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Tree cutting to float rattan to market: a threat to primary forests?

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Abstract—Cutting small trees to float bundles of rattan cane to market is widespread in Indonesia and is purported to adversely affect primary forests and biodiversity conservation. I monitored rattan cane harvesting, tree species used as floater logs, and the locations and volume of floater log cutting in two forest villages adjacent to Lore Lindu National Park in Central Sulawesi, Indonesia for two years. During this period, an average of 135 and 100 tons of commercial rattan cane, primarily *Calamus zollingeri*, was harvested annually from the two villages, respectively. Floating cane to market required approximately 2350 and 1667 logs (each 3 m in length and 15–20 cm in diameter) or about 1175 and 834 trees annually in the two villages. Eight tree species were regularly used as floater logs and all were light-weight, fast-growing, pioneer species. Floater logs were harvested from fallowed shifting cultivation fields and naturally disturbed riparian flood plains. Over the two year study period, there was little floater log cutting in primary forests either inside or outside of the national park. The use of early successional tree species to float rattan to market does not appear to adversely affect primary forests or protected area management in this region.

Key words: Rattan; floating to market; use of trees.

INTRODUCTION

Sustainable harvesting of non-timber forest products (NTFPs) has been advocated as a means to simultaneously conserve forests and encourage economic development throughout the tropics [1, 2] and is now an integral component of most tropical forest conservation and management practices [3]. However, many ecologists contend that NTFP harvesting is neither ecologically sustainable nor economically viable [4, 5]. Struhsaker [6] argues that the notion of sustainable extraction is an ecological oxymoron and that it is simply impossible to ascertain all possible ecological effects associated with harvesting primary forest products at an acceptable level of probability within a biologically meaningful time period.

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Rattan, arguably the world's most important NTFP, is collected primarily from wild populations in primary forests. Indonesia supplies over 90% of the world's commercial rattan cane [7] and the majority is gathered from forests in which management has been largely absent or ineffective [8]. Market demand for rattan, particularly large-diameter cane, is growing and furniture-quality canes are becoming increasingly scarce [9]. At present, wild rattan harvesting is not managed and little is known about direct or indirect ecological effects associated with cane harvesting, transport or processing.

Over the past two decades, the island of Sulawesi has emerged as a major source of large-diameter furniture rattans. *Calamus zollingeri* Beccari, a robust, clustering rattan that ranges from Sulawesi through eastern Indonesia, is the principal commercial species. *Calamus zollingeri* and several other large-diameter furniture-quality rattans, including *C. merrillii* Beccari and *C. subinermus* H. Wendl. ex Beccari, are particularly attractive for sustained-yield management because they coppice and reproduce both sexually and vegetatively [10]. Reliable rattan production data for Sulawesi are unavailable, but cane harvesting, trade and processing are prominent components of the region's household, village and provincial economies.

Rattan harvesting is widespread in and around protected areas in Indonesia and is purported to threaten biological diversity and forest conservation in Lore Lindu National Park (LLNP) in Central Sulawesi [11, 12]. Potential ecological impacts associated with rattan harvesting include: effects to genets, ramets, and ramet production and growth; effects on ecosystem nutrient supplies, forest structure, forest succession, and vertebrate food resources; and indirect effects due to transporting cane to market and incidental hunting of birds and mammals. In this paper I document impacts associated with transporting bundles of *C. zollingeri* cane downstream to a roadside access point in a principal rattan collecting region — LLNP. Cutting logs to float cane downstream is the primary means of transporting rattan to market in this and many other regions of Southeast Asia.

RESEARCH SITE AND METHODS

I undertook this study in Central Sulawesi, Indonesia (120°E, 1.5°S; elevation 800 m) in and around the villages of Moa and Au. Soils in the region are Ultisols derived from volcanic and metamorphic rocks, the climate is humid and precipitation averages 3000–4000 mm yr^{-1} with a moderate dry season from June to August [12].

Moa and Au are adjacent to LLNP, a 230 000 ha preserve established in 1982 to protect critical watersheds and one of the largest remaining primary forests in Sulawesi. After the park was established, all traditional farming and forest product collecting were prohibited. Nevertheless, rattan collection continues to be widespread within the park. The major sources of cash income in Moa and Au include perennial cash crops (i.e. coffee and cacao) and *C. zollingeri* cane collecting.

In Moa, for example, over 90% of village household rely on rattan gathering for cash income, all of which is collected from within LLNP [13].

The extent of and ecological impacts associated with cutting trees to float rattan downstream were assessed through a variety of methods. Annual rattan cane production from Moa and Au was determined by recording total cane harvesting from the two villages for two years (October 1996–September 1998). Prior to floating downstream, canes are cut, tied into bundles and lashed to an air-dried floater log (i.e. to float the fresh canes which are heavier than water). To determine average bundle weight (rattan is sold by weight based on diameter size classes), I weighed 20 cane bundles selected at random in both Moa and Au. I measured the length and diameter of 20 randomly selected floater logs in both villages and interviewed rattan collectors regarding the tree species used and the locations where harvested. Finally, I collected specimens of each tree species for subsequent identification (voucher specimens deposited in Herbarium Bogoriense, Bogor, Indonesia). Based on this information, I estimated annual rattan cane harvesting and floater log cutting in each village and then evaluated the impact of log cutting to primary forests and LLNP forest conservation efforts.

RESULTS

Transporting rattan to market in the southern LLNP region entails floating cane down the Lariang River to a roadside access point near Gimpu. Rattan is harvested largely from primary forests within LLNP in the case of Moa and in primary forests outside the park in the case of Au. Cut canes are dragged to the edge of the Lariang or small tributary stream where they are stored until floated downstream.

Based on two years of record keeping by local rattan traders, villagers in Moa and Au harvested an average of 135 and 100 tons of commercial rattan cane, respectively, each year, the vast majority of which was *C. zollingeri* (Table 1). In both villages, canes were cut to 4 m lengths, bound into 50–60 kg bundles and tied to a single log. Floater logs averaged 3 m in length and 15–20 cm in diameter. If one conservatively assumes that each log floats one 50 kg bundle, a total of 2350 and 1667 logs were used annually to float cane downstream from Moa and Au,

Table 1.
Rattan cane production and floater log cutting in two villages

	Annual amount harvested[a]		
	Rattan (tons)	Floater logs[b]	Trees[c]
Moa	135	2350	1175
Au	100	1667	834

[a] Mean of two years (10/96–9/98).
[b] Assuming each 3 m log floats a 50 kg bundle of cane.
[c] Approximate, assuming two floater logs are cut from each tree.

Table 2.
Tree species used to float rattan[a]

Species	Local name (Uma)
Artocarpus teysmanni Miq.	tea uruh
Evodia latifolia D.C.	ki hio
Grewia multiflora Juss.	wokeh
Horsfieldia sp.	laru
Macaranga hispida Muell.Arg.	meapoh
Macaranga triloba (L.) Muell.Arg.	lengkoba
Pterospermum celebicum Miq.	entorodeh
Trema orientalis (L.) Blume	wulajah

[a] Voucher specimens in Herbarium Bogoriense, Bogor, Indonesia.

respectively. Since one to three logs can be cut from each tree, this represented removal of 1175 and 834 trees in each village annually.

Eight tree species were regularly used to float rattan in the two villages (Table 2). Not surprisingly, floater logs are cut from light-weight, fast-growing, pioneer tree species. Rattan collectors reported that floater logs were harvested almost exclusively from fallowed shifting cultivation fields and to a lesser extent from naturally disturbed riparian flood plains along the Lariang River. Over the two year study period, I observed no floater log cutting in primary forests in either village.

According to rattan collectors, floater logs are rarely harvested from primary forests because suitable-sized, pioneer trees are uncommon there and because primary forests are farther from the river than swidden fields. In this region shifting cultivation is used to produce upland rice and typically involves 1–2 years of cultivation followed by about 20 years of fallow. Given the short cultivation period and single burn, secondary forest succession occurs rapidly in swidden fallows producing extensive even-aged stands of floater log-sized trees within 15 years. While some swidden fallows are located within LLNP in Moa, they are all sites that were repeatedly cultivated for decades before the park was established.

DISCUSSION

The collection of *C. zollingeri* rattan is crucial to Moa, Au and dozens of other forest villages throughout Central Sulawesi. Rattan collecting is especially important for young men who have yet to establish homes or farms, for households unable to secure sufficient food or income through preferred means (e.g. irrigated rice farming, shifting cultivation and perennial cash crop farming), and as a supplementary or emergency income source for many others [13].

There is little evidence to support the claim that cutting small, early successional trees to float rattan threatens primary forests or biodiversity in LLNP, at least in these two village areas. I observed no tree cutting in primary forests either in or outside of the park in either village. The majority of floater logs were gathered from shifting cultivation fields that had been in fallow for 10–15 years and are likely to be cleared, burned and planted with upland rice again within the decade. Swidden fallows around Moa that are within LLNP are now off-limits to cultivation and, if not cleared, will gradually revert to well-developed secondary forests. Indeed, *C. zollingeri* and other rattan species, and seedlings of common primary forest tree species already occur on these sites. Selective removal of pioneer trees for floater logs could potentially accelerate forest succession and establishment of relatively slow-growing, heavy-wooded, late successional tree seedlings already on site (i.e. by reducing competition).

The long-term viability of intensive rattan and floater log cutting is uncertain. Current rattan extraction rates are unsustainable as they exceed cane growth rates [10]. In addition, long-fallow shifting cultivation practices are being replaced throughout the region by intensive (i.e. full-sun) perennial cash crops, particularly cacao. Consequently, the availability of both rattan and floater logs may decline in the future. This could lead to cane harvesting in more remote areas of LLNP and to floater log cutting in primary forests. However, in both cases, extraction is likely to be limited by the distance (i.e. to rivers) that collectors are willing to drag canes and logs.

When considered on a regional basis, delivery of floater logs to Gimpu and other communities may contribute to forest conservation as it represents the transfer of fuelwood from an area of surplus to an area of deficit. The region from Gimpu north is a broad valley that was cleared long ago for the cultivation of irrigated rice. Fruit and shade trees are common around homes, but are not used for fuelwood. Hedgerows of *Gliricidia sepium* around homes and fields are periodically lopped, but supply only a fraction of the valley's fuelwood needs. Gimpu and surrounding communities rely primarily on floater logs, which after being pulled from the Lariang River are dried, cut, split, and marketed throughout the valley.

If abundant, inexpensive floater logs were no longer available, households throughout the Gimpu valley would be forced to find alternative fuelwood supplies. The only locally available fuelwood source in the region is the forest of LLNP, which covers the steep slopes on the eastern border of the valley. Thus, far from being a threat to primary forests or biodiversity conservation, cutting early successional trees to float rattan cane to market may actually reduce pressure on primary forest and contribute to LLNP conservation efforts.

If forest conservation is to succeed in LLNP and in most other tropical regions, it is essential that protected area officials work with forest residents who are dependent upon forests for their survival, rather than simply prohibit historic forest uses on the assumption that they are destructive or otherwise incompatible with biodiversity conservation. As Schwartzman *et al.* [14] aptly state: 'Forest residents are potent political actors in tropical forest regions and an essential component of the environmental political constituencies that are essential for the long-term conservation of tropical forests.' Managed harvesting of wild rattan represents one potential means to collaborate with forest residents in an activity that appears to be compatible with forest conservation and local economic well-being.

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