Effects of Basket-weaving Industry on Mokola Palm and Dye Plants in Northwestern Botswana[1]

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The basket-weaving industry on the edge of the Okavango Swamps in northwestern Botswana is dependent on natural populations of the palm Hyphaene petersiana. *Commercialization of the basket industry has led to changes in the population structure of the palms. The mean size of palm leaves has decreased and the resource has been depleted in the vicinity of swamp villages. Plants used to dye the palm fibres for basketry are becoming scarce. Through use of alternative raw materials and development of new crafts both natural resources and the incomes of the village craftspeople could be sustained.*

The basket-weaving industry has recently been developed to provide income for the growing population in rural villages on the western margin of the Okavango Swamps in northwestern Botswana. The change from subsistence to commercial exploitation of leaves of the vegetable ivory palm *Hyphaene petersiana* Klotzsch and of vegetable dyes for basket making has decimated palms and popular dye plants within a day's walk from the villages. Unless the use of these plant resources is controlled they will be lost and the basket industry will collapse.

Our study, conducted in March 1982 at villages on the southern and western margins of the Okavango Delta, northwestern Botswana (Fig. 1) assesses the extent of utilization of *H. petersiana* (mokola in the Setswana dialect, mbare in the haMbukushu dialect) and dye plants by the basket industry and puts forward suggestions for the management of these resources. Although palm over-utilization by local craftwork industries has been noted elsewhere in Africa (Babiker 1982; Fleuret 1980) this is the first published quantitative record of the extent of such utilization.

Semi-desert scrub and dry savanna cover most of Botswana. However in the northwest the Cuito and Cubango rivers disgorge in an inland delta, the Okavango. Here the islands, channels, and lagoons create a mosaic of vegetation types, and it is on the high water-table grassland of the Okavango that *H. petersiana* occurs in Botswana.

There were hunter-gatherers on the margins of the Okavango Delta 100,000 yr ago (Campbell 1976). BaYei and haMbukushu pastoralists and agriculturalists have occupied the area since 1750 (Tlou 1976), but recent malaria and tsetse-control measures have led to rapid growth of human and domestic-animal populations in this part of the country. Angolan refugees, mainly haMbukushu, settled in the 13 villages comprising Etsha (19°07′S, 22°18′E) between 1967 and 1969 (Potten 1976). Population increase resulting from disease control, together with change in lifestyle from subsistence to consumerism, have led to reduction in

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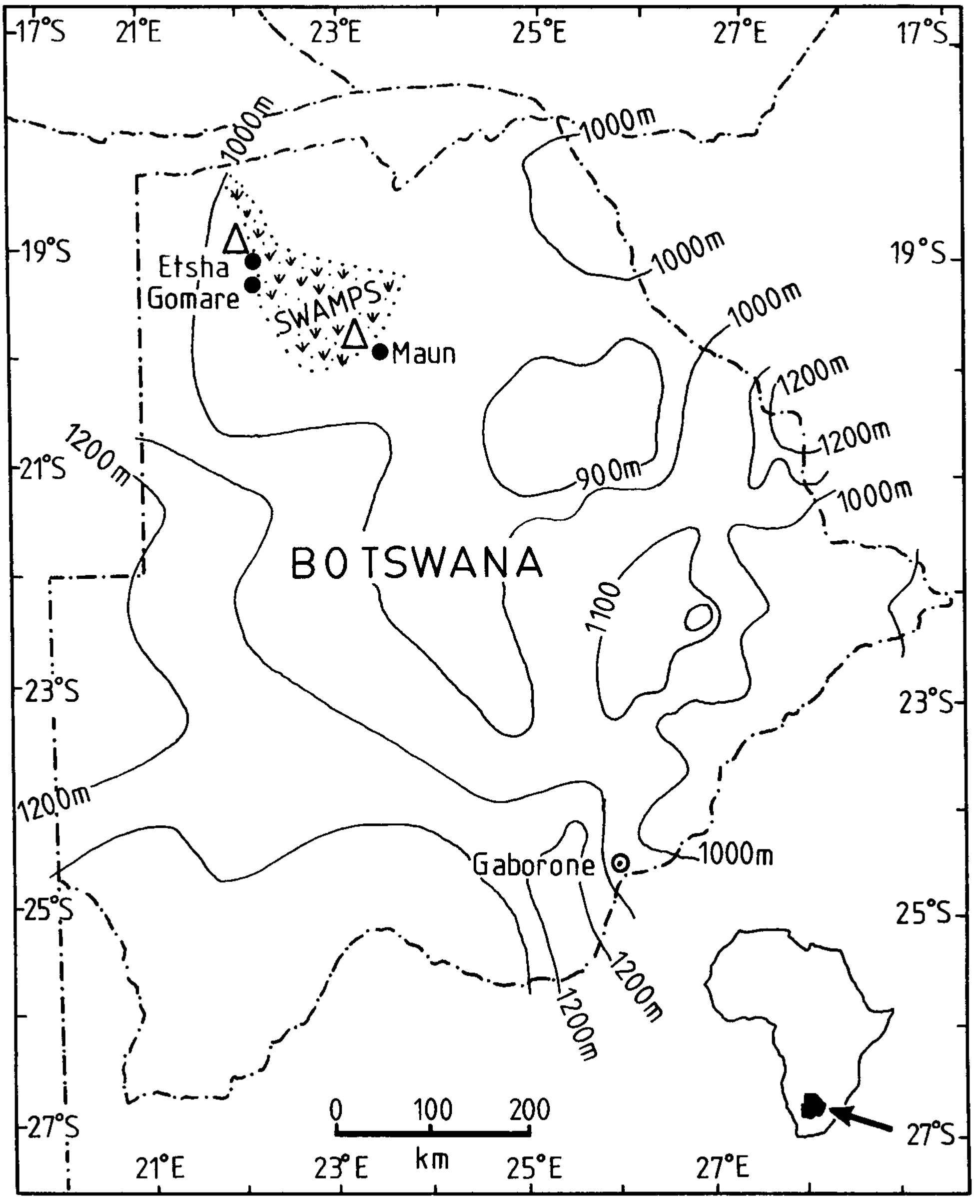

Fig. 1. Map of Botswana showing topography and study areas.

palatable grasses and removal of fuel, dye, fibre, edible, and medicinal plants for a radius of about 10 km around the swamp-margin villages.

In an effort to provide a source of income for the refugees settled in the villages on the western margin of the swamps, Malcolm Thomas, manager of the Etsha co-operative, organised the collection and sale of woven palm baskets from this complex of villages. Basket making as a cottage industry expanded rapidly when two Peace Corps volunteers developed markets for the baskets in Europe and the United States of America. Botswanacraft Marketing Company (Pty.) Ltd. was then established to buy baskets from the villagers, to encourage innovative bas-

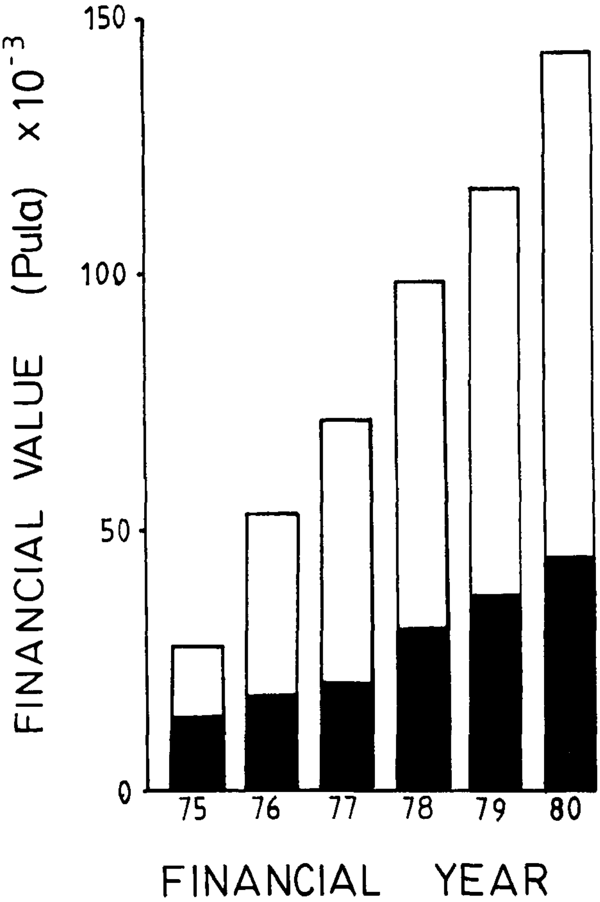

Fig. 2. The value of export (white bar) and domestic (black bar) sales of baskets through Botswanacraft Marketing Company. *Hyphaene petersiana* was used in the manufacture of 95% of exported baskets and 20% of baskets marketed locally (M. R. Ferrin, pers. comm.). 1 pula = $1 U.S., 1982.

ketry and maintain a high standard of craftwork, and to provide a sales outlet for the finished product. In 1975 Botswanacraft became a subsidiary of Botswana Development Corporation of the Ministry of Agriculture of the Botswana Government. As sales, particularly exports, increased (Fig. 2) the industry expanded rapidly (Yoffe 1978). By 1984 over 50% of the female population of Etsha (ca. 1,500) were making baskets to supplement their incomes; in that year Botswanacraft purchased baskets worth 25,000 pula (1 pula = $1 U.S., 1984) (Monageng and Terry 1984).

The baskets are constructed of fibre coils comprising narrow strips of palm leaf pinnae wrapped around an inner core of the same material or of grass leaves or the stems of creepers. The coils are then sewn tightly together with tough, pliable strips of palm leaf. This material is prepared by cutting and drying young, unopened mokola palm leaves, tearing then into strips, and soaking them in water before use to make them less brittle. Designs are worked into the weave of the baskets by using palm leaf strips dyed in extracts of bark or roots of local plants or in water discolored by rust. At Etsha the two types of baskets most commonly

Fig. 3. *Hyphaene petersiana* baskets, bowls, and beads and a palm "nut."

made are the open bowl and the lidded, spherical basket, known in haMbukushu as thikote and thikongo, respectively (Fig. 3). The most popular and colorfast dye sources at Etsha are the roots of gwarri, *Euclea divinorum* Hiern. (Ebenaceae), known as mushitondo in haMbukushu and that yield a dark brown dye, and the trunk and root bark of birdplum, *Berchemia discolor* (Klotzsch) Hemsley (Rhamnaceae), called mukerete in haMbukushu and that dyes the palm leaf strips red brown.

Hyphaene petersiana, recently placed in synonymy under *H. ventricosa* Kirk (Gibbs Russell et al. 1985), occurs on the high water-table grasslands of Zimbabwe, Angola, and Botswana. In the Okavango it occurs around the margins of the delta but is more common on the delta islands. The palm, which can grow 20 m tall, has a smooth trunk crowned by a canopy of large, fan-shaped leaves on long spiny petioles. Stands of single-stemmed palms are being replaced by palm scrub, the sucker shoots produced by felled palms. Tall palms are felled by palm-"nut" gatherers. The sucker shoots have little chance of regaining reproductive maturity, for not only are the unopened young leaves the raw material of the rapidly growing basket industry, but they are also browsed by domestic livestock, hippopotami, and elephants, and burned back by fires (Tinley 1973). The young leaf bases (njumu) and meristem (gau) are relished as foods by villagers, who excavate them with sharp hoes (Fig. 4). Traditional gathering of unopened leaves for basket weaving involved the selection and individual cutting of the larger leaf shoots below the leaf base by using a sharp knife. As the demand for palm leaves grew, mokola gatherers found that they had to walk further to collect adequate material: in the early 1970s mokola was abundant within an hour's walk from the village, but a decade later mokola collectors had to walk 5 to 6 hr before reaching suitable

Fig. 4. *Hyphaene petersiana* rhizomes and young suckers dug up for gau (meristem) and njumu (leaf base).

collecting sites (Monageng and Terry 1984). Axe or hoe cutting of the palm leaves before they have fully emerged is now a common practice. This harvesting method damages meristems and young leaves, further depleting the resource (Fig. 5).

The scarcity of weaving material in the vicinity of the Etsha villages became apparent in the early 1980s when weavers complained to Botswanacraft buyers that they had to travel great distances to obtain mokola and that leaves were often too short for weaving high-quality baskets. We were employed as consultants by Veld Products Research, on behalf of the Botswana Ministry of Commerce and Industry, to assess the impact of the basket industry on the palm and on the dye plants used in basket manufacture. Recommendations generated by our study (Cunningham and Milton 1982) are now being implemented to conserve both the natural resources and this valuable industry (Monageng and Terry 1984).

METHODS

Study sites

Information on plant species used in basket making, on collecting areas for these materials, and on problems encountered by the basket weavers in gathering materials was obtained by interviewing members of 64 households in three Etsha villages.

An estimate of the percentage of available palm leaves utilized by the basket weaving industry was made at three localities in the vicinity of Etsha, the centre of the industry, and at one locality near Maun (19°59′S, 23°25′E) a minor basket-producing area. Dye plant utilization was assessed at two sites in the Etsha area.

Fig. 5. Leaves of young *Hyphaene petersiana* suckers damaged by hoe cutting.

Herbarium vouchers collected are deposited in the herbarium of the Botany Department, University of Natal, Pietermaritzburg (NU).

The study sites, examples of high and low levels of palm utilization, were chosen on the basis of information obtained from Botswanacraft staff, from the Etsha co-operative manager, and from interviews with villagers. Wabe, only 2 hr walk from Etsha, is heavily utilized by palm-leaf gatherers. On this mainland site, palms occur in scattered clumps of small suckers, each clump originating from a single felled palm tree. Qoroga Island, 10.05 ha in area, is in the Qoroga Lagoon near Wabe and can be reached only by dug-out canoe (mekoro). Here we recorded both palm and dye plant utilization. The island of Xomaxau took us over 3 hr to reach on foot and by canoe. On this fairly large island (28.12 ha) single-stemmed palms and tall suckers were abundant. At Maun the *Hyphaene* population sampled occurred only in a narrow strip on the mainland margin of the swamps. All these study sites were identified and measured on 1:10,000 enlargements of 1:40,000 aerial photographs of Ngamiland flown in 1980 (Gelmroth and Bendsen 1981).

Utilization and assessment: palms

At Qoroga and Xomaxau the number of palm suckers per palm clump and the number of leaf shoots per sucker were sampled in a series of measured 10 × 20 m quadrats placed at 100 m intervals on a north-south oriented grid and covering 2% of the surface area of each of these islands. At Maun, 11 quadrats were placed adjacent to one another and covered 33% of the area occupied by that small palm population. The widely scattered palm clumps at Wabe did not lend themselves to stratified sampling, and here we simply recorded all suckers and leaf shoots in the first six palm sucker clumps in an area of about 4 ha.

The above-ground portion of a palm clump may comprise a number of suckers, each producing a succession of leaves in a rosette around the apical meristem. Only the unopened leaf found at the centre of the rosette is supple enough to be used in basketry. This is selected and cut by mokola gatherers, either with a knife or a sharp hoe. The truncated petiole or clean-cut leaves left by these harvesting techniques are easily distinguished from the ragged leaves indicative of browsing.

The degree of utilization of palms within a sample population was determined by examining the four youngest open leaves and the unopened leaf shoots on every palm sucker within selected palm clumps (Wabe) or within sample quadrats (Qoroga, Xomaxau, Maun). We assumed that the leaf production of *H. petersiana* suckers is similar to that of *H. coriacea* Gaertn. (syn. *H. natalensis* Kunze; Gibbs Russell et al. 1985), the ilala palm, which in Maputaland, northeastern Natal (32°40′S, 27°20′E), produces three to five leaves per annum in the size classes used by basket weavers (Cunningham 1984). If our assumption was correct, our sample of the four youngest leaves on each sucker would estimate palm-leaf utilization in the period March 1981 to March 1982.

The emerging unopened leaves on each sucker were counted and the distance between the leaf base and the tip of the central leaflet on the youngest open leaves was measured. If all these leaves had been cut or damaged, an undamaged leaf on the same sucker was measured so as to place the sucker in a leaf-size class. The four sample leaves on each sucker were then alotted to one of three utilization classes, as follows:

(1) Cut—the entire unopened leaf had been removed by palm leaf collectors, leaving a clean-cut petiole (Fig. 6, above);

(2) Damaged by palm-leaf collectors—leaves truncated by knife or hoe cutting prior to emergence of the petiole (Fig. 6, below); and

(3) Not damaged by palm-leaf or gau collectors—undamaged leaves and leaves browsed by large herbivores.

The number of suckers in every palm clump was recorded. As a palm rhizome produces one or more suckers whenever the apical bud is destroyed, the number of suckers per clump is an indication of the frequency of damage to the above-ground parts of the palm by fire or hoe-cutting of leaves or meristem.

Utilization assessment: dye plants

The removal of bark and roots of *Berchemia discolor* (*Ward 2947,* NU) and *Euclea divinorum* (*Cunningham 527,* NU) for making dyes was quantified by examining the entire populations of these species on two islands (totalling 14.2 ha in area) in Qoroga Lagoon near Wabe. Every plant observed was given a damage rating as follows:

Bark removal: 0 = no bark removed; 1 = not ringbarked, less than 25% bark removed; 2 = ringbarked, less than 25% bark removed; 3 = ringbarked, 25–49% bark removed; 4 = ringbarked, 50–74% bark removed; 5 = ringbarked, over 75% bark removed; and 6 = dead tree.

Root removal: 0 = no roots removed; 1 = less than 25% removal of lateral roots; 2 = 25–49% removal of lateral roots; 3 = 50–74% removal of lateral roots; 4 = 75% or more of lateral roots removed; and 5 = tree uprooted, tap root cut, tree dead.

This assessment probably underestimates overall damage to the species near

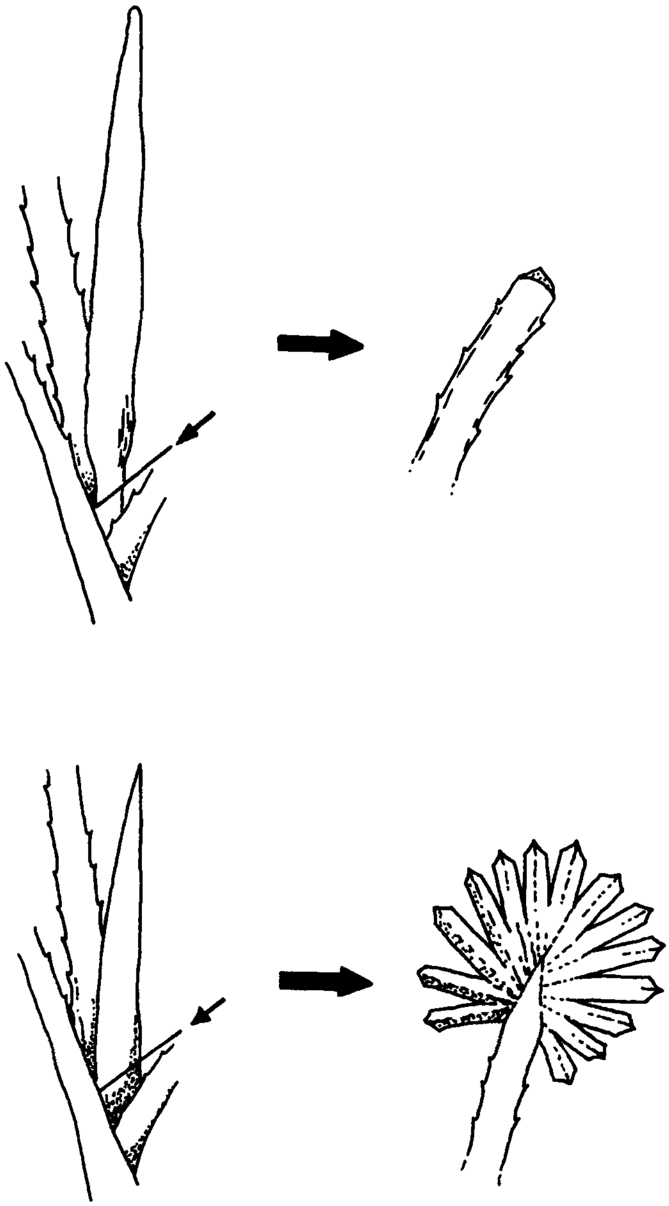

Fig. 6. Effects of post- and pre-emergence leaf-shoot cutting on the appearance of the expanded leaf of *Hyphaene petersiana.* **Above.** Cut made below base of fully emerged lamina and resulting clean-cut petiole. **Below.** Cut across emerging leaf shoot and appearance of expanded leaf with truncated pinnae.

villages as many of the dead trees seen could not be identified with any certainty and were excluded from our sample.

Interviews

Of the 64 basket makers interviewed, all women, 41 were haMbukushu, and 23 baYei. Interviews were subject to various degrees of suspicion concerning the

TABLE 1. PROBLEMS ENCOUNTERED BY A SAMPLE OF 64 BASKET MAKERS AT ETSHA, BOTSWANA, IN OBTAINING *HYPHAENE PETERSIANA* (MOKOLA) WEAVING MATERIAL.

Problem	Number of replies	% of total
Distance from resource	38	59.4
Cost of mokola	5	7.8
Thorns on mokola	5	7.8
Swampy terrain	2	3.1
Too many collectors	2	3.1
No problems	12	18.8

motives of the interviewer and to misunderstandings by one or both parties. To limit these sociological variables, the purpose of the study was explained at kgotla meetings (village gatherings) before we began our work; interviews were conducted by two locally born field assistants who understood the aims of the study and used a short, simple questionnaire; respondents were under no obligation to answer questions. To avoid the false information that may have been given if our questionnaire was thought to be a basis for new taxes, we asked no questions about the amounts of raw materials used or money obtained from basket sales.

RESULTS

Interviews

Of the 64 basket makers interviewed, 52 (81%) said that they had difficulty in obtaining mokola for weaving. Thirty-eight (59%) complained that they had to travel a long way to collect the palm leaves; there were other minor problems as well (Table 1).

Twenty-eight (44%) of the Etsha women interviewed collected all their own weaving material themselves, 20 (31%) bought all the mokola they used, 9 (14%) either bought or collected the palm leaves, 5 (8%) had all their weaving material collected for them by their husbands, and 2 (3%) sent their children to collect it. Mokola is sold as small bundles of dried, split leaf-strips ready for weaving. At the time of the study the average price per bundle (about one handful) was 10 thebe (U.S. $0.10, 1982). One kg (dry weight) of palm leaf fibre prepared for weaving requires approximately 1 kg of dye-plant material to stain it to the required intensity (Crouch 1981; Cunningham 1984).

Field study

(1) Palm leaf utilization by the basket industry. Palm leaves at the Maun study site appeared to be the least utilized. Their leaves were large, 5% exceeding 120 cm in length, and the size classes were normally distributed, peaking at 80–99 cm lamina length (Fig. 7). At Maun, palms bore more new leaf shoots per sucker (mean 1.30, SE $\pm$ 0.01) than those at any other study site, and utilization levels were relatively low. Only 16% of all palms sampled at Maun had been utilized for weaving material, the leaves of 12% having been damaged prior to emergence and the remainder (4%) cut at the lamina base. Fifty percent of young leaves

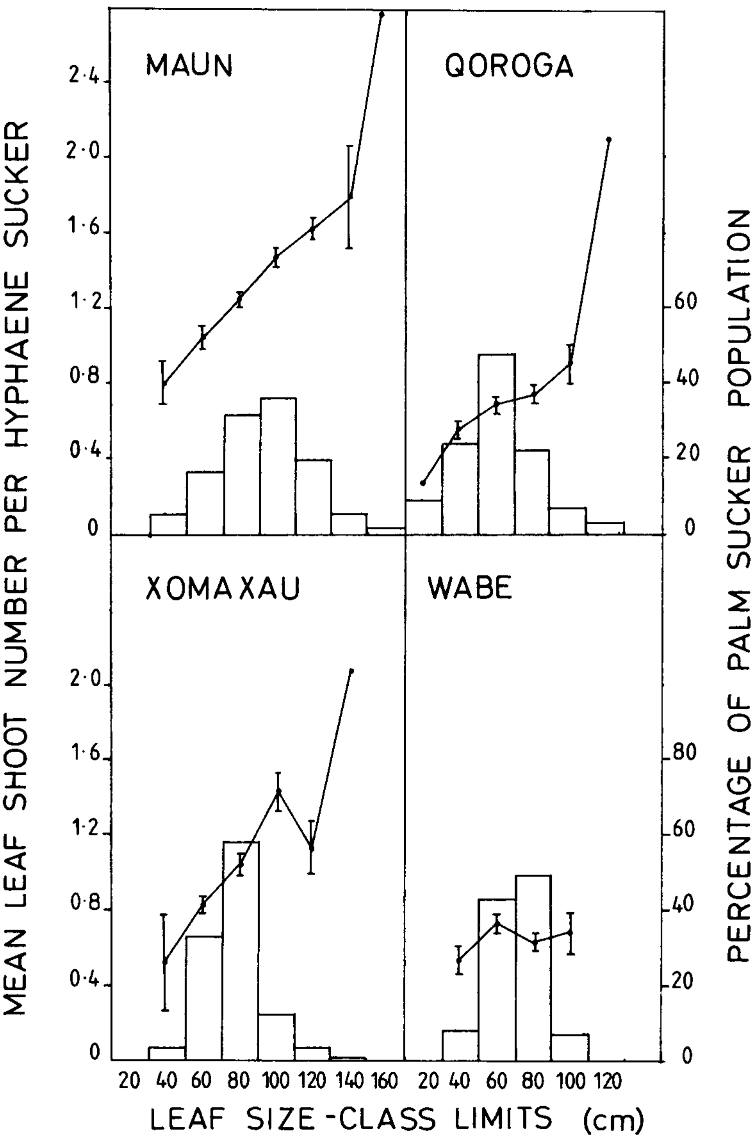

Fig. 7. Histogram showing distribution (%) of palm suckers (*Hyphaene petersiana*) in 20 cm leaf size-classes at four sites on the Okavango Delta. The mean number of leaf shoots per sucker is shown as a line graph; vertical bars represent standard error.

exceeding 120 cm had been cut, but there was little evidence for utilization of leaves less than 80 cm in length (Fig. 8).

At the Xomaxau study site, palms bore fewer new leaf-shoots than those at Maun (mean 0.98, SE ± 0.09 leaves per sucker despite the fact that the leaf utilization level was low at both sites. Thirteen percent of the leaves sampled had been cut, 7% prior to emergence, and 6% below the lamina base. Size-class distribution was skewed in favour of the smaller classes (Fig. 7), possibly indicating a longer history of utilization. As at Maun, utilization of the largest size class of

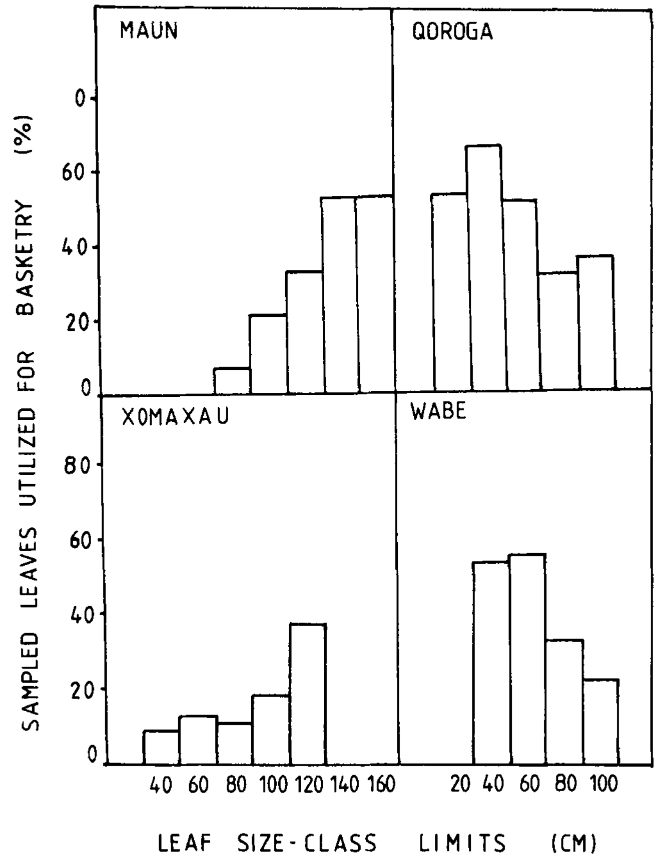

Fig. 8. Utilization (%) of sampled *Hyphaene petersiana* leaves in seven size-classes for basket making at four sites on the Okavango Delta. Knife cuts on petiole or leaf used as evidence for utilization.

leaves (100–120 cm at Xomaxau) was higher than for any of the smaller size classes (Fig. 8).

At the Qoroga and Wabe sites, both of which are close to the Etsha villages, we saw few single-stemmed palms; the low palms scrub showed signs of heavy utilization. Palms sampled at these sites had approximately half as many new leaf shoots per sucker as those at Maun (Fig. 7); leaves under 40 cm in length were more prevalent than at Maun and Xomaxau (Fig. 7). Of the 42% of leaves utilized at Qoroga, 17% had been cut below the lamina and the remainder damaged by pre-emergence cutting. Total leaf utilization at Wabe was 46% of leaves sampled, comprising 19% cut below the lamina and 27% damaged by pre-emergence cutting. At Xomaxau and Wabe, therefore, the basket makers had removed 40–50% of the four young, expanded leaves per palm sucker sampled, and we assume that this represents 40–50% of the annual leaf production. All size classes were harvested at these sites (Fig. 8), small leaves being more frequently damaged than larger leaves as a result of the non-selective hoe cutting (Fig. 9) favoured by mokola gatherers when working in dense, spiny palm scrub. Utilization of the smaller size classes of leaves (which yield short strips of weaving material) reflects the fact

Fig. 9. Palm suckers (*Hyphaene petersiana*) showing one cut petiole, and five expanded leaves and an emerging shoot with pinnae truncated by cutting of unopened leaf buds, for weaving material, before they have fully emerged from the shoot tip.

that few of the baskets made were durable enough for local use, the majority being manufactured for the curio trade.

Palm density (sucker shoots/ha) was greater where the palms were heavily utilized. This is probably because repeated damage of apical buds by hoes during harvesting results in the formation of large numbers of subsidiary suckers (Table 2). If we assume that every clump of palm suckers originated from a single felled palm tree, then there were 130–300 single stemmed palms/ha in our study sites, and the original density of palms would have been higher on Xomaxau and Qoroga islands than on the mainland sites at Maun and Wabe (Table 2).

(2) Dye plant utilization. Only 17% of the *Berchemia* population studied had escaped damage by collectors of plant dyes, and this undamaged fraction comprised mainly small saplings. Over 60% of all *Berchemia* trees on the two Qoroga islands investigated had been ringbarked (Fig. 10). The high percentage of *Euclea* with undamaged bark (Fig. 10) may be attributed to their small size (less than 3

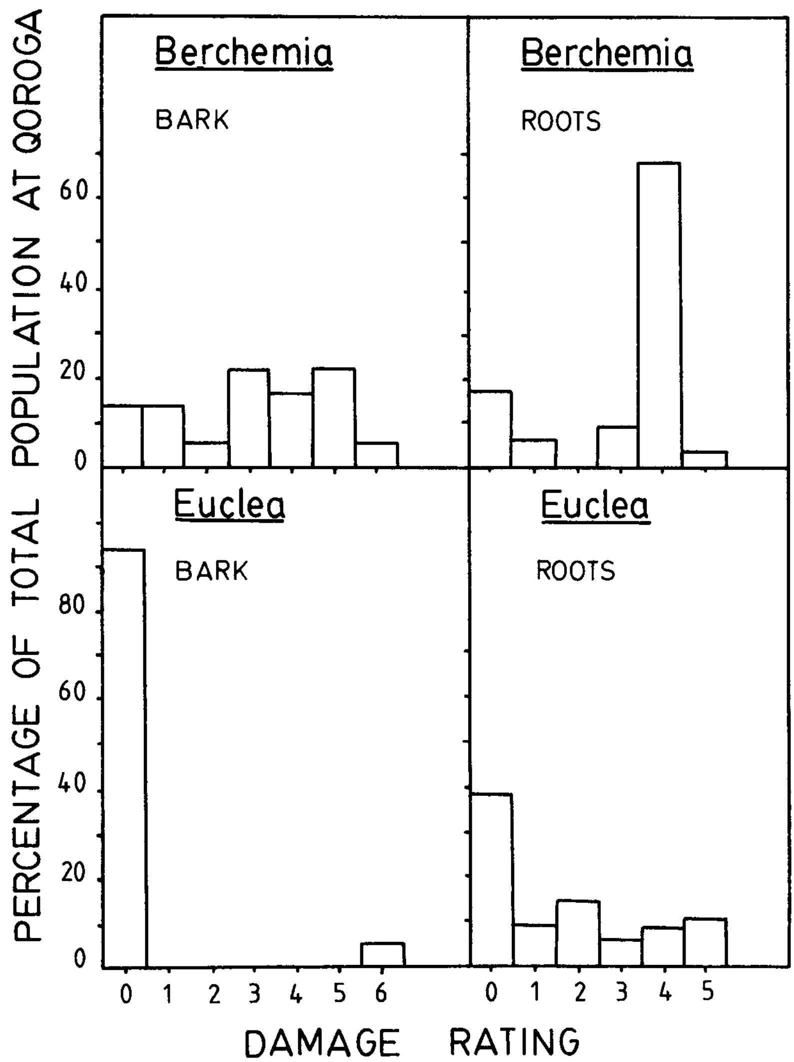

Fig. 10. Bark and root damage to populations of dye resource trees, *Berchemia discolor* (n = 36) and *Euclea divinorum* (n = 34) on islands at Quoroga. The damage rating is proportional to the impact of dye-material collection on the plant; class 0 = an undamaged tree, the highest class = a dead one.

cm basal diameter). These *Euclea* plants were probably the coppice or sucker regrowth of felled trees.

DISCUSSION

Interviews with the basket weavers of Etsha confirmed reports that it was becoming difficult for the craftspeople to obtain enough raw material for their industry in the vicinity of the western swamp margin villages. From the kgotla meetings we attended and from discussions with our guides, it was evident that the local scarcity of palm leaves on which their cash incomes depended had led to competition and friction between the people of Etsha (mainly haMbukushu) and those of Gomare (baYei). The seven-fold increase in the value of the industry

TABLE 2. *HYPHAENE PETERSIANA* PALM CLUMP DENSITY AND DEGREE OF SUCKERING AT FOUR STUDY SITES ON THE MARGIN OF THE OKOVANGO DELTA, BOTSWANA.

Clumps sampled			Suckers/clump		
Site	Number	Clumps/ha	$\bar{x}$	SE	Suckers/ha
Maun	10	127	5.1	1.1	650
Xomaxau	11	308	7.1	1.8	2,190
Qoroga	4	237	19.5	9.2	4,625
Wabe	6	25[a]	48.7	10.2	1,218[a]

[a] Estimate; Wabe site not measured.

over the period 1976–1982 suggests that an increasing number of people are benefitting from the manufacture and sale of palm baskets.

Comparison of *Hyphaene* palm populations at Maun with those at three sites nearer Etsha showed clearly that the intensive utilization of young leafshoots for weaving material has led to an increase in the density of sucker shoots but a reduction in the size and number of leaves produced by these suckers. This means that mokola leaves of the size and quality required by the weavers are becoming scarce within a day's walk from the villages. For the palm, this level of utilization prevents suckers from reaching reproductive maturity and eliminates the possibility of regeneration through seeding.

A single-stemmed mokola palm produces 24 leaves per year when over 2 m tall, but eight to nine leaves/yr when under 1 m tall; unstemmed, juvenile palms produce an average of six leaves/yr (Fanshawe 1967). An even lower rate of production was recorded for *H. coriacea* suckers in northeastern Natal, South Africa, where palm suckers in the leaf-size class 101–120 cm produced a mean of 3.79 leaves/yr (SE ± 0.59, n = 18 plants), but those in the 41–60 cm class produced only 2.83 leaves/yr (SE ± 0.48, n = 10 plants) (Cunningham 1984). Near Etsha, where frequent destruction of apical shoots has reduced most suckers of *H. petersiana* to the 41–80 cm leaf-size class, leaf production per sucker could well be lower than the six leaves/yr recorded by Fanshawe (1967) at less utilized sites.

Pruning trials on dicotyledonous shrubs (Buwai and Trlica 1977; McConnell and Smith 1977) and on ferns (Milton 1987) have shown that productivity can be sustained when there is an annual offtake of as much as 50% of the annual leaf production, but that more frequent or severe defoliation leads to declining production and a shortened life.

If we assume that our sample of the four youngest leaves on every palm sucker represented a year's leaf production and that the response of palms to defoliation is similar to that of dicotyledonous shrubs and ferns, then the palms at Qoroga and Wabe sites are being exploited to their limits.

Traditionally, basket weavers did not ringbark or destroy dye plants, but our results suggest that there is now an opportunistic scramble for the dye plant materials used in the basket industry.

MANAGEMENT RECOMMENDATIONS

The primary objective of a craftwork project based on a natural resource should be sustained-yield exploitation. Because of the aspirations of rural people for higher living standards and for items not made in rural areas (cotton fabric, canned foods, radios) and because of the increasing numbers of people in rural communities it will be difficult to maintain the utilization of a cash-providing natural resource (*H. petersiana* leaves) at a fixed level. Although over-utilization limits the life of the resource and its dependent industries, the short-term sacrifices required to maintain the resource for the future will be opposed by the villagers unless crafts based on alternative materials can be developed and marketed.

A resource such as mokola palm could be managed both at village level and through the marketing organisation (in this case, Botswanacraft).

The village level

A local committee headed by the village chief and supported by the marketing organisation should be involved in extension and control. The following recommendations should be presented to the craftworkers and each aspect explained and discussed before any attempt at implementation.

(1) Hoe cutting should be discouraged (perhaps by the imposition of spot fines) and leaves should be selectively cut with a sharp knife.

(2) Felling of mature palms in order to obtain the edible palm nuts and palm heart should be stopped. To overcome scepticism and resistance to the idea of propagating the palms from their seeds ("nuts"), demonstration plantings should be carried out near the villages by agricultural or forestry officers or Botswanacraft personnel.

(3) Edible shoots (njumu) and meristem (ngadi) of the more common and less heavily utilized wild date or tsaro palm (*Phoenix reclinata* Jacq.) should be substituted for the edible shoots (njumu) and meristem (gau) obtained by digging out young mokola palm suckers.

(4) Ideally, mokola palm leaf harvesting should not exceed one in three leaves produced, and leaves should not be cut before they have emerged from the ground or sheathing petiole base, as this practice wastes potential weaving material and damages underground stems and leaf buds.

(5) The growing of alternative fibre plants such as sisal (*Agave sisalana* Perrine) and *Yucca* sp. around fields or near homesteads would provide an alternative source of strong fibre suitable for building or craftwork.

(6) Uprooting and ringbarking of dye plants is destroying a valuable source of vitamin-rich fruit (Fox and Norwood Young 1982) as well as the dye resource. In order to overcome this problem, the use of synthetic dyes should be demonstrated and these should be sold through the Etsha village co-operative. A switch to synthetic dyes should be acceptable to local craftworkers as these dyes are inexpensive and, through their use, the considerable effort now expended on the collection, transport, and preparation of plant dyes could be avoided.

The marketing organisation

Trained staff will be required in order to implement the following management proposals.

(1) Quantity control. The annual quota of palm baskets bought should be based on the estimated sustained yield of mokola palm communities to be exploited. The amount of mokola leaves harvested could be reduced by a reduction in the number of baskets purchased by Botswanacraft.

(2) Quality control. Buyers should purchase only high quality baskets. Quality items take more time to produce so that less raw material is used over a given time. Work of exceptionally high quality should be labeled and marketed under the name of the craftworker. Such handmade articles bearing their makers' names would command higher prices in industrialised countries than anonymous items. In this way a higher financial return per unit effort and per kilogram of weaving material would be obtained.

(3) Alternative materials. The demand for *H. petersiana* leaves could be reduced by diversifying the resources used in the basket industry. Only abundant species resilient to harvesting should be considered as alternative sources of fibre. Reed (lethaka) *Phragmites australis* (Cav.) Trin ex Steud. (Poaceae) and papyrus (moseme) *Cyperus papyrus* L. (Cyperaceae) are abundant in the northern Okavango (Tinley 1973) and are commercially exploited in some countries. Information on their productivity and response to harvesting is available (De la Cruz 1978; Taylor and Moss 1982). Various grasses, including *Imperata cylindrica* (L.) Beauv. (silver spike, cogon grass, moshange) (Poaceae), could be more frequently substituted for *Hyphaene* palm leaf strips used to fill the coils of coil-built baskets. *Phoenix reclinata* leaves are suitable for the making of small plaited baskets; this palm grows readily from seed (Taylor and Moss 1982).

(4) New crafts. Developers of an alternative handwork industry should aim to produce items that, while dependent on freely available natural materials, give a relatively high financial return on the quantity of raw materials used. Exotic plant species such as sisal, or waste materials such as plastic fibres from which some sacks and orange bags are made, could be employed in craftwork.

CONCLUSION

Despite the fact that Yoffe (1978), in advocating further expansion of the basket industry in Botswana, described the supply of *H. petersiana* in the Okavango as "unlimited," we have shown that the raw materials of the basket industry are being over-utilized around villages on the northwestern margin of the swamps. Palm leaf-shoots are becoming time-consuming and expensive for the villagers to obtain, and the size and leaf production of palm suckers near the villages is declining. Single-stemmed mature *Hyphaene* palms are scarce, and entire populations of the preferred dye-plants have been decimated on swamp islands within a journey of a few hours from the villages.

To avoid a crash in the basket industry and irreparable damage to palm and dye-plant populations, we recommend controlled exploitation of the palm, diversification of the craftwork industry, and a switch from natural to synthetic dyes. The craftwork industry should be managed both at the village level and through the marketing organisation. Before new industries based on indigenous natural resources are developed, the quantity of material required annually should be estimated and reconciled with the abundance and productivity of the resource plants.

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