



# Palms and Palm Use in Ambalabe, a Community in Eastern Madagascar

Rainer W. Bussmann, Narel Paniagua Zambrana, Alyse Kuhlman, Fortunat Rakotoarivony, Aina Razanatsima, Nivo Rakotoarivelo, Jeremy Lalao Razafitsalama, and Armand Randrianasolo

## Research

### Abstract

Twenty-six native palm species of three genera were identified for Vohibe Forest, eastern Madagascar. In addition, two introduced (*Cocos nucifera* L., *Elaeis guineensis* Jacq.) and one native/possibly introduced species (*Raphia farinifera* (Gaertn.) Hyl.) are cultivated in the area. Local participants of an inventory on palm species and uses mentioned seven native species of two genera, including two folk species, but no plants could be found and no vouchers were collected. This makes Vohibe one of the richest palm hotspots in Madagascar. Palms play an important role in the life of the local population in Madagascar, providing food, material for utensils, medicine, and construction, but reports on palm use have been rare. Over 95% of the species are endemic to Madagascar. The use of palms is often destructive and possibly threatens some important species. In Vohibe Forest, nine local and three introduced species were used as resource by the population.

### Introduction

Palms (Arecaceae) are among the plants most closely related to the daily needs of the population in many tropical regions. In Madagascar, palms are often multipurpose species. They are used as human food, in construction, for fibers, and for medicinal purposes. While Arecaceae are better researched than other plant families in Madagascar, the scientific knowledge about the diversity of Madagascar palms and their uses is still limited because many of the last remaining forest areas are remote and remain botanically unexplored. Anthropogenic activities are the main factors leading to the decline of forest cover (Green & Sussman 1990). Eastern Madagascar is not immune to these pressures despite efforts by governmental and NGO actors to maintain and increase forest cover. Almost 99% of the 204 palm species native to Madagascar have been found in the rainforests of the eastern parts of the country (Dransfield & Beentje 1995), and many spe-

cies are highly endangered if no further action is taken to save them (IUCN 2013a,b).

The Vohibe Forest ecosystem has been a main focus of research and conservation of Missouri Botanical Garden (MBG) since 2007. Working with the local community, MBG's William L. Brown Center set a priority to maintain the integrity of the natural resources while enabling the population to use its resources sustainably. To better illustrate the importance of the forest and complete floristic collections of the site, an inventory of Arecaceae and their local uses was conducted.

The palms of Madagascar play an important role in the life of the local population, providing food, material for utensils, medicine, and construction, but reports on palm use have been rare (Byg & Balslev 2001a,b, 2003). Over 99% of the species are endemic (Dransfield *et al.* 2006), but the use of palms however is often destructive, and possibly threatens some important species.

### Correspondence

Rainer W. Bussmann, Alyse Kuhlman, Armand Randrianasolo, William L. Brown Center, Missouri Botanical Garden, P.O. Box 299, Saint Louis, Missouri 63166-0299, U.S.A. rainer.bussmann@mobot.org

Narel Paniagua Zambrana, Herbario Nacional de Bolivia, Instituto de Ecología-UMSA, Campus Universitario, Cota Cota Calle 27, Apdo. Postal 10077 correo central, La Paz, BOLIVIA.

Fortunat Rakotoarivony, Aina Razanatsima, Nivo Rakotoarivelo, Jeremy Lalao Razafitsalama, Missouri Botanical Garden Madagascar, Lot VP 31, Ankadibevava, Anjohy 101 Antananarivo, MADAGASCAR.

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## Material and Methods

### Study area

The Vohibe Forest system is located in the Atsinanana Region, Vatondry District, Rural Municipality of Ambalabe, from 19°06'–19°11'S and 48°31'–48°36'E. The Vohibe Forest lies about 9 km northwest from Ambalabe village, the capital of the municipality (Figure 1).

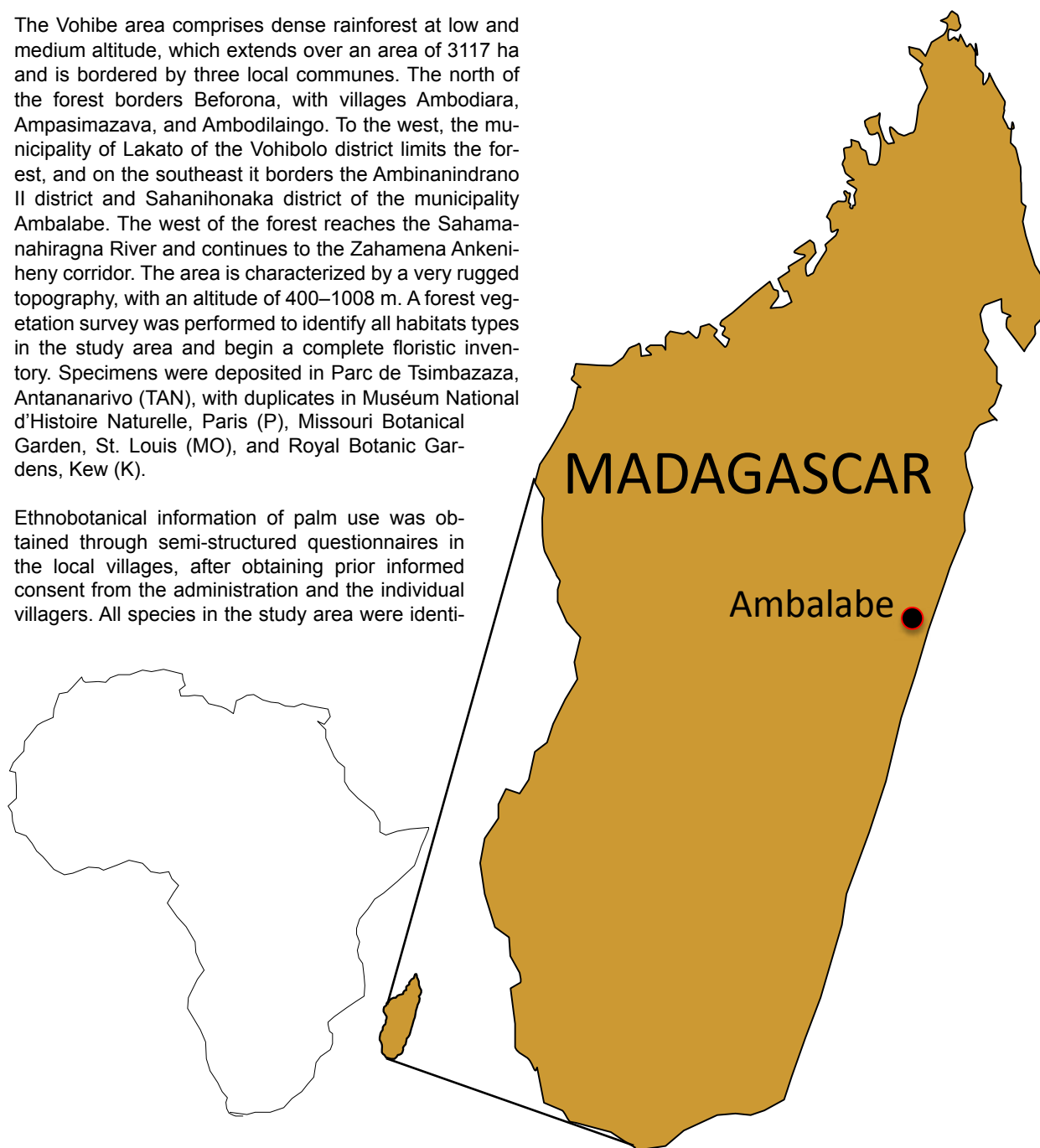
The Vohibe area comprises dense rainforest at low and medium altitude, which extends over an area of 3117 ha and is bordered by three local communes. The north of the forest borders Beforona, with villages Ambodiara, Ampasimazava, and Ambodilaingo. To the west, the municipality of Lakato of the Vohibolo district limits the forest, and on the southeast it borders the Ambinanindrano II district and Sahanihonaka district of the municipality Ambalabe. The west of the forest reaches the Sahamahiragna River and continues to the Zahamena Ankeniheny corridor. The area is characterized by a very rugged topography, with an altitude of 400–1008 m. A forest vegetation survey was performed to identify all habitats types in the study area and begin a complete floristic inventory. Specimens were deposited in Parc de Tsimbazaza, Antananarivo (TAN), with duplicates in Muséum National d'Histoire Naturelle, Paris (P), Missouri Botanical Garden, St. Louis (MO), and Royal Botanic Gardens, Kew (K).

Ethnobotanical information of palm use was obtained through semi-structured questionnaires in the local villages, after obtaining prior informed consent from the administration and the individual villagers. All species in the study area were identi-

fied on site using Dransfield *et al.* (1995, 2006) and IUCN (2013a,b) to allow the assessment of the conservation status of each species.

## Results

So far, 27 native palm species of three genera have been identified for Vohibe Forest. In addition, two introduced species (*Cocos nucifera* L., *Elaeis guineensis* Jacq.)



**Figure 1.** Ambalabe village, Madagascar.

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**Table 1.** Past and present useful Arecaceae species of the Ambalabe community of eastern Madagascar. Part used: **E** seeds, **F** fruit, **H** heart (meristem), **L** leaves, **N** new leaves, **R** rachis, and **S** stem. Habitat: **AN** anthropic, **AS** along streams and rivers, **LA** low altitude humid forest, **MA** mid-altitude humid forest, **SS** on steep slopes. Status (conservation/management status): **C** cultivated, **CR** critically endangered, **EN** endangered, **N** naturalized, **NT** not threatened, **R** rare, and **VU** vulnerable. Vouchers collected by: **RBU** Rainer Bussmann, **JR** Jaona Ranaivo, **JLR** Jeremy Lalao Razafitsalama, and **AR** Aina Razanatsima.

Scientific (Vernacular) names						
Uses		Preparation	Part used	Habitat	Status	Voucher #
Category	Specific					
NATIVE SPECIES CURRENTLY ENCOUNTERED IN VOHIBE FOREST						
<i>Dypsis angusta</i> Jum.						
				LA	EN	RBU 16800, RBU 17790, RBU 17796
<i>Dypsis angustifolia</i> (H.Perrier) Beentje & J.Dransf.						
				AS, LA	EN	
<i>Dypsis catatiana</i> (Baill.) Beentje & J.Dransf.						
				LA	NT	RBU 17794
<i>Dypsis concinna</i> Baker						
				LA, SS	-	RBU 16791, RBU 16799, JLR 1345
<i>Dypsis corniculata</i> (Becc.) Beentje & J.Dransf.						
				LA	VU	
<i>Dypsis crinita</i> (Jum. & H.Perrier) Beentje & J.Dransf. ( <b>vonitra</b> )						
Construction	Thatch		L	AS, LA	R	JLR 1337, JLR 1352
Utensils & tools	Ropes		R			
<i>Dypsis faneva</i> Beentje						
				LA, SS	-	RBU 16798, JLR 1339
<i>Dypsis fibrosa</i> (C.H.Wright) Beentje & J.Dransf. ( <b>vonitra</b> )						
Construction	Thatch		L	LA	NT	RBU 17787, RBU 17803, JLR 1349, JLR 1343
Utensils & tools	Ropes		R			
Human food	Heart		S			
	Larvae		S			
<i>Dypsis forficifolia</i> Noronha ex Mart.						
				LA, SS	NT	RBU 16801, RBU 17788, JLR 1340, JLR 1351
<i>Dypsis hiarakae</i> Beentje ( <b>sinkiara, tsirika</b> )						
				LA	VU	RBU 17798
<i>Dypsis hildebrandtii</i> (Baill.) Becc. ( <b>tsirika</b> )						
Utensils & tools	weaving tools ( <b>fankiboana</b> )		S	LA	VU	JLR 1355
<i>Dypsis humbertii</i> H.Perrier ( <b>raosy</b> )						
				LA	CT	RBU 17789
<i>Dypsis integra</i> (Jum.) Beentje & Dransf.						
				AS, LA	CT	RBU 15211
<i>Dypsis jumelleana</i> Beentje & J.Dransf.						

Scientific (Vernacular) names						
Uses		Preparation	Part used	Habitat	Status	Voucher #
Category	Specific					
				LA, SS	VU	RBU 16802, RBU 17797, JLR 1338
<i>Dypsis lantzeana</i> Bail.						
				LA, SS	-	JLR 1352
<i>Dypsis louvelii</i> Jum. & H.Perrier ( <b>tsirikabidy, ovana</b> )						
Medicinal & veterinary	Plague	Decoction	L	AS, LA	NT	RBU 17793, JLR 1348
Utensils & tools	Blowguns		S			
<i>Dypsis lutea</i> (Jum.) Beentje & J.Dransf.						
				LA	CT	RBU 17791, JR 1169
<i>Dypsis minuta</i> Beentje						
				LA, SS	VU	RBU 16792, RBU 17801, RBU 17791, AR 785, JLR 1356
<i>Dypsis nodifera</i> Mart. ( <b>bedoda, sira</b> )						
Utensils & tools	Blowguns		S	LA	NT	RBU 17803, JLR 1342, JLR 1343, JLR 1347
Animal food	Fodder		F			
Construction	Frames, walls		S			
Human food	Edible		F, H			
	Salt	Put ashes in water, then sift	H			
<i>Dypsis pilulifera</i> (Becc.) Beentje & J.Dransf. ( <b>rahosy, vakaka</b> )						
				LA	VU	JLR 1357
<i>Dypsis pinnatifrons</i> Mart. ( <b>tsingovatra, ovatsiketry, ambolo, hova, tsobolo</b> )						
	House posts		S	LA	NT	RBU 17786
<i>Dypsis procumbens</i> (Jum. & H.Perrier) J.Dransf., Beentje & Govaerts						
				LA, SS	-	JLR 1350
<i>Dypsis thiryana</i> (Becc.) Beentje & J.Dransf. ( <b>tsinkiara</b> )						
				LA	R	RBU 16797, RBU 17802
<i>Dypsis</i> sp. nov. 1						
				LA, SS	-	JLR 1341
<i>Marojejya insignis</i> Humbert ( <b>ovodananana, siralananana, tamboho</b> )						
Human food	Edible		H	LA, MA, SS	VU	JLR 1344
	Larvae		S			
<i>Ravenea madagascariensis</i> Becc. ( <b>anivona</b> )						
Construction	Floor		S	LA	NT	RBU 17792, JLR 1354
	Wall		R			
Human food	Edible		H			
	Larvae		S			

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Scientific (Vernacular) names						
Uses		Preparation	Part used	Habitat	Status	Voucher #
Category	Specific					
<b>NATIVE AND INTRODUCED SPECIES CULTIVATED IN AND AROUND VOHIBE</b>						
<i>Cocos nucifera</i> L. ( <b>coco</b> )						
Human food	Edible		F, H	AN	C	
Medicinal & veterinary	Diarrhea	Crush & infuse in hot water	L			
	Stomach ache	Decoction	L			
<i>Elaeis guineensis</i> Jacq. ( <b>palmier</b> )						
Human food	Edible		H	AN	C	
			F			
			E			
<i>Raphia farinifera</i> (Gaertn.) Hyl. ( <b>rafia</b> )						
Construction	Frames		S	AN	N	
			R			
	Walls		R			
Utensils & tools	Baskets, chairs, mattresses, strings, beehives		S			
Human food	Edible		F			
			H			
Medicinal & veterinary	Diarrhea	Mix with <i>Harungana madagascariensis</i> Lam. ex Poir. bark and make a decoction	F			
Utensils & tools	Fibers (clothes, hats, baskets, brooms, stoves, mats, fishtraps, weaving tools [ <b>baoba</b> , <b>bobinia</b> , <b>singata</b> , <b>sohana</b> , <b>zana-tenona</b> ], cordage, toys)		R			
<b>NATIVE SPECIES NO LONGER FOUND IN THE VOHIBE REGION</b>						
<i>Dypsis lastelliana</i> (Baill.) Beentje & J.Dransf. ( <b>menavozona</b> )						
Construction	Thatch		L	LA	-	
Human food	Edible		H			
<i>Dypsis mananjarensis</i> (Becc.) Beentje & J.Dransf. ( <b>laafa</b> , <b>lakatra</b> )						
				LA	VU	
<i>Dypsis</i> sp. ( <b>mandravinambody</b> )						
Human food	Salt		H	LA	-	
	Larvae		S			

Scientific (Vernacular) names						
Uses		Preparation	Part used	Habitat	Status	Voucher #
Category	Specific					
<i>Dypsis</i> sp. ( <b>marinjo</b> )						
Human food	Edible		H	LA	-	
	Larvae		S			
<i>Ravenea lakatra</i> (Jum.) Beentje ( <b>lakatra</b> )						
Utensils and tools	Hats, baskets, mattresses		N	LA	-	
Human food	Edible		H			
<i>Ravenea robustior</i> Jum. & H.Perrier ( <b>maroala, maroanala</b> )						
Human food	Edible		H	LA	-	
	Larvae		S	LA	-	
<i>Ravenea sambiranensis</i> Jum. & H.Perrier ( <b>monimony, laafa</b> )						
Construction	Floor		S	LA, SS	VU	
	Wall		R			
Human food	Edible		H			
	Larvae		S			

and one presumably native species (*Raphia farinifera* (Gaertn.) Hyl.)—possibly introduced to Madagascar (see Dransfield & Beentje 1995)—are cultivated in the area. Local participants reported seven native species of two genera, including two folk species outside the main research area in Vohibe, and no vouchers were included for these. For the complete names of all species see Table 1.

Vohibe yielded new records for *Dypsis angustifolia* (H.Perrier) Beentje & J.Dransf., *Dypsis faneva* Beentje, *Dypsis humberii* H.Perrier, *Dypsis integra* (Jum.) Beentje & J.Dransf., *Dypsis jumelleana* Beentje & J.Dransf., *Dypsis lantzeana* Baill., *Dypsis lutea* (Jum.) Beentje & J.Dransf., *Dypsis malcomberi* Beentje, and *Dypsis pilulifera* (Becc.) Beentje & J.Dransf. One species of *Dypsis* (*Razafitsalama* 1341) is possibly new to science.

#### **Palm use in Vohibe**

In Vohibe Forest, nine local and three introduced species were used as resource by the population (Figures 2 & 3).

#### Food

Once cut, the stems of *Dypsis fibrosa* (C.H.Wright) Beentje & J.Dransf., *Marojejya insignis* Humbert, and *Ravenea madagascariensis* Becc. are host for beetle larvae, which are highly valued by the people in the forest. Hunters often cut the trunks of these species and wait for a few months in order to collect the larvae that have developed in the stems.

The same species, plus *Dypsis nodifera* Mart., are cut for their palm heart, which is widely valued as food and also sold in local markets. During every survey, and despite constant patrolling, large individuals cut for palm heart harvest were frequently encountered, similar to studies in other areas (Byg & Balslev 2003). *Cocos nucifera*, *E. guineensis*, and *R. farinifera* serve sometimes as replacements. The hearts of *D. nodifera* and an unidentified species of *Dypsis* are burned for salt production. Palm heart harvest of native species locally threatens the species because it clearly decreases its population and also causes the formation of gaps in the forest ecosystem, which in turn affect the local microclimate and decrease resilience against cyclone damage. The local population indicated that *Dypsis lastelliana* (Baill.) Beentje & J.Dransf., *Dypsis* sp., *Ravenea lakatra* (Jum.) Beentje, *Ravenea robustior* Jum. & H.Perrier, and *Ravenea sambiranensis* Jum. & H.Perrier had been used for the same purpose in the past, but that those species cannot be found anymore.

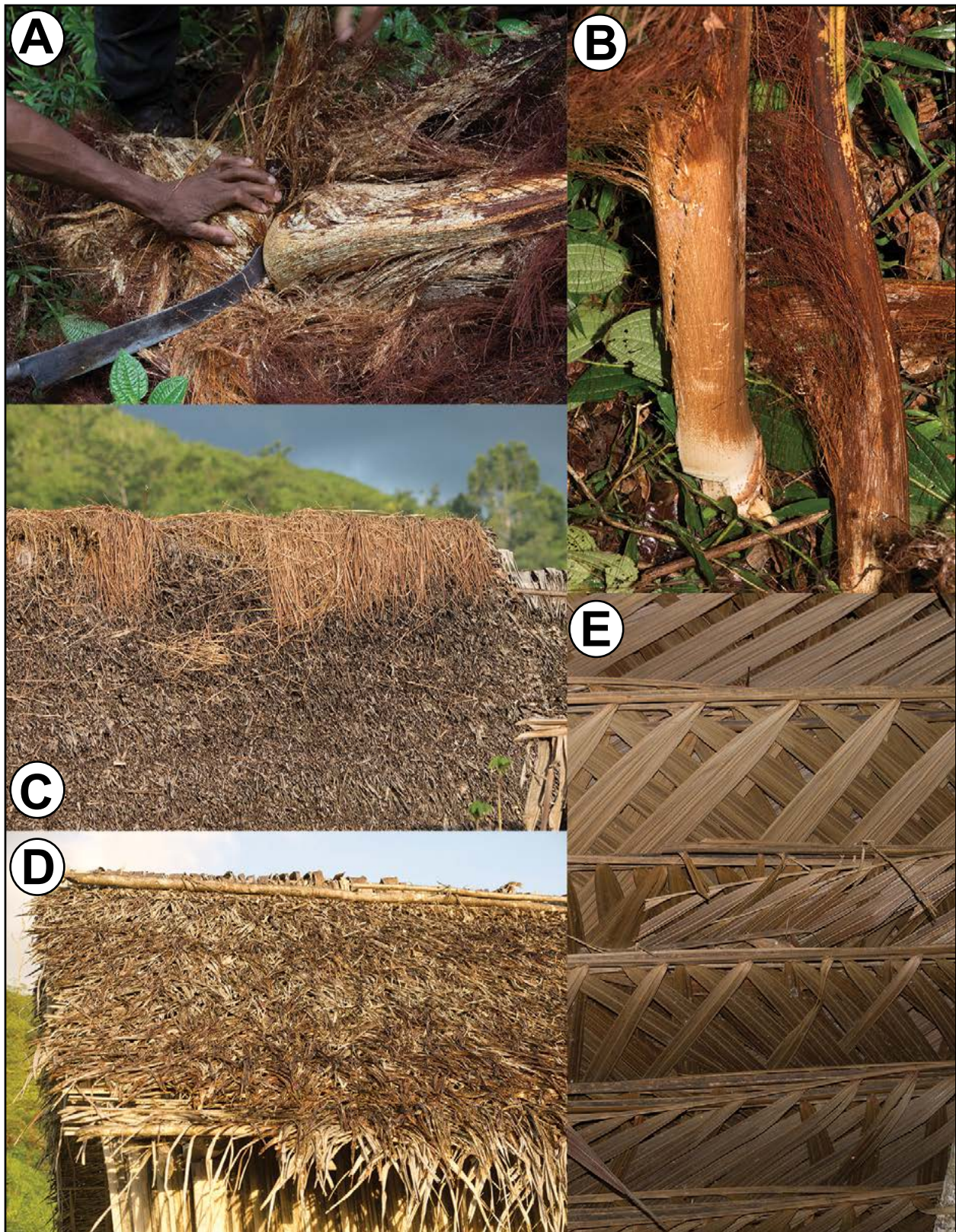
The fruit of *D. nodifera*, although very small, as well as *C. nucifera*, *E. guineensis*, and *R. farinifera* are being collected and eaten. *Dypsis nodifera* fruit are also used as fodder for domestic animals.

#### Medicine and veterinary

Medicinal palm uses are essentially unknown. Participants mentioned that the leaves of *Dypsis louvelii* Jum. & H.Perrier are boiled in water to treat plague. A decoction of *C. nucifera* serves to treat stomach ache and diarrhea, while the fruit of *R. farinifera* are mixed with the bark



**Figure 2.** Use of *Raphia farinifera* (Gaertn.) Hyl. and *Marojejya insignis* Humbert in Ambalabe, eastern Madagascar: **A.** Shirt made from *R. farinifera* fiber; **B.** Shirt detail; **C.** Broom made from *R. farinifera* leaf midribs; **D.** Fishtrap made from *R. farinifera* leaf midribs; **E.** Rice winnowing tray made from *Ravenala madagascariensis* Becc. leaves, sown with *R. farinifera* fibers; **F.** Floor mats woven from *R. farinifera* fibers; **G.** *Marojejya insignis* wall-boards; **H.** *Marojejya insignis* floor.



**Figure 3.** Use of *Dypsis fibrosa* (C.H.Wright) Beentje & J.Dransf. in Ambalabe, eastern Madagascar: **A.** Harvest of fibers; **B.** Raw fibers; **C.** Use as apical roof thatch; **D.** & **E.** Leaves used as roof thatch sheets (outer and inner view).



of *Harungana madagascariensis* Lam. ex Poir. and then boiled in water to treat diarrhea.

### Utensils

Today, wild palm species are rarely used to manufacture utensils. Participants indicated that young leaves of *R. lakatra* served formerly to make baskets and mattresses, but the species is not found anymore. The leaf sheath fibers of *Dypsis crinita* (Jum. & H.Perrier) Beentje & J.Dransf. and *D. fibrosa* are sometimes used to make ropes, while the stems of *Dypsis hildebrandtii* (Baill.) Becc. serve as a weaving tool. Sometimes the straight stems of *D. louvelii* and *D. nodifera* are still used to make blowguns.

*Raphia farinifera* is likely the most important useful palm species. The trunks are used to make baskets, chairs, mattresses, strings, and beehives while fibers from the young leaves provide material for cloths, hats, baskets, brooms, stoves, mats, fish-traps, weaving tools (**baobao**, **bobinia**, **singata**, **sohana**, **zana-tenona**), and cordage.

### Construction

*Dypsis pinnatifrons* Mart., *D. crinita*, *D. fibrosa*, *D. nodifera*, and *R. madagascariensis* serve as a source for construction material. *Dypsis crinita* and *D. fibrosa* in particular are prized for their leaves, which are used as thatch. In most cases, the palms are cut to harvest the leaves. *Dypsis nodifera*, *D. pinnatifrons*, and *R. madagascariensis* stems are sometimes used as house posts and are split for flooring and to construct walls. In addition, *R. farinifera* is often cultivated for the same purpose, and the rachis of its leaves, carefully harvested without destroying the trunk, is preferred as framing material. Formerly the stems of *R. sambiranensis* were used for flooring and the rachis used to build walls, but the species is no longer found.

Overall, very few palms were found cut for construction purposes. The remoteness of the forest makes palm exploitation for construction a rather tedious endeavor, and most villagers prefer to use *R. madagascariensis* for thatch and the construction of walls and other species for posts. The use of palms is mostly restricted to a few small settlements in the forest or close to its borders and as such does not pose an imminent threat.

## **Discussion**

The Vohibe Forest is a newly protected area to allow the conservation of its great diversity on one hand and its sustainable use by the local population on the other. Palms can play an interesting role in this effort. In addition to their ecological functions, the palms do provide food, medicine, and materials for the local population and are at least partially sold to merchants outside the region. Although commerce does not play a major role at the moment, careful

management will be needed to maintain the resource in the future. Palm use in Vohibe, in particular with regard to valuable species such as *Dypsis fibrosa*, follows very much the same pattern observed in other areas (Byg & Balslev 2001b, 2003) with similar observations of problematic, destructive, and possibly unsustainable harvesting.

## **Conclusions**

The zoning of the Vohibe protected area needs to take the distribution of palm species into account, in particular species that are of commercial interest for their fibers and palm hearts. While the palm populations can at present sustain the needs of the local population, further studies are needed to assess how an extension of palm commerce could affect the resource. Enrichment planting of species used by the local population should be considered as a priority in restoration management. Seven palm species were used in the past but seem to have been over-harvested and disappeared from the region. A re-introduction of these species might be an interesting tool to provide the necessary resources for the local population without affecting the current palm species found in Vohibe Forest.

The Vohibe Forest is part of the surviving remnants of the eastern Madagascar moist forest ecosystem and represents prime palm habitat. The site harbors over 27 species of Arecaceae. Based on IUCN (2013a) three species are listed as critically endangered (*D. humbertii*, *D. integra*, *D. lutea*), four endangered (*D. angusta* Jum., *D. angustifolia*, *D. faneva*, *D. lantzeana*), nine vulnerable (*Dypsis concinna* Baker, *Dypsis corniculata* (Becc.) Beentje & J.Dransf., *Dypsis hiarakae* Beentje, *D. hildebrandtii*, *D. jumelleana*, *D. malcomberi*, *Dypsis minuta* Beentje, *D. pilulifera*, *Marojejya insignis*), and nine species not threatened. *Dypsis crinita* and *Dypsis thiryana* (Becc.) Beentje & J.Dransf. are considered rare. The exploitation of some species of palms can, if intensified for commerce, pose major threats to the Vohibe ecosystem. The monitoring of harvesting activities needs to be one priority for the management of the site.

## **Acknowledgments**

We gratefully acknowledge the tireless help and hospitality of our colleagues in the communities around Vohibe, and most of all we want to express our sincere gratitude to the people of the region for sharing their ethnobotanical knowledge.

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