

## Impact of logging operations on Kirindy forest structure and species composition

Pierre Binggeli

Kirindy forest was selectively logged until 1990. Many signs of this harvesting are still observable, the most obvious feature being the secondary dirt roads. Here and there cut stumps can also be seen on the forest floor.

The impact of logging on forest structure and species composition was two fold. Firstly, a network of secondary dirt roads was established across the forest dotted with a number of depots. Secondly, hauling tracks were established in compartments logged using tractors or trails in the case of manual timber extraction (Fig. 1). In all compartments a variable number of mature tree of selected species were removed.

In the case of CS4 (adjacent to the camp) logging was semi-mechanized. All vegetation of secondary dirt roads, depots and hauling trails was removed to allow lorries and tractors to extract cut logs and temporarily store them. It is likely that some stumps would have been left on hauling tracks. In total about 5% of the forest area would have been denuded of vegetation to extract timber (see Table 1 for details). In the case of manual extraction the area would have been slightly greater 6.8 %. However, the trails were not straight so that they would have avoided medium size trees and thus at times would have had no impact on the canopy. On the contrary, hauling trails were straight and only very large trees were not cut and thus substantial areas of canopy were opened up.

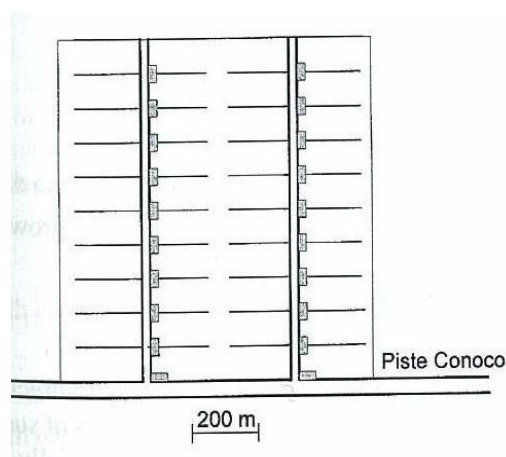


Figure 1. Idealized representation of logging infrastructure (note that, for instance, hauling tracks were not always at right to the two secondary dirt roads as in CS4).

The area disturbed by tree felling itself is unclear as no figure is available in the literature. A relatively small number of trees and a limited amount of timber was removed. Between 4 to 15m<sup>3</sup> representing 6 to 20 trees per ha were harvested. If one presumes that about 10 large trees were removed and one assumes that each falling tree produced a 100 m<sup>2</sup> gap, then tree felling disturbed less about 1% of the compartment. As in natural tree fall gaps, a falling tree will not kill or damage all the trees.

Table 1. Surface area of vegetation destroyed to establish logging infrastructure (see Fig 1 for layout).

Infrastructure	Number	Size (m)	% of area heavily disturbed
Secondary dirt roads	2	1000 x 6	1.2
Forest depots	20	20 x 20	0.4
Hauling tracks	40	220 x 4	3.5

5a



5b



5c



Abb. 5. Stämme werden mit Hilfe von Seilwinden oder mit Zebus aus dem Wald gezogen (a), in Depots gelagert (b) und zum Teil dort oder noch im Wald vorbearbeitet (c). [Fotos: U. Hornung]

Figure 2. Photographs of various stages of manual timber extraction. a. Logs dragged by cattle along trails to depot. b. Timber stored prior to transport to Morondava. c. In some cases the log was shaped in the forest (note base of cut tree bottom right) (from Ganzhorn, 1991).

Conclusion: logging infrastructure had a much greater impact on forest structure than harvesting. A keen eye can still readily observe the hauling tracks, but it is much harder to find cut stumps and associated treefall gaps. Tree harvesting had a major impact on species composition, but particularly that of the larger trees as some species were

highly preferred (e.g. *Commiphora* species)..

#### Reference

Ganzhorn, J. (1991) Forstprojekt im Trockenwald Madagaskars. *Biologie in unserer Zeit* 21, 293-297.