm in diameter. If they had taken all harvestable chicle macho, 253 chicle machos > 30cm still would have been left for the next cutting cycle. Extrapolating from my results, if PfB had removed all 120 mahogany trees and all 88 chicle macho trees, they would have opened up an additional 1.3 ha of felling gaps (1.3% of 100-ha, or an increase of 50% of the area in gaps). Not only would total gap area have been greater (total 3.7 ha), but financial returns would have been greater as well.

With regard to damage in the PfB’s commercial logging, total number of damaged trees per tree extracted (8.8) was 50% of that recorded in Whitman et al’s study (18.5) (1997). In addition, damage to the next harvest trees (> 30cm) was minimal. This indicates that directional felling and careful planning of skid trails is a useful investment for PfB, both in sustaining their next harvest trees and in conserving biodiversity.