

Principes, 38(4), 1994, pp. 204–210

Illegal Palm Felling in Lokobe Reserve, Madagascar

A. J. ADANY, C. R. BIRKINSHAW AND J. R. ANDREWS

% The Orchard, Stanedge Road, Bakewell, Derbyshire DE45 1DG, United Kingdom

ABSTRACT

Six species of palm grow in Lokobe Reserve, Madagascar. Three are illegally exploited. The methods of felling and processing are described and the implications of palm exploitation on the survival of the palms and on the forest ecosystem is assessed. The current policing of the reserve is described and recommendations for improved palm protection are given.

Site and Methods

The Réserve Naturelle Intégrale de Lokobe (from here on referred to as Lokobe Reserve) consists of 740 ha of primary lowland rainforest. It is located on a steep basaltic hill (summit altitude—430 m) at the southeast edge of the island of Nosy Be off the northwest coast of Madagascar (Long. 13°23'–25'S, Lat. 48°18'–20'E; see Fig. 1). Lokobe Reserve is a Strict Nature Reserve; therefore, no exploitation of its natural resources is allowed and access is restricted to scientists with permits (Decree 66-242, 01.06.66) (IUCN/UNEP/WWF 1987). The climate is markedly seasonal with a hot, wet season between October–May and a warm, dry season between June–September.

The palms of Lokobe Reserve were identified with the assistance of Dr. H. Beentje and with reference to Jumelle and Perrier de la Bâthie 1945, Moore 1965, and Uhl and Dransfield 1987. Herbarium specimens were made by H. Beentje and the authors. Between July 1991 and April 1993 the activities of the palm thieves in the northwest, west, southwest, and south of the reserve (covering ca. 10% of the Reserve area) were monitored. The date, location, and area (where appropriate) of each felling episode, and the number, species and maturity of the felled palms were recorded. For a sample of each of the felled species, measurements were taken of the trunk diameter at the top of the stump and the length of trunk left in the forest. An interview with a former palm thief provided information on palm felling methods. A broad survey of the reserve was made

to assess the extent of the problem. The incidental damage to the forest was quantified by counting the number of saplings and trees, in various trunk diameter classes, which had been snapped during the felling of a sample of 13 palms.

The importance of palm fruits in the diet of the black lemur (*Lemur macaco*), Lokobe's largest fruit-eating animal, was investigated by habituating a black lemur group and recording the activities of a focal animal at 5-minute intervals. Whenever the animal was recorded as feeding, the plant part and species were noted.

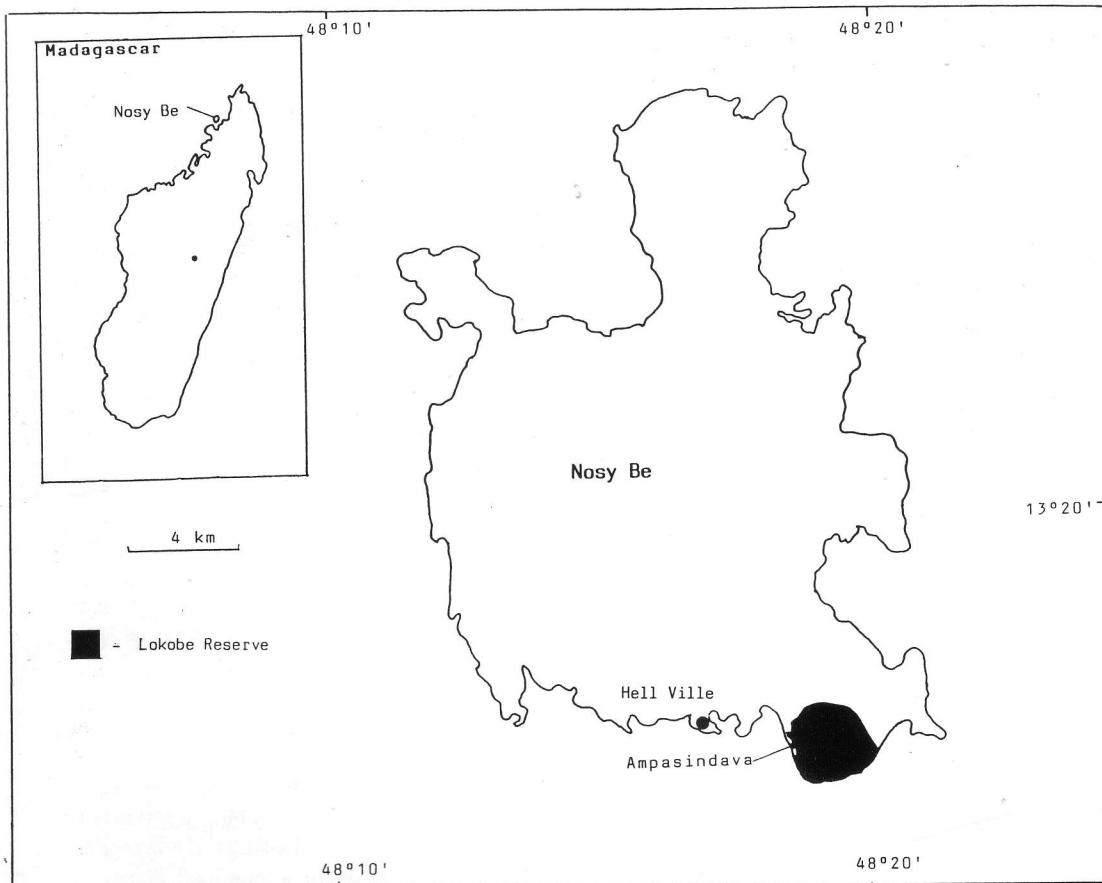
The Palms of Lokobe Reserve

Six species of palm are found in the reserve:

Chrysalidocarpus madagascariensis Beccari (Fig. 2) is a solitary palm with a mature height of 6–20 m (height to base of crown). It is the most common palm in the reserve and grows at all altitudes, although it is most frequent close to the sea. It is also found in patches of scrubby, secondary forest next to the reserve. In Lokobe Reserve this palm flowers between September and February and carries ripe fruit between February and May. This species is endemic to west Madagascar (Jumelle and Perrier de la Bâthie 1945) and is classified as Rare (Beentje 1992).

Neodypsis loucoubensis Jumelle (Fig. 3) is a solitary palm with a mature height from 8–20 m. It occurs throughout the reserve but is rare; where it occurs, it is possible to find several together. A search of 20 ha in the south of the reserve revealed just 5 mature plants (compared with ca. 200 plants of *C. madagascariensis*), but 1 ha in the northwest of the reserve contained 23 plants. *N. loucoubensis* may flower during any month of the year but fruiting occurs in two distinct periods, April–May and September–December. It is endemic to Lokobe Reserve and is classified as Endangered.

Ravenea sambiranensis Jumelle and Perrier



1. Location of Lokobe Reserve.

(Fig. 4) is a solitary palm with a mature height of 8–20 m. It is very rare in the reserve, where only four mature plants are now known, after five other plants were felled during the course of the study. Fruiting plants of *R. sambiranensis* were noted in June, July, November, and December. This genus is dioecious and all the known plants in Lokobe were female; nevertheless, two produced viable seed (one had empty fruits and one was not examined). *R. sambiranensis* is endemic to Madagascar where, in addition to Lokobe Reserve, it is known from the Manongarivo and Tsaratanana massifs in the northwest, the Bongolava embankment in the west, and in the eastern rain forest between Mananara to Vangaindrano (H. Beentje, pers. comm. 1993). It is classified as Vulnerable.

Vonitra nossibensis (Becc.) Perrier is either a solitary or a clustering palm with two or three major stems. At maturity it is 5–12 m high. Flowering was recorded between December–June and

fruiting between September–March. It occurs throughout the reserve but is most frequent at higher altitudes. It is endemic to Lokobe and is classified as Endangered.

Dypsis sambiranensis (Jum.) Jum. is a slender solitary understorey palm with a mature height of 6–10 m. Its phenology was not monitored closely, but flowering was noted in November and December and fruiting in February and March. This palm is occasional throughout the reserve. Elsewhere it occurs in a few localities in northern Madagascar and is classified as Vulnerable.

Phoenix reclinata Jacq. is restricted to the maritime edge of the reserve, where it grows in low, infertile clumps, less than 1 m high. Larger, fertile plants are found in scrubby vegetation throughout Nosy Be. It grows in northwest, northeast and north Madagascar, and around the maritime fringe of tropical and sub-tropical Africa (Jumelle and Perrier de la Bathie 1945). Its status

as a native in Madagascar is uncertain. It is classified as Not Threatened.

Theft of Palms

In Lokobe Reserve, *C. madagascariensis*, *N. loucoubensis* and *R. sambiranensis* are exploited for timber, in particular for planks that are used as floor boards in traditional houses. On only two occasions was the heart removed from the felled palm. Sometimes, when the palm thieves have trouble locating sufficient palms to complete a commission, *Ravenala madagascariensis* (Travellers Palm, Strelitziaeae) is also felled. It produces planks which are inferior but superficially very similar to those obtained from the palms and, when mixed with palm planks, passes unnoticed. Only mature palms are taken, as the trunks of young plants are too soft to produce durable planks. The range and mean (with standard deviation) trunk diameters (20 cm above the palm "foot") for a sample of felled palms for each of the three species are:

	Range (cm)	Mean (cm)	(s.d.)
<i>N. loucoubensis</i> (n = 23)	19–32	23.4	(3.2)
<i>R. sambiranensis</i> (n = 3)	21–25	22.2	(2.3)
<i>C. madagascariensis</i> (n = 11)	20–32	24.9	(3.2)

Palm exploitation is hard work and requires a good knowledge of the forest and experience in methods of felling and processing; not surprisingly, it is conducted by only a small number of professional palm thieves. These men work alone or in groups of two to three in response to a specific commission from a house-builder. An area of forest is located which is rich in mature palms and these are systematically felled over two to four weeks. At the end of felling, no mature palms remain at the site. The palms are felled using an axe, 30–60 cm above the palm foot. The lower portion of the trunk is cut into one to three sections either 3 m or 4 m long, according to the specifications of the commission. Only the lower portion of the trunk is used, as the upper portion is soft. The upper portion is left in the forest (mean length of discarded trunk = 8.7 m, s.d. = 2.9, range = 2.3–15, n = 37). The sections are split in half using an axe, and the soft central core removed

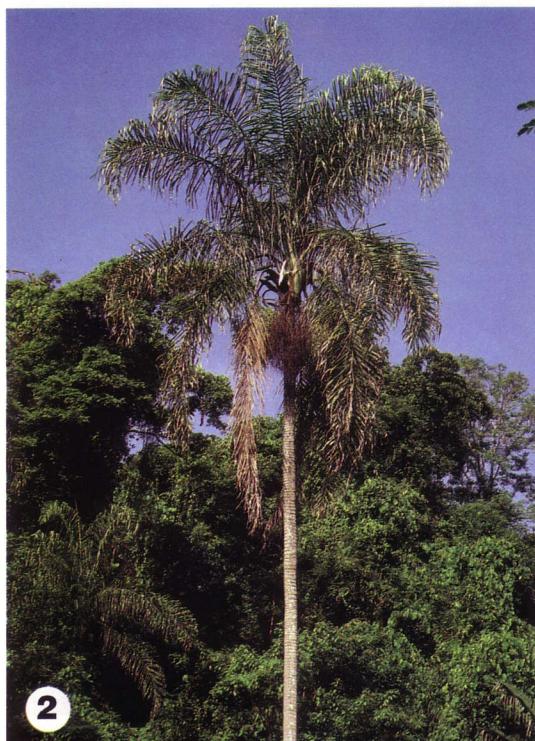
using a tool called a "fisitry" to produce two curved planks (Fig. 5). Thus, depending on their size, a palm can yield from 2–6 planks. The bark covering the planks is scraped off using another tool called a "gory". The planks are tied together in bundles of four to six using liana and carried to the edge of the forest where they are hidden. They are then transported away by pirogue (dug-out canoe), at dusk or during a moonlit night, often when the tide is particularly high so the boat can be loaded close to the forest. Generally the thieves work in the relatively cool period between dawn and mid-morning, felling and processing four to five palms a day. The planks are sold for 1,500 FMG each (\$0.75); therefore a whole palm may yield up to 9,000 FMG (\$4.50)—a relatively large amount given that typically a laborer earns just 2,000 FMG a day.

The number and species of felled palms and the area of felling for nine palm felling incidents recorded between July 1991 and April 1993 are shown in Table 1. The stumps of felled palms can be found from sea level to the highest altitudes and in all parts of the reserve except for inaccessible, steep, boulder-strewn ravines.

Felling and processing the palms causes some incidental damage to the neighboring vegetation. This is usually superficial, being restricted to saplings and young trees (Table 2). However, because the palms often have a clumped distribution, a large number may be felled within a small area; the combined impact of their loss from the forest canopy together with the damage to neighboring vegetation can be considerable.

Policing the Reserve

Lokobe Reserve is under the protection of the Department des Eaux et Forêts, whose regional office is in Hell Ville, Nosy Be, 7 km from the forest by track and 4 km by sea. The office is staffed by a regional director and four forest guards. The guards have bicycles and a pirogue. Routine patrolling of the reserve is limited to monthly perambulations around the seaward edge of the reserve (coinciding with the lowest low tides). Apart from occasionally walking a well worn path to a reservoir which lies within the reserve, the guards rarely enter the reserve. During the study, no palm thieves were apprehended and no caches of palm planks were confiscated, except those found by us. The guards are young, unarmed, and avoid confrontation with the thieves as they are afraid



that they may be attacked with axes and machetes. Moreover, the guards also have responsibility for all areas of Classified Forest on the island of Nosy Be, leaving little time for the effective policing of the reserve.

Importance of Palm Fruits in the Diet of Lokobe's Frugivores

In Lokobe Reserve, the Madagascar Blue Pigeon (*Alectroenas madagascariensis*) feeds on the fruits of *R. sambiranensis*, and the Grey-backed Sportive Lemur (*Lepilemur dorsalis*—classified as Endangered, Harcourt and Thornback 1990) and the Black Lemur (*Lemur macaco*—Endangered) feed on the fruits of *N. loucoubensis*, *C. madagascariensis* and *R. sambiranensis*.

The importance of palm fruits in the diet of the



2. *Chrysalidocarpus madagascariensis.* 3. *Neodypsis loucoubensis.*





4. *Ravenea sambiranensis.* 5. Processed palm planks.

→



black lemur was investigated in detail. This species spends a large proportion of its total feeding time eating palm fruits when these are available. For example, during March 1992, March 1993 and April 1993, a group spent 32.3%, 45.9%, and 30.4%, respectively of their feeding time eating *C. madagascariensis* fruit (total number of Feeding Records: 194, 74, and 79, respectively). Ian Colquhoun (pers. comm., 1994) reports that on Nosy Faly peninsula, where *C. madagascariensis* is locally abundant, during February 1992 and March 1992, four black lemur groups spent on average 49.5% and 47.5% of their feeding time eating the fruits of this palm (total number of Feeding Records: 204 and 99, respectively).

The seeds of *R. sambiranensis* are swallowed by the blue pigeon, and seeds of *C. madagascariensis* and *N. loucoubensis* are swallowed by the black lemur. Palm seeds collected from blue

Table 1. Felling incidents July 91–April 93.

Date	Location	Area	Species
July–Sept 91	N.W. Reserve, 150 m alt., close to path from Ampasindava and Reservoir	ca. 2 ha	23 × <i>N. loucoubensis</i> 3 × <i>R. sambiranensis</i>
Nov 91–Jan 92	W. Reserve	?	? (thieve's pirogue on beach for two months)
Feb–Apr 92	S. Reserve, between 50 and 150 m alt.	ca. 3 ha	20 × <i>C. madagascariensis</i>
Apr–May 92	S. Reserve, along maritime fringe for 300 m	?	20 × <i>C. madagascariensis</i>
May 92	N.W. Reserve, 100 m alt. close to path from Ampasindava to Reservoir	ca. 2 ha	6 × <i>C. madagascariensis</i> 2 × <i>N. loucoubensis</i>
July 92	N.W. Reserve	?	? (thieves seen loading planks onto pirogue at Ampasindava)
Nov 92	S. Reserve	0.8 ha	3 × <i>C. madagascariensis</i> (thieves frightened off)
Jan 93	W. Reserve	?	? (a considerable number—a loaded pirogue was seen travelling from the forest to Hell Ville on 7 successive evenings)
April 93	S. Reserve, along maritime fringe for 600 m	?	10 × <i>C. madagascariensis</i> 1 × <i>R. sambiranensis</i>

pigeon and black lemur droppings were viable, suggesting that these frugivores disperse the seeds of these palms.

On Nosy Faly peninsula, I. Colquhoun also observed the Western Gentle Lemur (*Hapalemur griseus occidentalis*—Vulnerable) eating the fruits of *C. madagascariensis*. The flesh was nibbled off the fruit and the seed had been spat out.

Table 2. Incidental damage to neighboring trees during felling.

Palm No.	No. of Trees Snapped in Various "Diameter at Breast Height" Classes		
	5–10 cm	10–15 cm	>15 cm
1 }	1	0	0
2 }			
3	2	0	1 (17 cm)
4	1	0	0
5 }			
6 }	6	2	0
7 }			
8	0	4	0
9	0	0	0
10	2	0	0
11 }	0	0	0
12 }			
13	2	0	0
Total	14	6	1

Palms bracketed together grew close together and damage caused by the felling of each was difficult to differentiate.

Discussion

During the course of this study, several hundred palms were felled in Lokobe Reserve. It is difficult to predict the consequences of this rate of felling on Lokobe's palm populations. On the one hand, the palms are not felled until they are relatively old, giving them at least some time to reproduce, the steep ravines probably provide refuges, and they seem to have effective dispersal agents which would allow them to recolonize the over-exploited parts of the forest from their refuges. However, on the other hand, the reserve is small, the rate of felling is high, and the palms have a clumped distribution, so they can be exploited efficiently. *R. sambiranensis* and *N. loucoubensis* are particularly at risk because their populations are small and they are felled along with the more common *C. madagascariensis*. In the absence of a commoner species, one might expect felling of these species to stop once their population had fallen to a level at which the time required to locate the few scattered plants made the exercise uneconomic. Currently, all three of the exploited species still regenerate. However, while young plants of *C. madagascariensis* and *N. loucoubensis* were locally frequent (in the vicinity of mature palms), those of *R. sambiranensis* were very rare.

Even if these species escape extinction, the reduction in palm density is to be regretted, as this reserve is one of Madagascar's few remaining

areas of lowland primary rainforest and as such should be maintained in a pristine condition. In addition, a reduction in palm density could lead to a decline in the populations of palm-fruit-eating animals.

Recommendations

To improve palm protection in Lokobe Reserve it is recommended that:

- i) forest guards visit the reserve more frequently and patrol more thoroughly (this may require the employment of additional guards);
- ii) the commitment and confidence of the guards be increased by rewarding hard work, training in self defense, providing good pay and work conditions, and emphasizing the importance of their work;
- iii) consideration be given to the feasibility of enriching secondary forest elsewhere with the exploited palm species to provide an alternative source of palm planks;
- iv) plants of *N. loucoubensis* and *R. sambiranensis* should be cultivated in a secure tropical garden or arboretum.

Acknowledgments

This research was carried out as part of The Black Lemur Forest Project. Permission to conduct the Project has been kindly granted by the Ministère de l'Enseignement Supérieur and the

Direction des Eaux et Forêts, Madagascar. The Black Lemur Forest Project is supported by the following organizations and we are most grateful for their help: National Science Foundation (U.S.A.); National Geographic Society; British Airways Assisting Nature Conservation; Royal Anthropological Institute; Boise Fund; Percy Sladen Memorial Fund; and Friends of Cricket St. Thomas Wildlife Park. We would also like to thank Adamaly Hassanaly and the Société Hassanaly, Nosy Be, for providing us with a field base at Ampasindava; Missouri Botanical Garden, for their assistance in the transportation of herbarium specimens; and Dr. Henk Beentje for comments on an earlier draft of this manuscript.

LITERATURE CITED

- BEENTJE, H. J. 1992. Conservation Status of Palms in Madagascar. Report to the Department des Eaux et Forêts, Antananarivo.
- HARCOURT, C. AND J. THORNBACK. 1990. Lemurs of Madagascar and the Comores. The IUCN Red Data Book. IUCN, Gland, Switzerland and Cambridge, U.K.
- IUCN/UNEP/WWF. 1987. Madagascar, an environmental profile. Edited by M. D. Jenkins. IUCN, Gland, Switzerland and Cambridge, U.K.
- JUMELLE, H. AND H. PERRIER DE LA BÂTHIE. 1945. Famille 30—Palmiers. In: H. Humbert, Flore de Madagascar et des Comores. Imprimerie Officielle, Tananarivo.
- MOORE, H. E. 1965. Palm hunting around the World. Principles 9: 13–29.
- UHL, N. W. AND J. DRANSFIELD. 1987. Genera Palmarum—a classification of palms based on the work of H. E. Moore Jr. Allen Press, Lawrence, Kansas.

CLASSIFIED

PALM SEED FOR SALE. *Rhopalostylis sapida* US\$50\1000; *Rhopalostylis baueri* US\$80\1000; *Chambeyronia macrocarpa* US\$300\1000. Also other New Caledonian species available from time to time, e.g., *Basselinia*, *Burretokentia*, *Actinokentia*, *Moratia*, *Veillonia*, etc. Contact: BRUCE LAUGHLAND, 20 Vic Butler St., Mt. Roskill, Auckland, New Zealand. Phone: 64-9-6243709. Fax: 64-9-6257704.

COLD HARDY PALMS. *Rapidophyllum hystrix*—*Sabal minor*—*Sabal palmetto*—*Trachycarpus fortunei*—*Serenoa repens*—*Zamia floridana*. We are now booking orders for Spring 1995 (domestic and foreign) shipment. CREATIVE NATIVE, P.O. Box 713, Perry, FL 32347. Phone: (800)628-4831/(904)498-2359. Fax: (904)498-1913. Wholesale Inquiries Welcome.