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This workshop brought together many practitioners and experts from Africa. It concluded by summarising that, since there are so few researchers and practitioners, duplication of effort should be avoided. There are policy and regulatory problems that needed to be overcome before rattan-based development can thrive. It concluded that greater effort was needed to disseminate information and technologies. Higher value products are also needed.



NEW RESEARCH ON AFRICAN RATTANS

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The proceedings of the CARPE-funded International Expert Meeting on the Rattans
of Africa held at the Limbe Botanic Garden, Cameroon

1-3 February 2000



Edited by

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PARTICIPANTS OF THE WORKSHOP OUTSIDE THE CONFERENCE
FACILITY IN THE LIMBE BOTANIC GARDEN



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FOREWORD

It is characteristic of the search for new knowledge in both bamboo and rattan that it is distributed widely, in a limited number of people, who have a limited opportunity to meet and work together. The mission of INBAR is “to improve the well-being of bamboo and rattan producers by consolidating, coordinating and supporting strategic and adaptive research and development”. It is therefore very appropriate that INBAR became involved in the activities discussed in this book.

The business of rattan production and trade is well established in Asia. It remains a vibrant business although one greatly affected by over-exploitation of the resource, resource scarcity and relative labour costs between countries. Far less is known about rattans in Africa, yet there is a potential to emulate the better aspects of Asian experience in order to alleviate rural poverty.

Rattan needs light overhead shade and a tree canopy to scramble up into. It is thus a unique crop in that it makes the farmer a colleague in arresting deforestation. The concept of participatory rattan farming in the forest margins deserves far greater attention than it has received from all those who wish to involve local people as allies in stabilising forest margins and arresting deforestation.

This workshop brought together many practitioners and experts from Africa. It concluded by summarising that, since there are so few researchers and practitioners, duplication of effort should be avoided. There are policy and regulatory problems that needed to be overcome before rattan-based development can thrive. It concluded that greater effort was needed to disseminate information and technologies. Higher value products are also needed.

With all these conclusions INBAR enthusiastically agrees and stands ready to assist, with its currently very limited resources, to assist to the best of its ability.



Director General
INBAR

KEY NOTE ADDRESS:

RATTAN RESEARCH - PERSPECTIVES FROM SOUTHEAST ASIA

*John DRANSFIELD*¹

The history of research into rattans and their utilisation in the south-east Asian region over the last thirty years is convoluted; research in the region has not always delivered products of value to the rattan industry: some research may never have been intended to do so. Whatever the case, I believe there are lessons to be learned from this experience, lessons of relevance to research on African rattans.

There is a long history of rattan exploitation in Asia and Malesia. Rattans were pulled from the forest and traded down rivers to coastal entrepreneurs who marketed them on to traders in Singapore and Hong Kong who in turn exported raw cane to Europe and North America for manufacture into furniture. Almost all this rattan was from wild stocks. Independently in several places in the region, local villagers planted rattan to provide a local supply of high quality cane for their domestic needs of basketry and matting. A good example is the First Division of Sarawak, where up to twelve different species of rattan have been cultivated, supplying a variety of cane colours and texture that are incorporated into the elegant baskets of the Bidayuh people. In one area of Central Kalimantan rattan was planted since the latter part of the nineteenth century on a rather extensive scale and was harvested as a cash crop. Periodically in the twentieth century there were perceived shortages of rattan that stimulated forest departments to pay some attention to the wild stocks of rattan. By the late 1950's forest departments in Malaysia had established small trials in various places, but these without exception were soon forgotten as the stocks of wild rattan recovered and the need for planting seemed to disappear. Then in the early 1970s it became apparent that in parts of the region shortages were genuine and were beginning to affect the market of rattan.

The Forest Research Centre at Gunung Batu in Bogor, Indonesia, mounted an expedition in 1973, which I joined, to investigate the long-standing cultivation of rattan (*Calamus caesius* and *C. trachycoleus*) in Barito Selatan. Although this excursion was fraught with problems and little time was spent in the rattan gardens, it was nevertheless extremely important for me as I learned at first hand that cultivation of small diameter rattan could be successful, at least on a smallholding basis, and it provided me with basic information on the silviculture of such species. Shortly after this, the Forest Research Institute Malaysia realised the importance of an integrated approach to rattan shortages in Peninsular Malaysia and started a rattan research programme with assistance from the United Kingdom government via the Colombo Plan. I joined this project as a rattan taxonomist and ecologist, with the remit to survey the wild rattans of Peninsular Malaysia, to provide a manual for their identification, to select good quality species of silvicultural potential and to establish small scale trials in various forest types, both natural and man-made. We have to remember that the rattan flora of Peninsular Malaysia consists of over 100 species, so a guide to the identification of the wild resource was seen as an essential basis for rattan research. As a plant taxonomist I of course still feel this is the case with any floristic region.

During the period that we conducted the research in Peninsular Malaysia two important events occurred that would have significant effects on the development of

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rattan research. Both of them involved visits to the Forest Research Institute to my counterpart, Dr. Manokaran, and myself to discuss rattans. The first was a visit by a representative from the International Development Research Center in Canada to FRIM to discuss the potential role of rattan in the alleviation of rural poverty in Southeast Asia. This visit, by Giles Lessard, was the start of a major involvement by IDRC in rattan in the region and led, ultimately, to the founding of the International Network for Bamboo and Rattan. More about this later. The other event was the visit of a group of Malaysian Chinese economists from a small company called Markiras Corporation to FRLM to discuss the potential of rattan as a cash crop to alleviate the poverty of a group of Murut tribespeople in Sabah, people who had been moved from their traditional homelands on the border with Indonesia to an administratively easier-to-control area nearer to the local administrative centre. These two visits, with such similar aims, resulted in a major dichotomy in research. The former became the highly politicised research programme involving many nations in the region, the latter became the tightly managed economically-driven research that resulted in the establishment of the first commercial-sized rattan plantations in the region and the reorganisation of the rattan trade in Sabah.

As I have mentioned above, Murut people had been moved away from a sensitive border area into an area in the centre of Sabah, an area of poor soils, where the people had, not surprisingly, not prospered. The Sabah government concerned with the need to improve the lot of these villagers, hired Markiras corporation to come up with suggestions for poverty alleviation and Markiras suggested rattan cultivation. With expertise from FRIM and Kew, the Sabah Forest Development Authority (SAFODA) and the Sabah Forest Department then started a rattan project, once again cataloguing the known rattan diversity (resulting in the publication of a rattan manual and, incidentally, the identification and selection of one of the most promising of the large diameter canes: *Calamus subinermis*) and the selection of species suitable for cultivation. A major event was the importation by SAFODA of seeds of *Calamus trachycoleus* from Indonesia. At the time this was not strictly banned: now such a seed export would be banned. *Calamus trachycoleus*, the elite small diameter species for alluvial soils prone to flooding, freed SAFODA to develop a rattan plantation on an area of land with reasonably good soils not used for any major perennial agricultural activity. This aggressive, rapidly growing species (the stems of which will grow as fast as 7 m a year) produces a good quality cane and rapidly establishes itself under the right conditions. Although the initial impetus for this research was the need to find a source of income for rural poor people, the project developed as a commercial forestry rather than a social forestry project. Now, over 20 years on the first estate has been ploughed up and planted with oil palm, the rattan having succumbed to poor management, inefficient harvesting techniques and the ravages of the wild fires that affected Sabah in the 1980s and 1990s.

Undoubtedly, the estate was also affected by the considerable effects of the fluctuations in rattan prices in Indonesia, the country that dominates world supply of rattan. Perhaps the whole scale of the enterprise was too large. Had the same effort been put into agricultural extension for rattan planting to the very people for whom the project was originally conceived, small holders, the result may have been more lasting. However, in the early days of the SAFODA estates, it seemed that rattan was the answer for everyone, for growing in forest in marginal areas. New estates, both government and private, sprang up all over Malaysia and, increasingly, elsewhere in the region. Eventually the Commonwealth Development Corporation (CDC) together with a Malaysian private company established an estate in Sarawak in the mid-1980s. This, the most tightly managed estate in the region, is still extant, with an enthusiastic ground staff. If any estate is to be economically successful, it will be this one. However, there remain problems, the most serious of which is how to harvest rattan successfully and not leave significant amounts of cane in the forest canopy. This

problem has yet to be solved.

With so much interest in rattans, rattan research started to burgeon in the region, rattan workshops and international rattan seminars were held. The research seemed to explode in all directions, from taxonomy, ecology, tissue culture, anatomy to mechanical properties. All too often, I believe, this research ended up being research for its own sake and contributed little to our understanding of how to provide a sustainable source of rattan for the future, surely the real aim of focussed research. As an example I cite the effort that was expended on research into the tissue culture of rattan. All the really significant commercially important canes in the region are species of *Calamus*, a genus we all know to be dioecious; that is, there are separate male and female plants and the species are thus obligatory out-crossing. In Peninsular Malaysia in the early 1980s there was a perception that there was an extreme shortage of seeds of the elite species, *Calamus manan*, despite the fact that whenever the financial incentive was sufficient and the season right, the Malay Aborigine plant collectors at FRIM were always able to find plenty of seeds wild in the forest. Research was started to produce planting stock from tissue culture. Palms are usually difficult to propagate in tissue culture and a few years elapsed before a successful technique was developed. Although successful, the time required to produce the plantlets and then acclimatise them to growth first in the nursery and then in the plantation exceeded the normal time for seeds to germinate and grow to the point they can be planted out. Of course, such seedlings do not require the same sort of acclimatisation that a propagule raised in a test tube requires. Added to this, by the time the research had reached the point where large-scale production of plantlets could be achieved, rattans in many of the trials and even commercial plantings of *Calamus manan* had reached sexual maturity and were producing so many fruits that there was a plentiful supply of planting material. Currently, I can envisage only one major potential use for the tissue culture techniques, that is in the propagation of selected provenances of elite rattans, material that cannot be achieved by conventional techniques of seed production, because of outbreeding, and at the moment there seems not to be a demand for major expansion of rattan planting.

Another example of research that has had little effect on the sustainable management of rattan is research into rattan cane anatomy and the mechanical properties of canes. For me, the cane anatomical research has been of great interest because it has provided a wealth of details that can be used to assess the evolutionary relationships of the rattans. It has also given a better understanding of why good quality rattans are good. What is it about the interior structure of a rattan that makes one species better than another? However, the trade really doesn't need to know this; any rattan merchant can tell whether a species is good or not, simply by handling and testing its performance.

Some of the research on rattans in the region, that has at least been focussed on issues important for an understanding of sustainable management of rattan, has failed because it was conducted in a way that was simply unscientific and cannot be reproduced. The reliance on vernacular names has had a particularly blighting effect on certain aspects of rattan research in south-east Asia. If rattan research is to be scientific then it is essential that we know which species we are using for the research. For that we need to establish the scientific identity of the species and vouch our research with specimens that can be checked against the type specimens that provide the essential reference points for plant taxonomy.

Finally, I come back to the problem of the scale of research, and its application. I believe we have seen in south-east Asia that the large scale cultivation of rattan (the big rattan estates) are fraught with problems and that many of these problems do not

affect the small scale planting of rattan by small-holders. Given ownership of land and the rattans growing on it, villagers have a vested interest in how the rattans perform. They make every effort to harvest canes carefully and in a mixed village economy where rattan represents only one potential source of income, they do not need to harvest canes if the price is too low; the canes can be left until the price is more favourable.

In Asia I consider that too much of rattan research has been academic rather than aimed at the real needs of rattan growing and, of this research, not all is of good quality. Research on African rattans is not so far advanced as in Asia. Although some research has been conducted over the past decade or so, it is only now that the basic taxonomy is being sorted out and this is absolutely essential as a basis for further research. As I have said before, we just have to know what we are dealing with. Is *Laccosperma secundiflorum* as a scientific name used in the same way in Ghana as it is in Gabon? If it isn't, research results in Gabon cannot be applied in Ghana and vice versa. In conclusion, I believe that we have to consider all the time whether our research is relevant to the goal of providing a long term sustainable supply of rattan in Africa, and whether the resource will be available to the people for whom it could have major potential to alleviate rural poverty.

THE RATTANS OF WEST AND CENTRAL AFRICA: AN OVERVIEW²

Terry C.H. SUNDERLAND

Abstract

Four genera of rattan palms, represented by 20 species, occur in West and Central Africa. In common with their Asian relatives, the rattans of Africa form an integral part of subsistence strategies for many rural populations as well as providing the basis of a thriving cottage industry. Although many of the African rattan species are used locally for a multiplicity of purposes, the commercial trade concentrates on the bulk harvest of only a few widespread and relatively common species.

African rattans have long been recognised by donor agencies and national governments as having a potential role to play on the world market as well as a great role within the regional Non-Timber Forest Products (NTFP) sector of Africa. As increased interest is being shown in the potential role of high value NTFPs to contribute to conservation and development, rattan is frequently mentioned as a product that could be developed and promoted in a useful way. However, the development of the rattan resource in Africa has until recently, been hindered by a lack of basic knowledge about the exact species used, their ecological requirements and the social context of their utilisation. Hence it has not been possible to design appropriate management strategies that might be implemented to ensure their sustainable, and equitable, exploitation. Recent research has concentrated on the provision of information on the taxonomy, ecology and utilisation of these taxa. Now that this baseline information is available, rattan research in Africa is now concentrating on the development and promotion of the rattan resource from both ecological and socio-economic perspectives.

A brief introduction to the biology of African rattans

Morphological distinctness from the Asian rattans

The four genera of African are relatively easy to differentiate, particularly through the morphology of their climbing organs (Sunderland, 2000). Calamoid palms climb with the aid of two main organs; either a flagellum (a shoot arising directly from the leaf and regarded as a modified inflorescence Baker *et al.* (1999)) or a cirrus (a whip-like extension to the leaf Tomlinson (1990)). Flagella only occur in certain species of *Calamus*, including the sole representative of the species in Africa, *C. deërratus*. The other Calamoideae, particularly those of Asian origin, climb with the aid of a cirrus. However, the three rattan genera endemic to Africa, *Laccosperma*, *Eremospatha* and *Oncocalamus*, possess a vegetative morphology unique within the Calamoideae in that the cirrus is actually a marked extension between the distal leaflets. The leaflets are present as reduced, reflexed thorn-like organs termed acanthophylls. This structure is also present in some members of the unrelated genera present only in the New World; *Chamaedorea* (sub-family Ceroxyloideae; tribe Hyophorbeae) and *Desmoncus* (sub-family Arecoideae; tribe Cocoeae) (Uhl and Dransfield, 1987).

² A version of this paper also appears in *Unasylva* 52 (205):18-26

In common with other members of the genus, *Calamus deërratus* possesses dyads of unisexual flowers, however the inflorescence units of the endemic rattan genera of Africa also somewhat unique within the Calamoideae. For example the genera *Eremospatha* and *Laccosperma* are composed of dyads of hermaphroditic flowers³, a feature unique within the Palmae (Uhl and Dransfield, 1987; Baker *et al.*, 1999).

In addition, *Oncocalamus* species possess a distinctive and complex, not only within the Calamoideae, but within the Palmae as a whole. *Oncocalamus* is monoecious, and consists of a central 1-3 pistillate flowers with two lateral cincinni subtended by a single bract, with each cincinnus bearing basal 1-3 pistillate flowers and 3-5 distal staminate flowers. The unusual flower cluster of the African taxa, and *Oncocalamus*, in particular, suggests that a complex evolution of the Calamoideae has occurred in Africa with much extinction, caused by dramatic climatic upheaval, leaving only isolated lineages. This assertion is supported by the speciation patterns exhibited today by African palms, in that they have a distinct Guineo-Congolian centre of diversity, probably as a result of the maintenance and later speciation of forest refugia during periods of climatic change.

Cane anatomy and quality

Anatomical studies of three of the four (*Laccosperma*, *Eremospatha* and *Calamus*) African genera have recently been undertaken in Ghana (Oteng-Amoako and Ebanyele, this volume). The initial results of the study suggest that the thickness of the fibre walls, the proportion of fibre tissues and metaxylem vessel diameter differ significantly between the genera, hence influencing the relative utility of the members of each genus.

The relatively higher proportion of thick-walled fibres and narrower diameter of metaxylem vessels suggests that the genus *Laccosperma* has a greater density and hence strength properties than the canes of *Eremospatha* and *Calamus deërratus*. These latter taxa have a relatively higher proportion of thinner wall fibres and larger metaxylem vessels, which contribute to greater void volume of the stems resulting in lower density and strength (*ibid.*). The study also revealed that fibre wall thickness, fibre proportion and metaxylem diameter, which are the likely determinants of rattan quality, do not differ significantly between *Calamus* and *Eremospatha* and therefore these genera are included within the same density and strength groupings. These findings concur with those of Wiener and Liese (1994) who additionally examined material of *Oncocalamus*. This latter genus was found to have very thin fibre walls and very large metaxylem vessels and possessed the least desirable properties of density and strength of any of the African rattans.

These anatomical conclusions generally correspond with those of researchers of rattan utilisation in Africa. It is generally accepted that the large-diameter species of *Laccosperma* are particularly durable, whilst *Oncocalamus* is particularly weak and brittle and, as such, is not commonly valued as a source of cane (Profizi, 1986; Defo, 1997; Defo, 1999; Sunderland, 1999a; 1999b). However, it is surprising that *Eremospatha* and *Calamus* are found to be anatomically similar, and hence share similar cane properties, as most workers note that *Calamus deërratus* is considered of

³ Less commonly, *Laccosperma* may also possess triads of flowers.

inferior quality to that of the desired species of *Eremospatha* and is only utilised in the absence of other species. Further anatomical studies, which are currently under way, might shed more light on this anomaly.

Ecology and distribution

Rattans in Africa are widespread throughout West and Central Africa and are a common component of the forest flora. Some species, such as *Laccosperma secundiflorum* and *Eremospatha macrocarpa*, have large ranges and occur from Liberia to Angola, whilst *Calamus deërratus* is particularly widely distributed and occurs from the Gambia, across to Kenya and southwards to Zambia. In terms of diversity, the greatest concentration of rattan species, along with the highest levels of endemism, are found in the Guineo-Congolian forests of Central Africa. Eighteen of the 20 known African rattan species occur in Cameroon. The diversity of rattans in the Upper Guinea forests, by comparison, is somewhat poor with only seven species, none of which are endemic to that region.

Within this forest zone, rattans occur in a wide range of ecological conditions. The majority of the species occur naturally in closed tropical forests and are early gap colonisers. Because of this, many of the taxa are extremely light demanding and respond well to a limited reduction in the forest canopy. Increases in forest disturbance, such as through selective logging activity encourages the regeneration of rattans and these palms are often a common feature along logging roads and skid trails. For some taxa such as some species of *Oncocalamus*, their light-demanding nature is such that they are often the earliest colonisers of heavily disturbed areas. Other species of rattan, notably *Calamus deërratus*, grow in permanently and seasonally inundated forest or swamps, whilst other species, such as *Laccosperma opacum* and *L. laeve*, are highly shade-tolerant and prefer to grow under the forest canopy.

The seed of most rattans in Africa are dispersed predominantly by hornbills (Whitney *et al.*, 1998). However, primates, predominantly the drill (*Mandrillus leucophaeus*) and mandrill (*Mandrillus sphinx*), chimpanzees (*Pan troglodytes*) and gorillas (*Gorilla gorilla*) along with elephants (Gartlan pers. comm.; White and Abernethy, 1997; Sunderland, 2000) are also key dispersal agents. The seeds are often scattered far from the mother plant. Limited predation, and sometime caching by rodents accounts for some additional, although limited, dispersal. Interestingly, significant germination also occurs near to the parent plants through natural fruit fall, particularly in areas where over-hunting has led to a significant decline in faunal dispersal agents.

Despite intensive field work and herbarium collection, especially in the past several years, no obvious phenological pattern has been identified for flower development and seed production for most African rattan species.

The resource base

Although numerous studies have concentrated on evaluating the local importance of rattan in Africa, very few have attempted to adequately define the resource base. However, it is now known that the utilisation of rattan to supply the thriving cottage

industry is limited to a few species (Sunderland, in press). Table 1 (below) presents the major commercial species of rattan utilised in each region.

Table 1. Commercially important rattan species by region

Region	Commercially utilised species
West Africa (Senegal, Côte d'Ivoire, Ghana, Benin, W. Nigeria)	<i>*Laccosperma secundiflorum</i> (P. Beauv.) Kuntze <i>*Eremospatha macrocarpa</i> (G. Mann & H. Wendl.) H. Wendl. <i>Eremospatha hookeri</i> (G. Mann & H. Wendl.) H. Wendl. <i>Calamus deërratus</i> G. Mann & H. Wendl.
West/Central Africa (E. Nigeria, Cameroon, Congo, Gabon, E. Guinea)	<i>Laccosperma secundiflorum</i> (P. Beauv.) Kuntze <i>*Laccosperma robustum</i> (Burr.) J. Dransf. <i>*Eremospatha macrocarpa</i> (G. Mann & H. Wendl.) H. Wendl.
Central Africa (DR Congo, CAR)	<i>*Laccosperma robustum</i> (Burr.) J. Dransf. <i>*Eremospatha haullevilleana</i> de Wild. <i>Eremospatha macrocarpa</i> (G. Mann & H. Wendl.) H. Wendl.
Southern/East Africa (Zambia, Uganda, Kenya, Tanzania)	<i>*Calamus deërratus</i> G. Mann & H. Wendl. <i>*Eremospatha haullevilleana</i> de. Wild.

* Indicates primary commercial species

Conservation status of African rattans

It is reported that the demand for rattan is increasing and much greater amount of cane is being processed in many areas of Africa today than was being worked five or ten years ago (Morakinyo, 1995; Ndoye, 1994; Falconer, 1994; Townson, 1995; Trefon and Defo, 1998; Defo, 1997; Sunderland, 1998; Defo, 1999; Sunderland 1999a; 1999b; Kialo, 1999; Minga, this volume; Holbech, 2000; Sunderland *et al.*, this volume; Oteng-Amoako and Obiri-Darko, this volume). This increased demand has led to a significant decline in wild stocks and has resulted in considerable local scarcity particularly around urban centres. This scarcity and the associated irregular supply of unprocessed rattan have been identified as one of the major constraints to the continued development of the industry. Despite this, the commercial rattan species are at present considered “not threatened” on a continent-wide basis.

Table 2. The conservation status of African rattan species

Species	Geographical range (km ²)	IUCN Category
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<i>Calamus deërratus</i> G. Mann & H. Wendl.	8,049,170	Not threatened
<i>Eremospatha barendii</i> sp. nov.	One collection only	Endangered
<i>E. cabrae</i> de Wild.	1,918,050	Not threatened
<i>E. cuspidata</i> (G. Mann & H. Wendl.) H. Wendl.	1,891,190	Not threatened
<i>E. haullevilleana</i> de Wild.	2,703,930	Not threatened
<i>E. hookeri</i> (G. Mann & H. Wendl.) H. Wendl.	1,102,420	Not threatened
<i>E. laurentii</i> de Wild.	2,731,880	Not threatened
<i>E. macrocarpa</i> (G. Mann & H. Wendl.) H. Wendl.	4,259,660	Not threatened
<i>E. quinquecostulata</i> Becc.	9,276	Vulnerable
<i>E. tessmanniana</i> Becc.	5,899	Vulnerable
<i>E. wendlandiana</i> Dammer ex Becc.	604,086	Not threatened
<i>Laccosperma acutiflorum</i> (Becc.) J. Dransf.	1,485,230	Not threatened
<i>L. laeve</i> (G. Mann & H. Wendl.) H. Wendl.	1,226,210	Not threatened
<i>L. opacum</i> (G. Mann & H. Wendl.) Drude	1,807,940	Not threatened
<i>L. robustum</i> (Burr.) J. Dransf.	1,537,390	Not threatened
<i>L. secundiflorum</i> (P. Beauv.) Kuntze	3,195,390	Not threatened
<i>Oncocalamus macrospathus</i> Burr.	701,830	Not threatened
<i>O. mannii</i> (H. Wendl.) H. Wendl.	129,432	Not threatened
<i>O. tuleyi</i> sp. nov.	18,423	Vulnerable
<i>O. wrightianus</i> Hutch.	2,872	Endangered

The African rattan trade

During the colonial period, there existed a significant trade in cane and cane products in Africa. In particular, Cameroon and Gabon supplied France and its colonies (Hédin, 1929), and Ghana (formerly the Gold Coast) supplied a significant proportion of the large UK market during the inter-war period (Anon, 1934). The export industry was not restricted to raw cane and in 1928 alone over 250,000 FF worth of finished cane furniture was exported from Cameroon to Senegal for the expatriate community there (Hédin, 1929). More recently, an initiative promoted by UNIDO in Senegal was exploiting wild cane for a large-scale production and export (Douglas, 1974), although this enterprise folded not long after its establishment due to problems securing a regular supply of raw material.

Table 3. Raw rattan cane exports from Douala and Kribi to France 1926 to 1928 (modified from Hédin, 1929)

Year	Tonnes Exported	Value (FF)
1926	100	250,000
1927	58	137,000
1928 (Douala)	32	80,000
1928 (Kribi)	34	85,000

The nature of the trade

The conditions and circumstances under which rattan is harvested and transported in Africa are remarkably consistent throughout its range. The majority of the harvesting for commercial trading is undertaken by individuals usually farmers or hunters, or other rural people primarily involved in other occupations. Rattan harvesting provides many of these individuals with extra revenue, particularly in times of need such as for medical expenses or the payment of annual school fees (Trefon and Defo, 1998; Sunderland, 1998). Many cash-crop farmers also harvest rattan to obtain extra capital to purchase chemicals, planting stock and other necessary items for their primary occupation (*ibid.*). Despite the recognised capital returns of rattan harvest and sale, the unpleasant and difficult nature of rattan harvesting means that most harvesters state they would prefer to concentrate on their primary occupations given the opportunity.

In general, rattan harvesters tend to work in the same forest area, and return each time they need to cut cane. If the harvester is not an indigene of the area, the chief of the local village is paid a small retainer for providing access to the forest. The harvesters usually prefer to collect as close to a motorable road as possible to avoid head-portering the bundled canes too far. However, local scarcity near many urban centres now forces many harvesters further into the forest (Sunderland, 1998; Defo, 1999; Profizi, 1999). The added portage resulting from this increased range is slowly generating an increase in the raw cane prices, which is being felt at the market level.

Village-based harvesters transport the harvested rattan to the urban markets themselves, or they may sell at the village to a local trader who then transports the cane for sale to urban artisans. Some urban-based artisans harvest rattan themselves, although this is often only the case where there is close proximity to the wild resource. Falconer (1994), and Oteng-Amoako and Obiri-Darko (this volume) provide a good overview of the production to consumption system of rattan in Ghana, as do Defo (1999) and Sunderland *et al.*, (this volume) for Cameroon.

Although many of the commercial species of rattan respond well to selective logging activities, logging has also resulted in increased rattan exploitation. The development of a wide network of logging roads throughout many forest areas in West and Central Africa has enabled greater access to otherwise inaccessible areas of forest. Indeed, the logging trucks themselves are often known to be responsible for the transport of harvested rattan (Defo, 1997; Sunderland, 1998).

Indigenous management systems for the rattan resource in Africa are unknown, and, throughout its range, rattan is considered an “open-access” resource; there are very few, if any customary laws regulating the harvest of rattan from the wild. This is also mirrored in the National legislation for most countries. Those States that require the exploitation of forest products to be governed by the issue of licenses and permits, often do not adequately monitor the exploitation of these resource, nor receive the full forestry taxes related to that exploitation. In general though, many national forestry codes still do not include the exploitation of non-timber forest product in their regulations and the over-harvesting of many commercially important products, including rattan, continues unabated and uncontrolled. However, as will be discussed,

these legislative and institutional constraints to sustainability are currently being addressed.

Amount and value of the trade

Large quantities of raw cane enter the urban centres of West and Central Africa each day (Morakinyo, 1995; Ndoye, 1994; Falconer, 1994; Townson, 1995; Trefon and Defo, 1998; Defo, 1997; Sunderland, 1998; Defo, 1999; Sunderland 1999a; 1999b; Kialo, 1999; Minga, this volume; Holbech, 2000; Sunderland *et al.*, this volume; Oteng-Amoako and Obiri-Darko, this volume). Table 4 (below) summarises the findings of some of these studies where quantification of field data has been possible.

Table 4. The scale and value of the African rattan trade in selected urban markets

City (country)	Population (sample size)	Estimated amount of cane used / month (m)	Estimated mean annual value (US\$)	Reference
Lagos (Nigeria)	10,712,800 (not known)	180,000m	1,141,180	Morakinyo (1994)
Accra (Ghana)	1,512,800 (27 enterprises)	not known	64,080	Falconer (1994)
Kumasi (Ghana)	602,000 (11 enterprises)	not known	95,475	Falconer (1994)
Ankasa (Ghana)	Not known (12 markets)	4,300 m (all species)	62,000	Holbech (2000)
Bata (Equatorial Guinea)	80,000 (15 enterprises)	20,550m (all species)	27,400	Sunderland (1998)
Douala (Cameroon)	1,262,000 (25 enterprises)	26,955m (large dia.) 28,875m (small dia.)	127,405	Sunderland <i>et al.</i> , (this volume)
Yaounde (Cameroon)	1,157,400 (31 enterprises)	23,165m (large dia.) 29,765 (small dia.)	103,500	Sunderland <i>et al.</i> , (this volume)
Kinshasa (DR Congo)	2,456,000 (114 enterprises)	13,760m (large dia.) 14,448 (small dia.)	56,600	Minga (this volume)

Processing and transformation

Processing of raw cane essentially entails the removal of the epidermis (skin) from the stem and the drying of the raw cane prior to its use. Immature stems, or the very apex of mature stems, where the leaf sheath is also present are not used, and are often left or discarded at the time of harvest. The processing of raw cane throughout much of

Africa is undertaken manually, with the stems being scraped with kitchen knives to remove the skin followed by drying, usually undertaken in the open air. This rudimentary means of processing is not only labour intensive, but also results in inferior quality cane being available for artisan use and hence limits the value of the finished products. This inferior quality has also led to speculation that the quality of cane in Africa inherently poor (Dransfield pers. comm.). However, this speculation has not been supported by thorough anatomical studies and it is possible that if processed and transformed more efficiently cane from Africa could, in terms of quality, rival that of Asia.

There are also long-term conservation benefits from improved methods of processing and transformation. Most notable of these is the fact that a more durable and longer lasting product will ensure that less cane needs to be continually harvested from the wild. In addition, from the social perspective the advantages of urban artisans producing better quality products are clear and directly relate to the current DFID initiative of ensuring the valorisation of forest products contribute to overall poverty alleviation.

In this respect, there are currently initiatives to introduce appropriate processing and transformation technology from Asia that are suitable for the African milieu (Sunderland and Nkefor, 1999). A model processing unit has recently been constructed in Limbe, Cameroon and will be used primarily as a training and will function as a demonstration unit. Similar units will be established in Ghana and Nigeria over the course of the next two years.

Discussion: manifold routes to sustainability

The sustainable harvesting and management of the African rattan resource is primarily hindered by a paucity of a sound information on stocking, growth, yield and harvest intensity. In addition, the lack of adequate land and resource tenure precludes many attempts at long-term and sustainable harvesting and the fact that rattan is considered an “open-access” resource throughout much of its range mitigates the prospects for long-term sustainable management. However, a number of research strategies are currently being developed to address these shortfalls in baseline information and institutional and social constraints.

The harvesting techniques employed in the extraction of rattan in Africa, and which are generally the same despite the considerable geographic variation on the continent, have an impact on potential sustainability. Particularly for clustering species, the mature stems selected for harvest are those without lower leaves (i.e. where the leaf sheaths have sloughed off) and usually only the basal 10-20m is harvested; the upper “green” part of the cane is too soft and inflexible for transformation and is often left in the canopy. In many instances, all the stems in a cluster may be cut in order to obtain access to the mature stems; even those that are not yet mature enough for exploitation and sale. This is particularly an issue where resource tenure is uncertain or weak.

However, where resource tenure is somewhat more clearly defined, younger stems, are not removed and are left to regenerate and provide future sources of cane, usually on a 2-3 year rotation. Despite the fact that this example of better “stool management” relies on adequate land and resource tenure, there is considerable reason for optimism

in the African context. Currently there is a significant paradigm shift from the management of forest resources being controlled by the State to those of community-based management regimes. Formal legislation in this regard is now being developed and implemented in many rattan-producing countries. Through the empowerment of forest communities in this way there is significant potential to ensure the long-term sustainable, and equitable, exploitation of a wide range of forest resources, not only rattan.

Rattans are currently harvested exclusively from wild populations in Africa. Unlike some areas of SE Asia where rattan is traditionally cultivated as part of mixed gardens by sedentary cultivators, or is planted in recently-burned forest by shifting cultivators (Godoy, 1992), no known similar cultivation practices exist in West and Central Africa. However, the ecological and social factors prevalent here are favourable to the development of a cultivated and managed rattan resource.

In this regard, recent research by the African Rattan Research Programme has concentrated on aspects of seed storage and pre-treatments. The material made available by these trials has led to the recent establishment of an experimental silvicultural trial. The trial consists of a 1-hectare plot of *Laccosperma secundiflorum*, planted beneath obsolete rubber and has been undertaken in collaboration with the Cameroon Development Corporation (CDC). Further community-based trials, within the legislative context of community forest management, have also recently been established in Cameroon, soon to be followed by similar initiatives in Ghana and Nigeria. These latter trials are concentrating on the introduction of rattans into agroforestry systems and enrichment planting of farm bush and secondary forest. Annual growth rates as well as the economic viability of these cultivation systems are currently being monitored and assessed.

Recent initiatives aimed at introducing certification schemes for NTFP resources as well as for timber, also have potential for the sustainable management of the rattan resource in both Africa and Asia. Recent guidelines for the criteria for the certification of rattans have recently been developed by Sunderland and Dransfield (in press).

Conclusion

As essential biological, ecological and socio-economic information on the African rattan resource becomes available and suitable strategies to ensure sustainability are implemented, there is significant potential for the rattans of Africa to contribute significantly not only to the regional development of the resource, but also to the thriving global market. Through applied forest management regimes, and through the development of community-based management supported by appropriate legislative frameworks, African rattans could provide a real opportunity for the useful and sustainable development of rural areas as well as for forest conservation through extractive management. It is essential that baseline research contributes to the development and implementation of forest policy. The African Rattan Research Programme is working to provide the management guidelines necessary within the context of national forest legislation, for sustainability strategies to be adopted and adequately implemented.

Acknowledgements

I would like to thank the Central African Regional Programme for the Environment (CARPE), the United States Forest Service and the International Network for Bamboo and Rattan for funding the first phase (1996-2000) of the African Rattan Research Programme. The programme is now currently funded by the Forestry Research Programme (FRP) of the UK's Department for International Development (DFID) under grant number R7636 ZF0139.

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THE ANATOMY OF FIVE ECONOMIC RATTAN SPECIES FROM GHANA

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Introduction

The five economic rattan species which provide the raw material for the rattan cottage industry in Ghana are: *Eremospatha hookeri*, *Eremospatha macrocarpa* (Mfea), *Laccosperma secundiflorum*, *Laccosperma acutiflorum* (Eyie) and *Calamus deerratus* (Demmere) (Oteng-Amoako and Obiri-Darko, this volume).

In the wild, these species are easily identified by their morphological and taxonomical features like leaves, flowers, fruits and spines. However identification of different rattan species of equal stem diameter can pose a problem especially when all the vegetative features used in identification are removed. In addition to the identification problem, poor harvesting technique of rattan from the wild without cultivation have led to scarcity of rattan supply especially *Eremospatha macrocarpa* which is the most widely used and exploited species. Hence, the sustainability of the rattan industry in Ghana is threatened (Oteng-Amoako and Obiri-Darko, this volume).

Cultivation of rattans remains the best option for sustaining the industry. Therefore basic comprehensive research on rattans such as taxonomy, ecology and anatomy that would help the conservation of genetic resources and propagation of superior rattans is necessary. Study of the anatomy, in particular, will facilitate better identification and aid in understanding of species quality for future plantation establishment and hence enable us to widen the scope of the utilizable species in Ghana.

The main aim of this study therefore is to conduct a comprehensive study on the anatomical features of five economic rattan species of Ghana to aid in their identification, quality and understand their physical properties for effective development, processing and utilization.

Basic anatomy of rattan stems

The internal structure of rattan stem can be divided into four distinct zones:

- Epidermis;
- Hypodermis;
- Cortex and
- Central cylinder.

The epidermis, which is the outermost layer of the stem, consists of a single row of horizontally elongated cells. The cell size and lumen shape may vary depending on the species. In some species the epidermal cells is covered on the outside by a coating of cutinous or siliceous material. Very often the siliceous layer, cell lumen and shape of epidermal cells are found to be useful in identifying species (Siripatanodilok, 1982; Bhat, 1991).

The hypodermis when present is just below the epidermis is made up of one or two layers of unligified cells. Some species of rattan are devoid of hypodermis layer and hence may be a very good diagnostic feature (Bhat, 1991).

The cortex is found underneath the hypodermis or directly below the epidermis in species where there is no hypodermis. The cortex varies in width depending on the species or internodal level in the stem. The cortex contains parenchyma cells and in some species incomplete vascular bundles and fibre bands may be present (Weiner and Liese, 1988).

The central cylinder lies inner to the cortex and comprises scattered vascular bundles embedded in thin-walled parenchymatous ground tissue. A vascular bundle generally consists of vascular tissues, namely xylem including fibrous sheath and phloem. The xylem characteristically consists of a solitary or two wide metaxylem vessels and narrow protoxylem vessels, ranging from two to six or rarely eight or more on one side of the metaxylem (Weiner and Liese 1988; Bhat, 1991). Thin-walled xylem parenchyma cells are present interspersed with the vessels. The fibrous sheath is present as a cap to the vascular bundle away from the protoxylem vessels. The composition of vascular bundles and their various arrangements (patch-work-like, diffuse and ring) in the central cylinder are of very useful diagnostic feature (Weiner and Liese, 1988; Bhat, 1991).

The phloem which consists of 4 to 12 sieve tubes with companion cells is either divided into two strands or distributed on lateral sides of solitary metaxylem vessels or only single phloem field depending on the genera.

The thin-walled parenchymatous ground tissue consists of isodiametric or elongated cells with intercellular spaces. Some of the intercellular spaces often modify themselves as “mucilage canals” (Bhat, 1991). Weiner and Liese (1988), has revealed that, the shape and arrangement of the ground tissue parenchyma in cross section are important features for identification and outlined them as follows:

- ◆ "puzzle-like" (large and generally thin-walled parenchyma cells of irregular outline forming an interwoven network resembling that of a jigsaw puzzle; intercellular spaces large and numerous)
- ◆ "pebble-like" (smaller and thicker-walled +/- circular cells arranged in an alternating pattern; intercellular spaces small and inconspicuous)
- ◆ "net-like" (large and thin-walled cells +/- rectangular with rounder corners, arranged in an orderly opposite pattern with geometrically distributed interstices)

Rattan stem anatomy as basis for identification and quality

Identification

Recent studies show that most of the anatomical features are not rigid and species-specific and hence fail to offer diagnostic clues. For instance, different types of vessel perforation plates, viz. simple, scalariform as well as mixed scalariform and simple, occur not only within the same species but also in different species (Bhat *et al.*, 1988). However, based on these differences, keys to the identification of rattans of different

genera of Southeast Asia (Weiner and Liese, 1988; Liese and Weiner, 1989) and to species from South India (Renuka *et al.* 1987; Bhat *et al.* 1989) have been prepared.

Quality

The three most important structural features which determine rattan properties are; fibre wall thickness, proportion of fibrous tissue and the diameter of metaxylem (Bhat *et al.*, 1990; Bhat and Verghese, 1989). It is because of definite patterns of variation in these structures that rattan species behave differently at different points along the stem and between species. With higher proportion of fibres, thicker-walled fibres and narrower metaxylem vessels, the basal internodes and stem periphery are generally denser and stronger and have a lower rate of shrinkage than apical and central regions of the stem (Bhat, 1991). The fibre wall substance (or thickness) contributes to the basic density while the metaxylem vessel diameter is inversely related to basic density because it increases the void volume of the stem tissue. Therefore, with thinner wall, lower amount of fibre and wider metaxylem vessels, the apical younger internodes and the central core are weaker and have less utilization value than the basal and peripheral portions (Bhat and Liese, 1990). Similar anatomical explanation holds true for the interpretation of differences in behaviour between species (Yudodibroto, 1985; Bhat and Thulasidas, 1989).

Materials and methods

10-meter long matured stems of *Calamus deeratus*, *E. hookeri*, *E. macrocarpa* *Laccosperma laeve* and *Laccosperma sp.* collected from Asonti near Axim in the wet evergreen forest were used in this study. The mean diameters of the species were 8mm for *Eremospatha* 15mm for *Calamus* and 35mm for *Laccosperma*. From each sample⁴ of the species, 40mm samples were taken from the mid-section for anatomical studies.

To ensure very thin sections each 40mm sample was divided longitudinally into two diameter flanks for microtomy. Longitudinal and transverse sections of about 10-30µm were then prepared using a sledge microtome.

Permanent slides of species were prepared by mounting microtomed sections in canada balsam after staining with safranin and dehydrating in alcohol of increasing concentrations. The anatomical features were then studied using illumination light of a compound microscope. The composition and arrangement of various tissues of epidermis, hypodermis, cortex and central cylinder zones were observed and described. Various cell proportions of the central cylinder were determined by point sampling method using an eyepiece scale of 11 points placed progressively from the periphery towards the center of the section. Cell dimensions were determined using the eyepiece scale at a magnification of 200x.

Results

General features (all species)

⁴ Samples were collected and identified by Terry Sunderland of the African Rattan Research Programme.

The stem anatomy of the five rattan species was generally similar to other rattan species observed by Weiner and Liese (1992; 1994). All of the three genera investigated were distinctly made up of three zones of epidermis, cortex and central cylinder.

The epidermis of all the species had a single row of parenchyma cells and siliceous layer covering the epidermal cells. The cortex contains parenchyma, fibre bands and rudimentary vascular bundles. The central cylinder consists of vascular bundles embedded in parenchymatous ground tissue. The vascular bundle is composed of xylem and phloem, which are surrounded by fibre sheath and parenchyma tissue. The xylem vessels consist of a large round metaxylem vessel or two vessels and a small cluster of protoxylem vessels. The phloem is made up of different number of sieve tubes with companion cells.

Specialised features

The following diagnostic features were found in the species.

***Calamus* (*C. deerratus* -Fig. 1)**

Epidermal cells are rectangular(e), height almost twice the width with stomata (o) in the cuticular layer (Fig. 1b)

Two layers of unlignified parenchyma cells below the epidermis suspected to be the hypodermis (h), which has to be confirmed in an extended investigation.

The cortical zone (x) is 6 to 10 cells wide of varying sizes, rectangular with rounded corners, lignified and interconnected. The cortex is interspersed with small fibre bands.

The outer vascular bundles of the central cylinder are incomplete whilst the inner ones are complete and diffusely arranged. A complete vascular bundle consists of one large metaxylem vessel (m) with diameter range of 68-337 μ m and phloem fields (s) consisting of two strands of sieve tubes. The surrounding fibre sheath (f) is relatively extensive in peripheral vascular bundles but forms a small border in the inner vascular bundles is made up of thin-walled fibres. The protoxylem (p) consists mostly of cluster of 2 to 5 vessels but cluster of 6 to 10 vessels also occur in few vascular bundles.

The ground tissue parenchyma (g), polygonal and rectangular in shape, corresponds to "net-like" type in transverse section and in longitudinal section like "coins in a pile".

***Eremospatha* (*E. hookeri* -Fig.2 and *E. macrocarpa* -Fig.3)**

Epidermal cells are rectangular in *E. hookeri* (Fig. 2) but square in *E. macrocarpa* (Fig. 3).

The width of cortex *E. macrocarpa* is smaller, up to eight rows of cells than *E. hookeri* which exhibits up to about 14 rows of cortical cells. The first two rows of cortical cells are smaller, thick-walled and uniform in size than following ones. The

cortex consists of round shaped parenchyma cells which are interconnected. The cortical cells *E. macrocarpa* are relatively uniform in size but those of *E. hookeri* are variable sizes. In both species fibre bands are scattered in the cortex.

Rudimentary vascular bundles are located at the periphery of the central cylinder whilst fully differentiated vascular bundles are found in the inner central cylinder. First two rows of vascular bundles form a ring while the rest are diffusely arranged. The vascular bundles have 1 or 2 metaxylem vessels with diameter range of 81 – 227µm and one phloem field consisting of a cluster of 4 to 6 sieve tubes. Vascular bundles with one metaxylem vessel are few and more frequent at the periphery of the central cylinder whilst those with 2 metaxylem vessels are more in number and concentrated in the inner central cylinder. The protoxylem consists of a cluster 2 to 10 vessels per vascular bundle and is located directly opposite to the phloem field (Fig. 3a marked "x"). Vascular bundles of the central cylinder exhibit small border fibre sheath. In cross section the ground tissue corresponds to "net-like" type and in longitudinal section consist of "vertically elongated cells".

***Laccosperma* spp.** (*Laccosperma* sp. -Fig.4 and *Laccosperma laeve* -Fig.5)

Epidermal cells of *Laccosperma* sp. are rectangular in shape (Fig.4b) and that of *Laccosperma laeve* is square (Fig.5b).

The cortex, up to 16 cells wide, are thick-walled, lignified and of variable sizes and shapes. The first three row of cells of *Laccosperma* sp. are thick-walled sclerids with ramiform lumen followed by polygonal parenchyma. However, the first two rows cortical cells of *L. laeve* are square shaped thick-walled fibres and followed by combination of square and horizontally orientated cells. In both species, fibre bands surround rudimentary vascular bundles embedded in the cortex.

In both species, the vascular bundles at the periphery of the central cylinder are "patch-work-like" and inner ones "diffusely" arranged. The vascular bundle is composed of one metaxylem vessel of 40-203µm diameter and one phloem field consisting of a cluster of 4 to 10 sieve tubes located directly opposite the protoxylem (a cluster of 2 to 6 vessels). The extensive fibre sheath is very thick-walled with smaller lumen and highly lignified fibres. The fibre sheath of the outer vascular bundles almost encloses the entire vascular bundles. The inner vascular bundles of *L. sp.* and *L. laeve* exhibit "horseshoe" and "sickle" shaped fibre sheath respectively.

Thick-walled and lignified polygonal and rectangular parenchyma cells constitute the ground tissue. *Laccosperma* sp. ground tissue corresponds to "pebble" type in cross section and in longitudinal section consist of thick-walled polygonal and square parenchyma cells in rows interspersed with few vertically elongated cells. *L. laeve* ground tissue corresponds to "net-like" type and in longitudinal section like "coins in a pile".

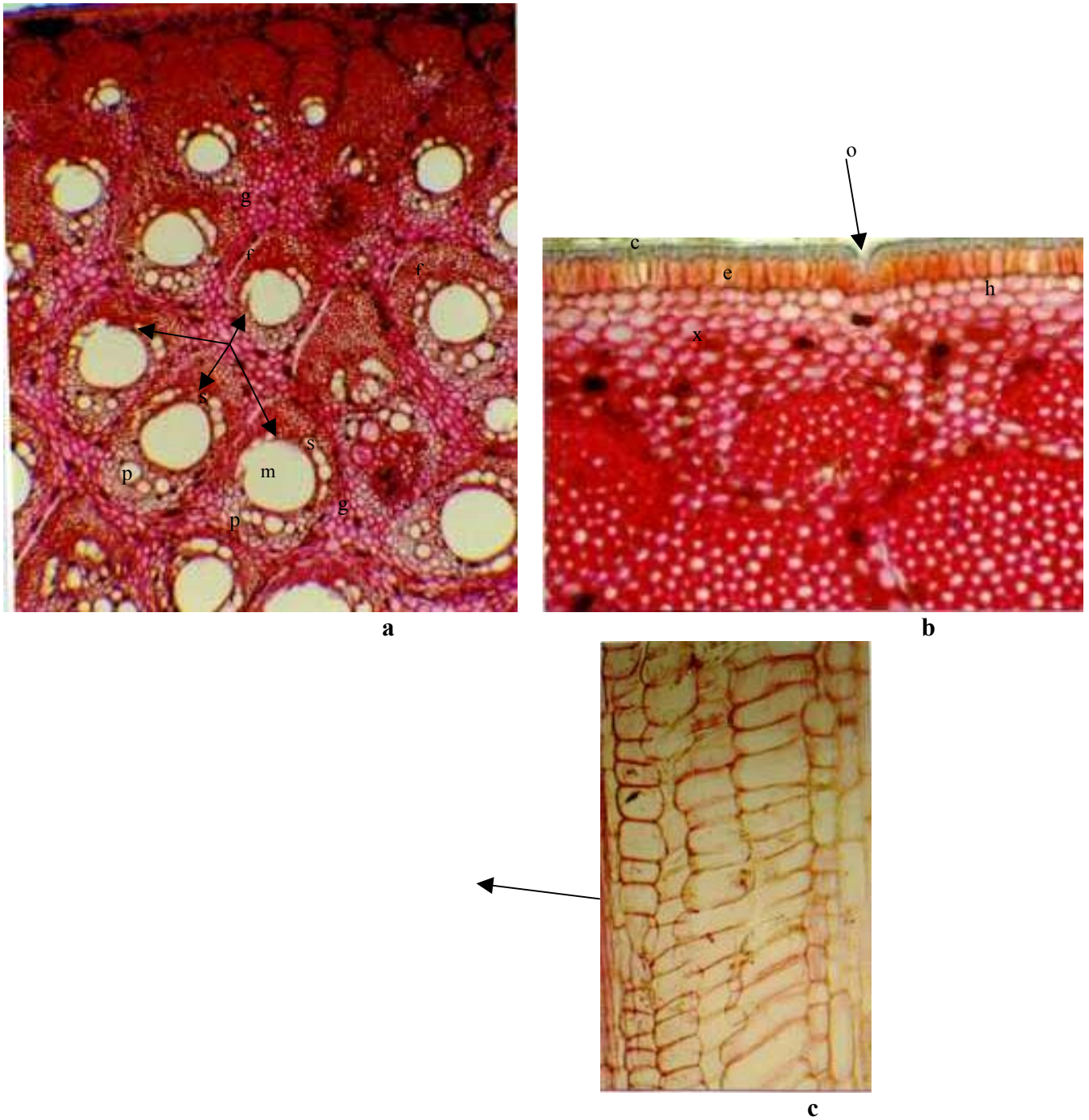


Fig.1: (a) Cross section of *Calamus deerratus* showing vascular bundles (arrowed) with single large metaxylem vessel (m), 2 phloem field(s) of 4 to 5 sieve tubes surrounded by fibre sheath (f) embedded in a "net like" ground tissue (g) (50x).
 (b) Cross section of *C. deerratus* showing rectangular epidermal cells (e) with stomata (o) with two layer hypodermis (h) (200x).
 (c) Longitudinal section of *C. deerratus* showing ground tissue parenchyma arranged like "coins in a pile" (arrowed) (200x)

Key

c=siliceous/cuticle layer; e=epidermis; h=hypodermis; x=cortex; m=metaxylem; p=protoxylem; f=fibre sheath; g=ground tissue parenchyma; s=phloem field consisting of sieve tube elements and companion cells.

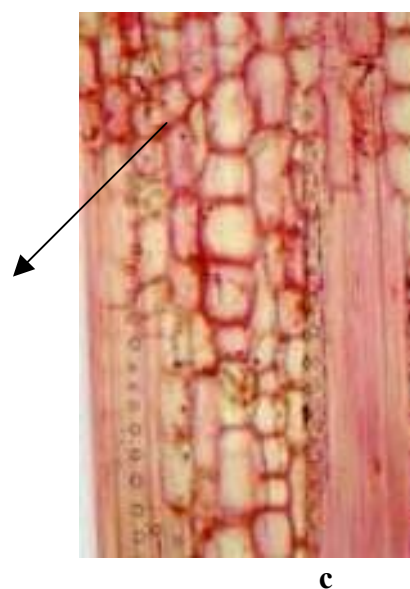
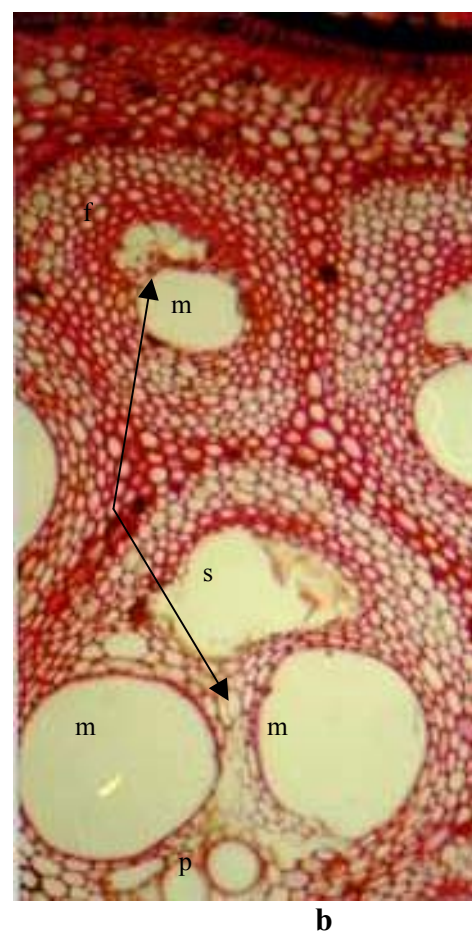
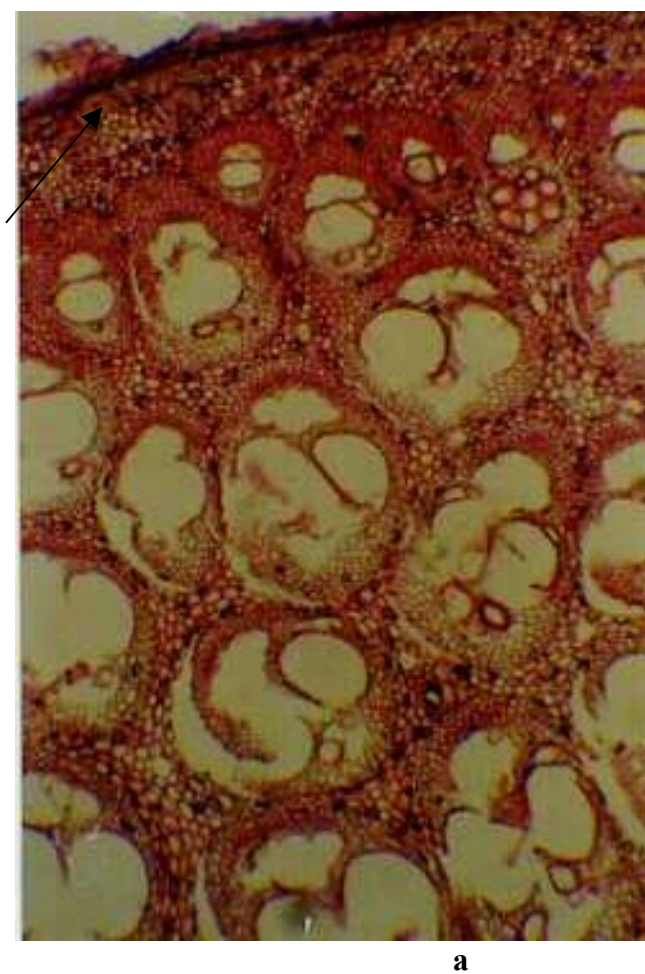
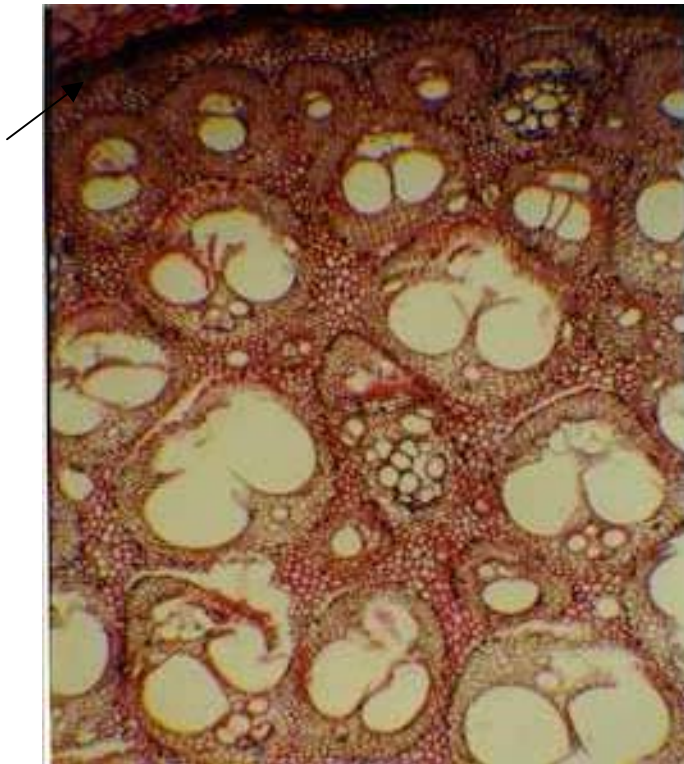


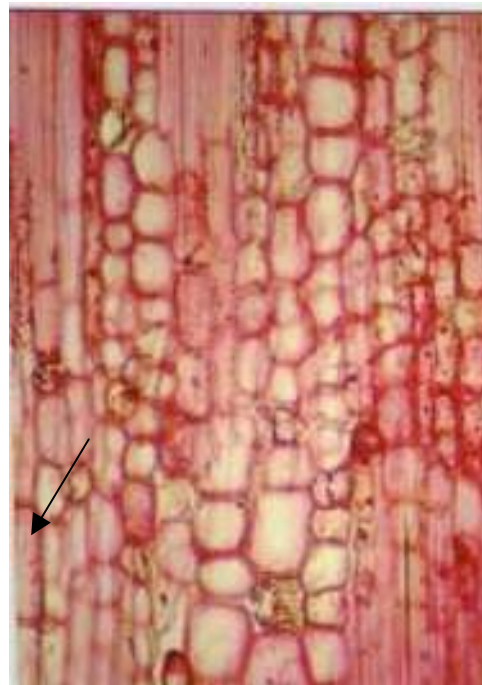
Fig.2: (a) Cross section of *E. hookeri* showing epidermis, cortex of up to 14 rows of cells (arrowed), and central cylinder consisting of vascular bundles and ground tissue parenchyma (50x)
 (b) Cross section of *E. hookeri* showing rectangular epidermal cells and two types of vascular bundles -2 metaxylem or 1 metaxylem vessels (arrowed) and small fibre sheath (marked "x") (200x).
 (c) Longitudinal section of *E. hookeri* showing ground tissue parenchyma consisting of vertically elongated cells (arrowed) (200x)



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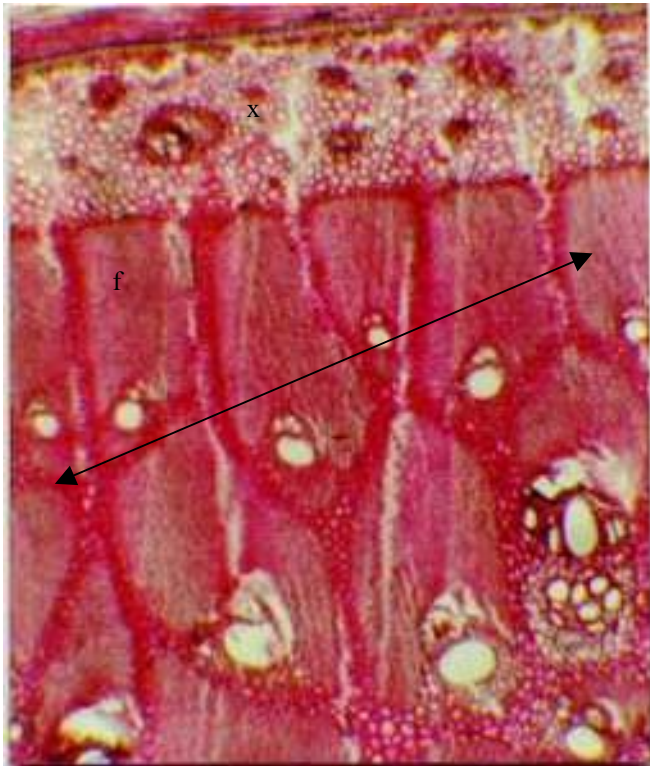


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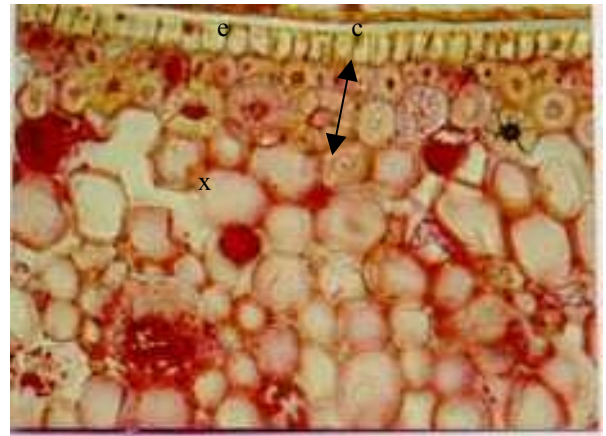


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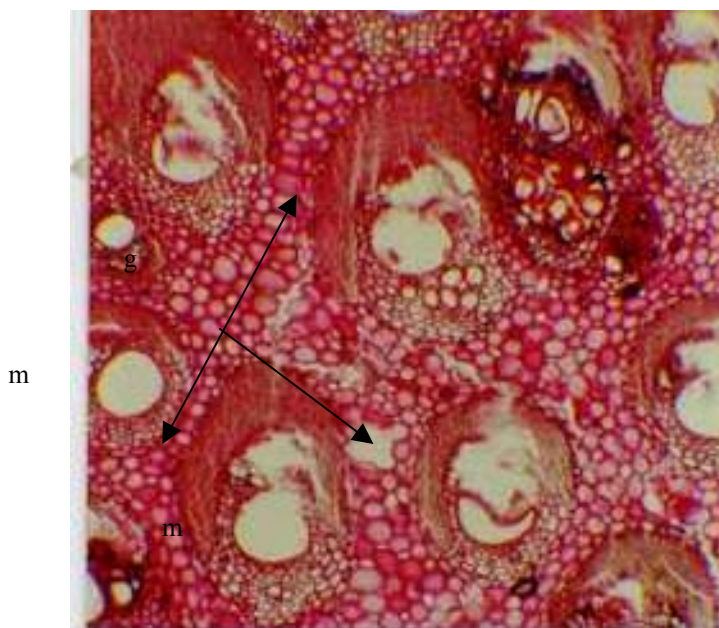
Fig.3: (a) Cross section of *E. macrocarpa* showing epidermis, up to 8 rows of cells (arrowed) central cylinder consisting of vascular bundles with 1 or 2 metaxylem vessels (50x).
 (b) Cross section of *E. macrocarpa* showing square epidermal cells (arrowed) (200x)
 (c) Longitudinal section of *E. macrocarpa* showing ground tissue parenchyma consisting of vertically elongated cells (arrowed) (200x).



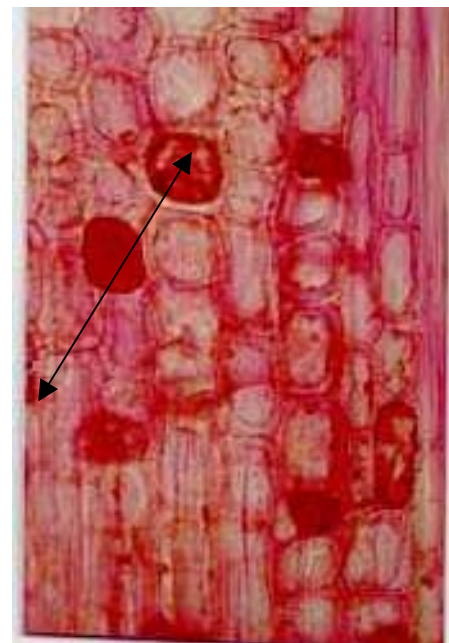
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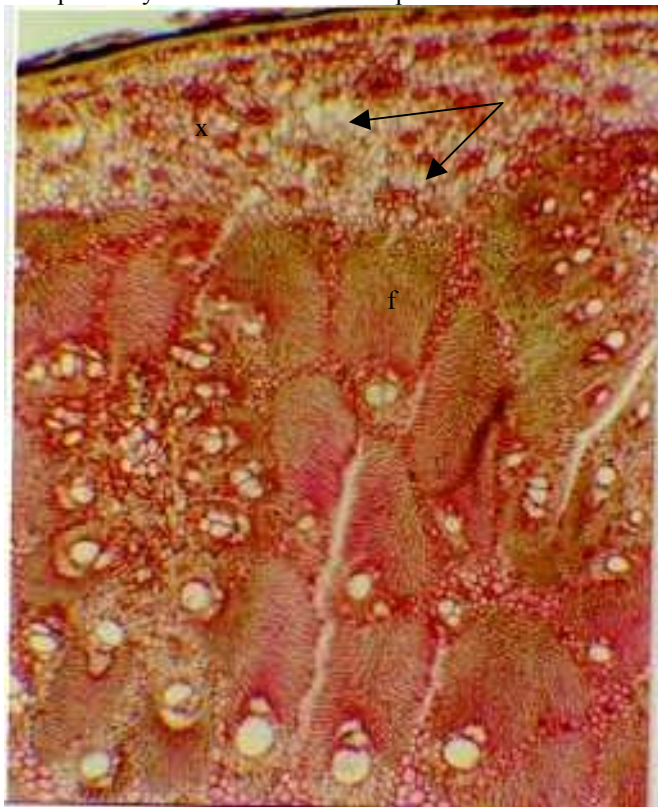
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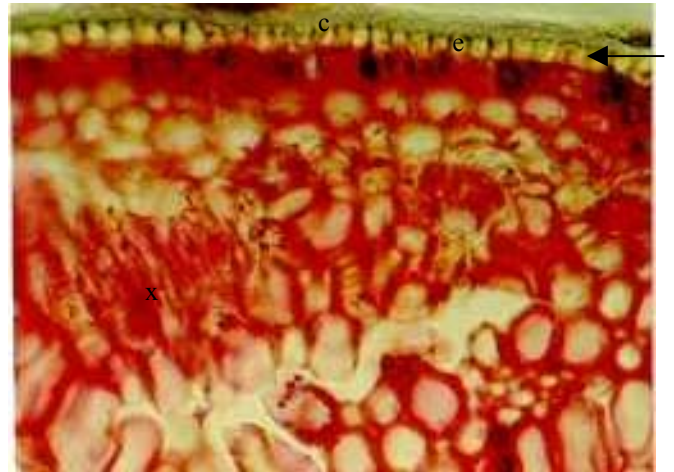
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Fig.4: (a) Cross section of *Laccosperma sp.* showing single layer epidermis, cortex (x) and "patch-work-like" arrangement (arrowed) of vascular bundles at the peripheral central cylinder (50x).
 (b) Cross section of *Laccosperma sp.* showing rectangular epidermal cells (e) covered with cuticle layer (c) and three rows of thick-walled sclereids (arrowed) just below the rectangular epidermal cells (200x).
 (c) Cross section of inner central cylinder of *Laccosperma sp.* showing diffusely arranged vascular bundles (arrowed) embedded in "pebble type" ground tissue parenchyma (g) (50x)

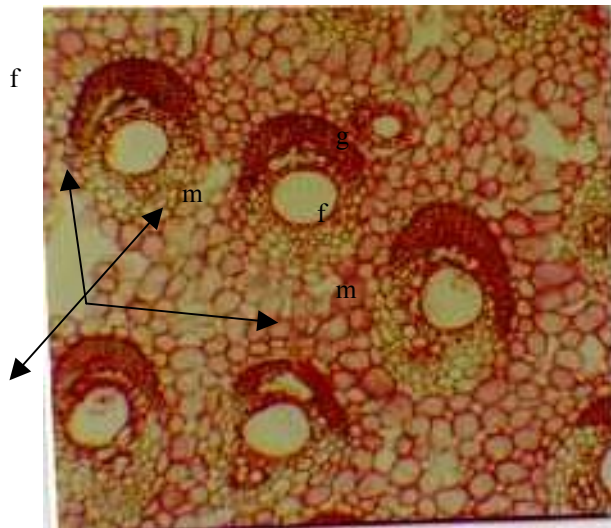
(d) longitudinal section of *Laccosperma sp.* showing ground tissue consisting of thick-walled, polygonal and square parenchyma cells in rows interspersed with few vertically elongated cells (200x)



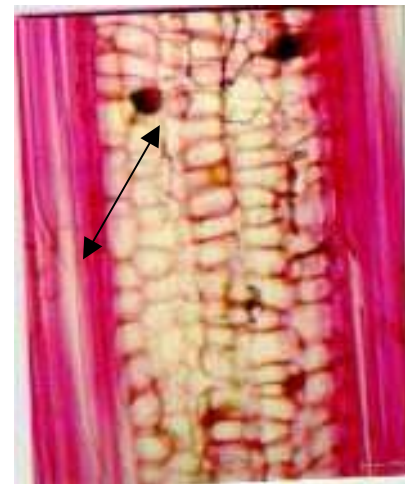
a



b



c



d

Fig.5: (a) Cross section of *Laccosperma laeve* showing epidermis (e) , cortex (x) consisting of thick-walled, square and horizontally orientated cells (arrowed) (50x)
 (b) Cross section of *L. laeve* showing square epidermal cells (arrowed) (200x)
 (c) Cross section of inner central cylinder of *Laccosperma laeve*. showing diffusely arranged vascular bundles (arrowed) embedded in "pebble type" ground tissue parenchyma (g) (50x)
 (d) Longitudinal section of *Laccosperma laeve* showing ground tissue parenchyma arranged like coins in a pile (arrowed) (200x)

Table 1: Comparison of some anatomical features of the five species

	<i>C. deerratus</i>	<i>E. hookeri</i>	<i>E. macrocarpa</i>	<i>L. sp.</i>	<i>L. laeve</i>
Epidermal cell dimensions (µm)	13 x 27	12 x 15	12 x 12	12 x 18	13 x 13
Cortex width (µm)	54 – 135	68 – 203	81 – 121.5	230 – 400	243 – 540
Vascular bundle diameter (µm)	509(270-729)	440(176-743)	465.8(162-662)	589.5(270-756)	402(324-473)
Number of vascular bundle per mm ²	4(3-5)	4(3-5)	4(3-5)	4(3-6)	4(3-6)
Metaxylem vessel diameter (µm)	252(68-338)	h ₁ =83.7; h ₂ =78;227(54-338)	m ₁ =81;m ₂ =98.3;224(54-310)	148(40-203)	116(41-135)
Fibre width (µm)	16(12-21)	23.5(18-30)	20(15-27)	20(15-21)	16(9-21)
Fibre lumen (µm)	10(6-15)	17(9-24)	14.42(6-21)	9(6-18)	5(3-9)
Double fibre wall thickness (µm)	6(4-6)	6.5(3-9)	5.58(3-9)	11(6-18)	11(6-15)
Fibre proportion(%)	15.97	14.58	16.7	31.7	20.8
Xylem vessels(P&M)proportion (%)	26.39	28.47	35	11.7	9
Phloem proportion (%)	7.64	6.25	5.6	2.5	4.9

h₁ &h₂=Mean diameter of 1&2 metaxylem vessels respectively of *E hookeri*

m₁&m₂=Mean diameter of 1&2 metaxylem vessels respectively of *E macrocarpa*

P= protoxylem

M=metaxylem

Discussions

Anatomical Differences between Genera

The five economic rattan species of Ghana can be grouped into their respective genera viz. *Calamus*, *Eremospatha* and *Laccosperma* by the number of metaxylem, phloem fields and arrangement of their vascular bundles.

Calamus exhibits one large metaxylem vessel and two phloem fields consisting of 4 to 6 sieve tubes each in single files located laterally about the metaxylem vessel. The vascular bundles are diffusely arranged (Fig. 1a). In contrast, the vascular bundles of *Eremospatha* consists of one or two metaxylem vessels and one phloem field consisting of a cluster of 4 to 6 sieve tubes located directly opposite the protoxylem vessels (Fig. 2a, 2b and 3a). The first two rows of vascular bundles form a ring but the inner ones are diffusely arranged (fig. 2a and 3a). *Laccosperma* is however distinguished from the other genera by having one small metaxylem vessel and one phloem field (consisting of a cluster of 4 to 10 sieve tubes) also located directly opposite the protoxylem vessels of a vascular bundle (Fig. 4a, 4c, 5a and 5c). The outer vascular bundles is "patch-work-like" arranged (Fig. 4a and 5a) and following ones diffusely arranged (Fig. 4c and 5c). *Laccosperma* can further be distinguished from *Calamus* and *Eremospatha* by its highly extensive fibre sheath (consisting of thick-walled and strongly lignified fibres) of the outer vascular bundles (Fig. 4a and 5a).

Anatomical differences between species

Species within a particular genus can further be distinguished from each other by the following: morphological variations of epidermal cells; nature, structure and arrangement of cortical cells; and arrangement of ground parenchymatous cell in transverse and longitudinal sections.

Calamus deerratus, the sole representative of *Calamus* in Africa, differs from all the other African rattan species by the occurrence of stomata among the rectangular epidermal cells (Fig.1b). Within the genus *Eremospatha*, *E. hookeri* is differentiated from *E. macrocarpa* by rectangular epidermis and a wider cortex of 6 to 14 rows of cells wide (Fig. 2a) consisting of cells of variable sizes (Fig.2b) compared to *E. macrocarpa* which has cortex of 6 to 8 rows of cells (Fig 3) consisting of uniform cortical cells and square shaped epidermal cells (Fig. 3a, 3b). In the genus *Laccosperma*, *L. sp.* is differentiated from *L. laeve* by having rectangular epidermal cells and polygonal cortical cells of which the first 3 rows are thick-walled sclerids (Fig. 4b). In contrast, *L. laeve* have square shaped epidermal cells and the cortex consist of square shaped and horizontally orientated cortical cells which are not connected (fig. 5b). *L. laeve* is further differentiated from *L. sp.* in the cross section by having a "net-like" type ground tissue parenchyma (fig. 5c) and in longitudinal section "like coins in a pile" (Fig. 5d) as oppose to "vertically elongated" cells of *L. sp.* (fig. 4c).

Quality of rattan stems

Anatomical features such as phloem percentage, diameter and number of vascular bundles do not differ much in all the rattan species studied (Table 1) hence are not likely to be useful parameters to explain the behaviour or quality of the different rattan species. However, fibre wall thickness, proportion of fibre tissues and metaxylem vessel diameter differ greatly especially between different genera (Table 1). Therefore they are used to explain the quality behaviour of different genera. Previous studies by Bhat *et al.* (1990), Bhat and Verghese (1989), revealed that the three most important structural features that appear to determine rattan behaviour are fibre wall thickness, proportion of fibrous tissue and metaxylem vessel diameter.

Because of relatively higher proportion of thick-walled fibres and narrower diameter of metaxylem vessels, *Laccosperma spp* are expected to have higher density and strength properties than the stems of *Eremospatha* and *Calamus sp.* which have relatively higher proportion of thin wall fibres and larger metaxylem vessels (Table 1) which contributes to greater void volume of the stems resulting in lower density and strength.

The study revealed that fibre wall thickness, fibre proportion and metaxylem diameter which are the likely determinants of rattan quality do not differ very much in *Calamus* and *Eremospatha spp* and therefore are expected to be in the same density and strength groupings.

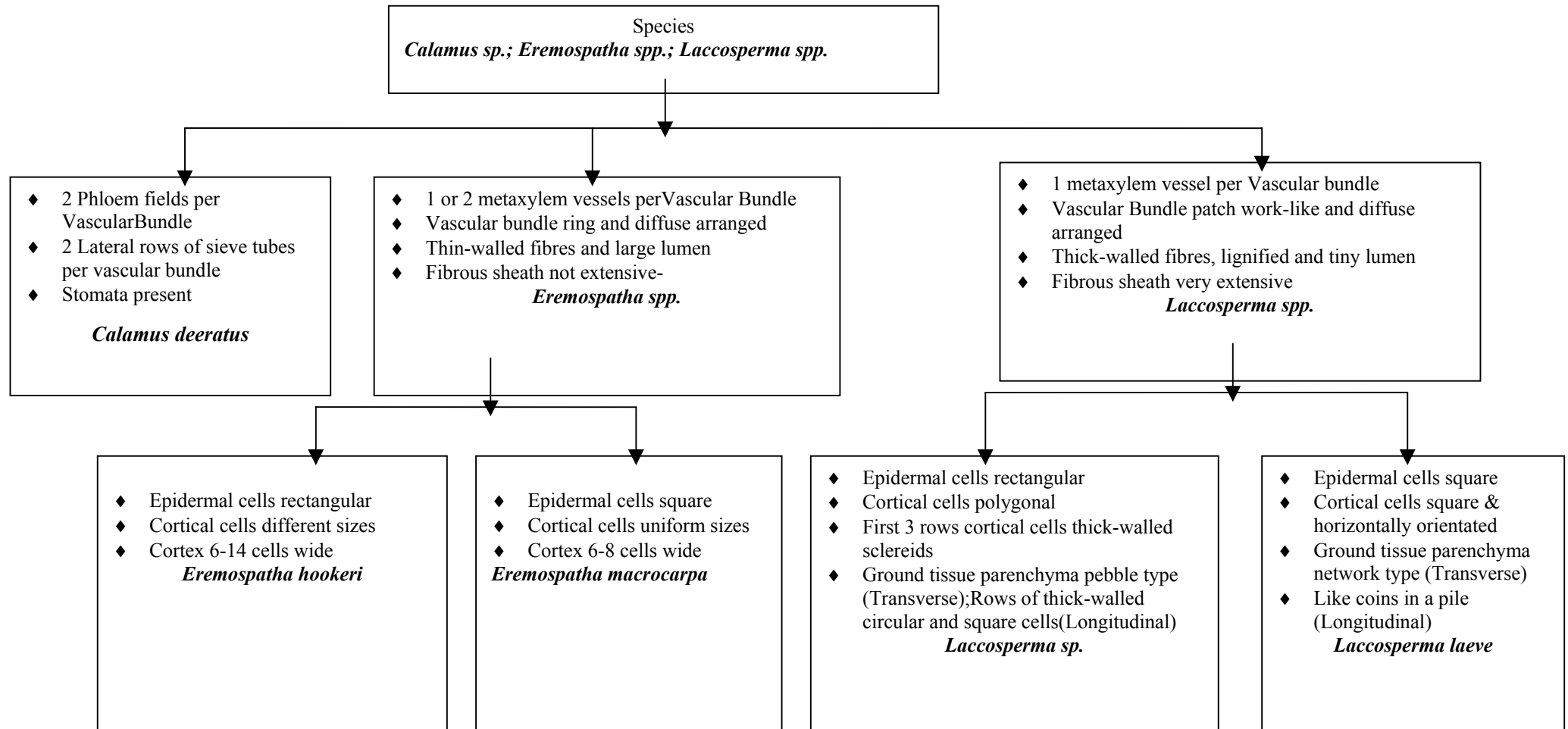
The pertinent question is why are *Eremospatha spp* utilized more than *Calamus* in Ghana?. According to a recent study on production to consumption system of rattan industry sector in Ghana, only 7% of the respondents utilized *Calamus sp* with 47% and 46% of respondents using *Laccosperma* and *Eremospatha spp.* respectively (Oteng-Amoako and Obiri-Darko, this volume).

The study suggests that a more extensive anatomical, density and physical properties investigation is necessary to determine interrelationships between the three properties and the extent of stem-to-stem variation to aid in identification. A thorough understanding of stem quality and density variation within species will be needed for rattan improvement programmes and for plantation establishment.

Conclusion

The primary objective of this study was to use the anatomical features for identification purposes. Consequently a dichotomous identification key has been developed for the five economic rattan species based on their identification features as shown in Table 2. The key first differentiates between the three genera of rattan and then the species within a genus.

TABLE 2: A DICHOTOMOUS IDENTIFICATION TABLE FOR FIVE ECONOMIC RATTAN SPECIES STEMS OF GHANA



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RATTAN PALMS IN THE DJA BIOSPHERE RESERVE (CAMEROON) AND ITS PERIPHERY: DISTRIBUTION AND DENSITY OF COMMERCIAL SPECIES

Z. L. NZOOH DONGMO, B. A. NKONGMENECK, & R. C. FOTSO

Summary

African rattan palms, which belong to genera different from those of South-East Asia, are still poorly known today. To contribute to the knowledge we have about these plants, we prospected the Dja biosphere reserve (Cameroon) and its periphery. This prospection involved the transect method and noting of stem density of commercial species. This survey enabled the identification of 9 different species belonging to 4 genera of African rattan palms. It also enabled the localisation of important rattan palm stands that were composed of different species within the Dja forest ecosystem. These stands are found within glades. In the north west part of the reserve, glades of *Laccosperma secundiflorum* found on ochre red ferrallitic soils cross on each other. To the west and to the south of the reserve, numerous glades of *Oncocalamus mannii* found on brown sand-clay ferrallitic soils converge. In the south east zone (to the south of Lomié) characterised by a stony ferrallitic substratum, very few glades of rattan were found.

In the areas exploited by villagers, the average density of commercial rattan palms in their respective preferential habitats varied from 44 to 1493 climbing stems per hectare.

Key words: Rattan palms, glades, densities, Dja biosphere reserve.

Introduction

Rattan figures among the most important non-timber forest products. It generates increasing revenue in countries of the humid forest zones of South-East Asia and Africa (Falconers, 1992; WWF, 1994; Morakinyo, 1994; Siebert, 1994; Ndoye, 1995; Appanah *et al.*, 1998). Natural stands of rattan palms are growing thinner with an ever-increasing market demand. Whereas knowledge about their diversity as well as abundance remain very low. One of the hindrances to this knowledge is the limited number of herbarium collections, particularly in the case of the Central African humid dense forests (Morakinyo, 1994). The most important actions among others aimed at ensuring the conservation of rattan palms are studies that would contribute to the improvement of our knowledge on taxonomy and phytogeography of rattan palms. In this respect there exist studies carried out by Profizi (1986), Morakinyo (1994) and (1995), Tuley (1995), Sunderland (1997) and (1998). These studies were undertaken using data from herbarium sample sheets and or using data from field surveys.

This work is a contribution to better knowledge on the diversity and phytogeography of rattan palms in the Central African humid forest zones. The objective is to come out with an inventory of the different rattan species in the Dja biosphere reserve and its periphery, to determine their geographical distribution as well as their various stands, and the quantities of commercial species exploited by villagers. The distribution of rattan palms stands among other objectives will contribute to the elaboration of the Dja vegetation map. Given the economic importance of rattan, a better knowledge of rattan palms potential in the Dja biosphere reserve and its periphery may enable the development of a rational system to reduce the present hunting pressure on this protected area.

Site of study

The Dja biosphere reserve (2°50' and 3°30' N, 12°20' and 13°40' E) and its periphery is situated in the south east of Cameroon. Its altitude varies between 500 and 700m. The climate is the equatorial type with four seasons: two dry seasons with the longer one from November to February and the short one from June to July; two rainy seasons with the longer one from August to October and the short one from March to May. Average annual rainfall is more than 1500 mm and annual temperatures vary between 23.5°C and 24.5°C (Sonke, 1998). Being a meeting point between the low Guinea vegetation and the Congo basin, the Dja biosphere reserve belongs to the Guineo-Congolian evergreen forest sector and more precisely to the Congolian district of Dja (Letouzey, 1985).

Methodology

An inventory of the different species of rattan palms was undertaken and their distribution noted, in the course of prospection. The stem densities of commercial species of rattan palms in zones used by villagers (less than 10km in to the reserve) were evaluated by counting their stems.

Prospection

Prospection was undertaken along transects and incursions, within the Dja biosphere reserve (DBR) and its periphery. These transects are notably: the north-south transect of Djolimpoum (34.14 km), the west-east transect of Mekas (10 km), the East - West transect of Djomedjo (10 km), the south-north transect of Alat-Makay (10 km). Incursions of 7 to 10 km long and 2 to 4 km wide were made on both sides of paths crossing the different villages of the DBR and its periphery (Figure 1). Different species of rattan palms were located, harvested and identified in the course of prospection. Rattan palms species were determined on the one hand by comparing our samples with those of the National Herbarium of Cameroon and on the other hand, using the articles of Tuley (1995), Morakinyo (1994) and Profizi (1986). The different glades or deadwood patches bearing rattan palms were equally located. The species diversity of rattan palms as well as the nature (colour and texture) of the soil and the topography were noted for each of these glades.

Enumeration

Stem counting was undertaken within quadrants of 20 x 20m. These were delimited within the preferential habitat of each of the commercial rattan palm species. On the one hand census was based on seedlings resulting from seed germination and on the other hand on clones (vegetative multiplication). In each clone, counted stems were distributed according to growth stage. These are:

- **Seedling stage**, comprising erect young stems (bearing juvenile leaves); these stems are generally less than 3 m tall.
- **Juvenile stage**, comprising young climbing stems having anchor organs with those of the base falling off or staying on. The leaf sheath of their base inter-nodes remain green.
- **Adult stage**, comprising mature climbing stems. Mature stems as described as by Nur (1992) have completely dry leaf sheath at their base and no longer carry fragmented or rotten thorns.

Results

Diversity and geographical distribution of species

We harvested and identified nine species of rattan palms belonging to 4 African genera. These are *Calamus deërratus*, *Eremospatha macrocarpa*, *Eremospatha hookeri*, *Eremospatha wendlandiana*, *Eremospatha sp.1*, *Eremospatha sp.2*, *Laccosperma secundiflorum*, *Laccosperma opacum*, and *Oncocalamus mannii*. The morphological description of the different species is given in table 1 and 2. Illustrations are shown in plates 1 to 4. These species are distributed into 3 groups according to the location of their area of distribution within the DBR:

- The first group comprises species that are found in the whole region. These are *C. deërratus*, *E. macrocarpa*, *Eremospatha sp.1*, *L. secundiflorum* and *L. opacum*.
- The second group comprises species found in the west and south of the DBR and are absent in the north and in the north east of the reserve. These are *O. mannii* and *E. hookeri*.
- The third group comprises species found in the south of the DBR. These are *E. wendlandiana* and *Eremospatha sp.*

Intersecting glades of rattan palms are composed of different species. They are either found on ancient village settlement sites or along elephant passage corridors, or on soils of gentle slope and shallow water table.

In the north west of this reserve are found glades dominated by stems of *Laccosperma secundiflorum* interspersed with those of *Eremospatha sp.1* and *E. macrocarpa*, on ochre red ferralitic soils. In the west and south of the reserve are found glades dominated by

stems of *Oncocalamus mannii* on brown sandy ferrallitic soils. These are interspersed with stems of *E. hookeri* in the west and stems of *Eremospatha sp.2 E. macrocarpa* and *E. hookeri* in the south.

In the Southeast zone (south of Lomié), characterised by a stony ferrallitic substratum and a succession of valleys, the glades found are few and dominated by *O. mannii*.

Densities of commercial species in zones under village use

Rattan palms species used by the population are *Laccosperma secundiflorum*, *Eremospatha macrocarpa*, *Oncocalamus mannii*, and *Calamus deërratus*. *L. secundiflorum* is a highly heliophilic species that it produces large diameter stems used as braces for the making of objects. An inventory of the stems of this species was carried out in 32 plots within glades in the Etou-Schouam sector. Results reveal a great density variation from one glade to the other (high standard deviation). Adult stems are highest in number (Table 3). In the case of climbing stems (both juvenile and mature), the maximum density is 2,375, minimum density 400 and average, 954 ± 551 stems per hectare.

Oncocalamus mannii is a species whose stems are used as assembly ropes in the absence of *E. macrocarpa*. Stem counting of this species was undertaken in 40 plots (20 in glades within the Meka sector (west of the DBR) and 20 others in glades within the Mbouma sector (south of the DBR). Irrespective of the stage of development, the densities obtained in the 2 sectors are not significantly different. It varies greatly (high standard deviation) from one glade to the other like in the preceding case. Adult stems are the highest in number (table 4). Globally, for all climbing stems (both mature and juvenile), maximum density is 3025, the minimum density 400 and average, 1492 ± 637.1 stems per hectare.

In the case of *Eremospatha macrocarpa*, stem counting was undertaken within 40 quadrants (20 within glades, 20 in high canopy primary forest found on stable ground). These 40 quadrants are distributed along the first 10km of the Djolimpoum line. The densities obtained in the two types of milieu are not significantly different. This is irrespective of the stage of development. These densities vary greatly (high standard deviation) from one sector to the other like with the other species. Adult stems are equally the highest in number (Table 5). For both juvenile and mature stems the maximum density is 625, the minimum density 12 and average, 230.9 ± 185.7 stems per hectare.

Calamus deërratus is the species used by women in weaving baskets. Stem census for this species was undertaken in 40 quadrants within large gaps in marshy forest. These quadrants were distributed along the first 10km of the Djolimpoum line. Obtained densities equally vary from one sector to the other. For climbing stems (both juvenile and mature), the maximum density is 80, the minimum density and average, 44.67 ± 22.75 stems per hectare. Contrary to the preceding species it is the young plants that are more numerous.

Discussion and conclusions

Nine species of rattan palms belonging to four African genera were identified in the Dja biosphere reserve and its periphery. Considering this number, the Dja biosphere reserve and its periphery therefore figure among the regions of high rattan palm density in the African humid dense forests zones. This is also the case of Rio Muni (Equatorial Guinea) with 10 species (Sunderland, 1998) and Cross River State (Nigeria) with 7 species (Morakinyo, 1994).

The different species are divided into 2 groups relative to the location of their growing area in the DBR. According to the studies of Profizi (1986), Morakinyo (1994), Sunderland (1997) and (1998);

- Species found in the whole region are widespread in the Guinea zone.
- Species found in the west and south of the DBR are most often in the Biafra type Atlantic forest of the Niger delta of Southeast Cameroon and in the south of Libreville (Gabon). The east limit of this Atlantic forest as defined by Letouzey (1985) being close to the west of the DBR, the presence of these species in the Congolian forest should be as a result of progressive dispersal of their seeds by squirrels, hornbills other birds and monkeys. They are species of regional distribution.

This distribution of rattan palm species as well as the distribution of the various stands observed reinforces floristic heterogeneity of the Dja forest mass. A heterogeneity, which owes to the fact that it, is a junction zone between the low Guinea domain and the Congo basin.

In zones that are under village use, the average densities of commercial species of rattan palms in their respective preferential habitat vary from 44 to 1493 climbing stems per hectare. The species *Calamus deerratus* had the lowest densities whereas *Oncocalamus mannii* had the highest densities. In the case of *Laccosperma secundiflorum*, *Eremospatha macrocarpa* and *O. mannii*, when distributed according to their stage of development, the densities of their adult stems are higher than for those in other stages. The stems of these species grow normally from one stage of development to the other in their respective preferential habitats.

Given these high densities, we need a better understanding of the renewal capacity of the natural stands of these species, the growth and development rates of their stems, as well as the time taken by a young plant to attain maturity. All these will enable the putting in place of a mechanism for their sustainable management.

Besides a better understanding of preferential habitat characteristics of the different species and the nature of the links between their stems and other components of the milieu (trees, shrubs, climbers, grasses, animals) shall contribute in supporting silvicultural programmes. Such silvicultural programmes among other objectives is aimed

at enriching with rattan palm stems with the intention to substitute currently over exploited natural stands.

Acknowledgements

This work was done within the framework of ECOFAC, under the Cameroon component programme entitled "Conservation et Utilisation Rationnelle des Ecosystèmes Forestiers d'Afrique Centrale" and under the guardianship of the Ministry for the Environment and Forests. The authors express their gratitude to both Cameroonians and foreigners in the management of this programme, as well as to all other members of their team for facilitating research in the field. Thanks also go to Piau Damien for his assistance during data collection, Mr. Sonwa J. Denis for his assistance in the form setting of this article. Thanks equally go to the management of the African Rattan Research Programme for offering the opportunity to participate in this workshop.

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Table 1: Morphological characteristics of species of the genus *Eremospatha*

Morphological characteristics			<i>E. macrocarpa</i>	<i>E.hookeri</i>	<i>E. wendlandiana</i>	<i>E. sp.1.</i>	<i>E. sp.2</i>
Distinctive characteristics	Number of stems of the clone		2 to 40	2 to 4	2 to 10	2 to 4	2 to 10
	Stems at maturity	Configuration	1 axis	++axis	1 axis	++ axis	1 axis
		Length (m)	50 - 100	...	50 - 100	...	50 - 100
		Diameter (cm)	1 - 4	0.8 - 2	1 - 4	0.8 - 1.5	1 - 4
	Leaves	Rachis (m)	1.5 - 2.5	0.5 - 1	0.5 - 1	0.3 - 0.5	0.5 - 1
		Cirrus (m)	2 - 3	0.3 - 0.75	1 - 1.5	0.3 - 0.5	1 - 1.5
	Leaflets	Number (paired)	30 - 40	8 - 20	7 - 15	8 - 10	7 - 15
		Form	Covered with ribbons and pointed at the top, with projecting nervures on the lower face	Lanceolate with projecting nervures on the upper face	Rhomboid tough and elongated	Oblong	Obovoid and elongated
		Dimension (cm)	20-30 x 2-3	4-16 x 1.5-8	9-15 x 15-30	2-8 x 8-20	4-8 x 15-30
	Inflorescence	Length (m)	0.5 - 1.5		0.5 - 1.5	0.2 - 0.3	
		Colour of flowers	Violet			Beige	
	Fruit	Shape	Ovate with round base and truncated top		Oblong with rounded base and truncated top	Oblong with round bases and truncated top	
	Size (cm)	1 - 1.5 to 3		1 - 2 to 3 - 5			
Common characters	Glabrous leaf sheaths (without thorns), pleonantic inflorescence (axillary) with 2 axis. Cirrus having harpoon-shaped small hooks, leaflets of the base of the rachis with prickly hairy edges, petioles absent on leaves of juvenile stems; the petioles of the leaves of seedlings carry hook-shaped prickly structures; fruits have scales, are orange in colour and becomes red at maturity.						

Table 2: Morphological characteristics of species of the genus *Laccosperma* and the species *Calamus deërratus* and *Oncocalamus mannii*

Morphological characteristics			<i>Laccosperma</i> genus		<i>Calamus deërratus</i>	<i>Oncocalamus mannii</i>
			<i>L. secundiflorum</i>	<i>L.opacum</i>		
Distinctive characteristics	Number of stems of the clone		2 to 60	2 to 3		2 to 35
	Mature stems	Configuration	1 axis	++ axis	1 axis	1 axis
		Length (m)	45 - 60	5 - 10	50 - 150	50 - 150
		Diameter (cm	4 - 5	1 - 2	1 - 3	3 - 5
	Leaves	Rachis (m)	2.5 - 3	0.5 - 1	0.5 - 1.5	1 - 1.5
		Cirrus/flagellum (m)	1.5 - 3	0.15 - 0.5	2 - 3.5	2 - 3
	Leaflets	Number (paired)	40 - 75	7 - 10	20 - 35	30 - 40
		Shape	Covered with hanging ribbons, slender at the top	Oval	Covered with ribbons, slender at the top	Covered with ribbons, slender at the top
		Dimension (cm)	20 - 30 x 3 - 9	20 - 30 x 3 - 9	25 - 50 x 1 - 2	30 - 35 x2 - 3
	Inflorescence	Length (m)	0.5 - 1.5	0.2 - 0.5	0.1 - 0.2	0.5 - 1.5
		Fruit form	Ellipsoidal	Round	Ellipsoidal to oval	Round
		Fruit size (cm)	0.7 - 1.5 x 1 - 2	1- 1.5 x 1 - 2.5	1 - 1.5 x 1 - 2.5	1 - 1.5 x 1 - 1.5
	Seedling (petiole)		Long and pointed thorns	Less pointed thorns	Long and pointed thorns	Petioles void of thorns
Other characteristics		Hapaxanthic inflorescence (terminal) leaf sheath bearing numerous slender thorns, thorny cirrus endowed with small hooks in the form of a harpoon		Thorny flagellum rising from the leaf sheath; inflorescence carried by this flagellum. Leaf sheath furnished with many sharp structures.	Pleonantic inflorescence, leaf sheath with numerous easy falling black thorns	

Table 3: Average densities per development stage of stems of *Laccosperma secundiflorum*

	Sexual multiplication	Vegetative multiplication			
	Seedlings	Number of clones per hectare	Total number of stems per hectare, and per stage of development		
			Seedlings	Juvenile stems	Adult stems
Average	140,40	68,27	124,63	326,22	628,10
Standard deviation	49,00	35,64	46,62	188,50	362,93

Table 4: Average densities per development stage of stems of *Oncocalamus mannii*

	Sexual multiplication	Vegetative multiplication			
	Seedlings	Number of clones per hectare	Total number of stems per hectare, and per stage of development		
			Seedlings	Juvenile stems	Adult stems
Average	80,88	128,50	80,20	438,90	1053,00
Standard deviation	56,27	54,87	34,24	187,40	449,80

Table 5: Average densities per development stage of stems of *Eremospatha macrocarpa*

	Sexual multiplication	Vegetative multiplication			
	Seedlings	Number of clones per hectare	Total number of stems per hectare, and per stage of development		
			Seedlings	Juvenile stems	Adult stems
Average	45,85	29,08	30,77	74,46	156,50
Standard deviation	39,71	14,82	20,45	46,63	148,90

Table 6: Average densities per development stage of stems of *Calamus deërratus*

	Number of stems per hectare, and per stage of development		
	Seedlings	Juvenile stems	Adults
Average	72,33	28,67	16,00
Standard deviation	64,40	14,95	15,26

NB: For this species, it was impossible for us to distinguish between seedlings resulting from the germination of seeds and those produced by the rhizome.

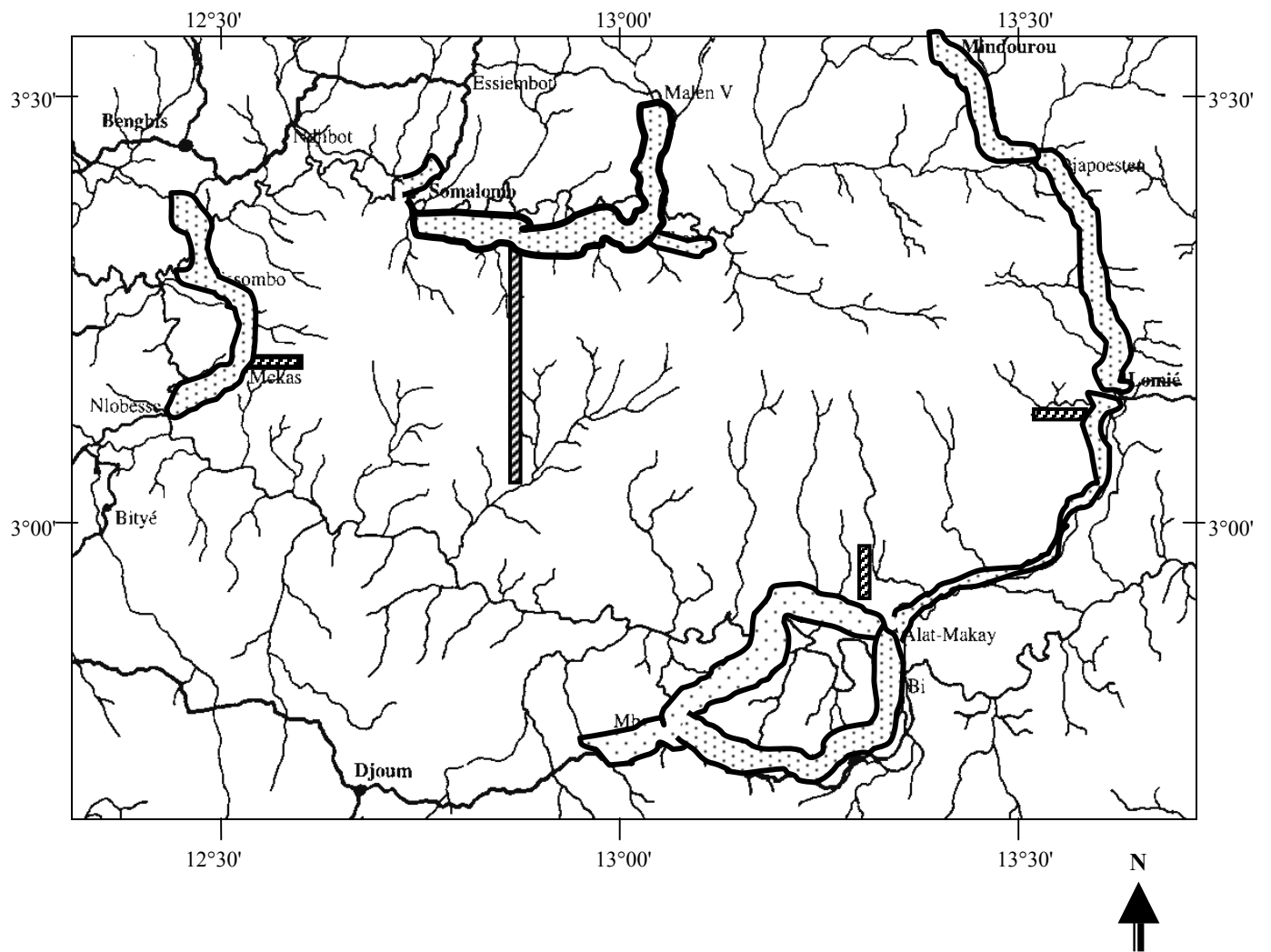


Figure 1 : Localisation des secteurs prospectés dans la réserve de biosphère du Dja et sa périphérie.

1. Transects ( Incursions dans les zones d'utilisations villageoises ()

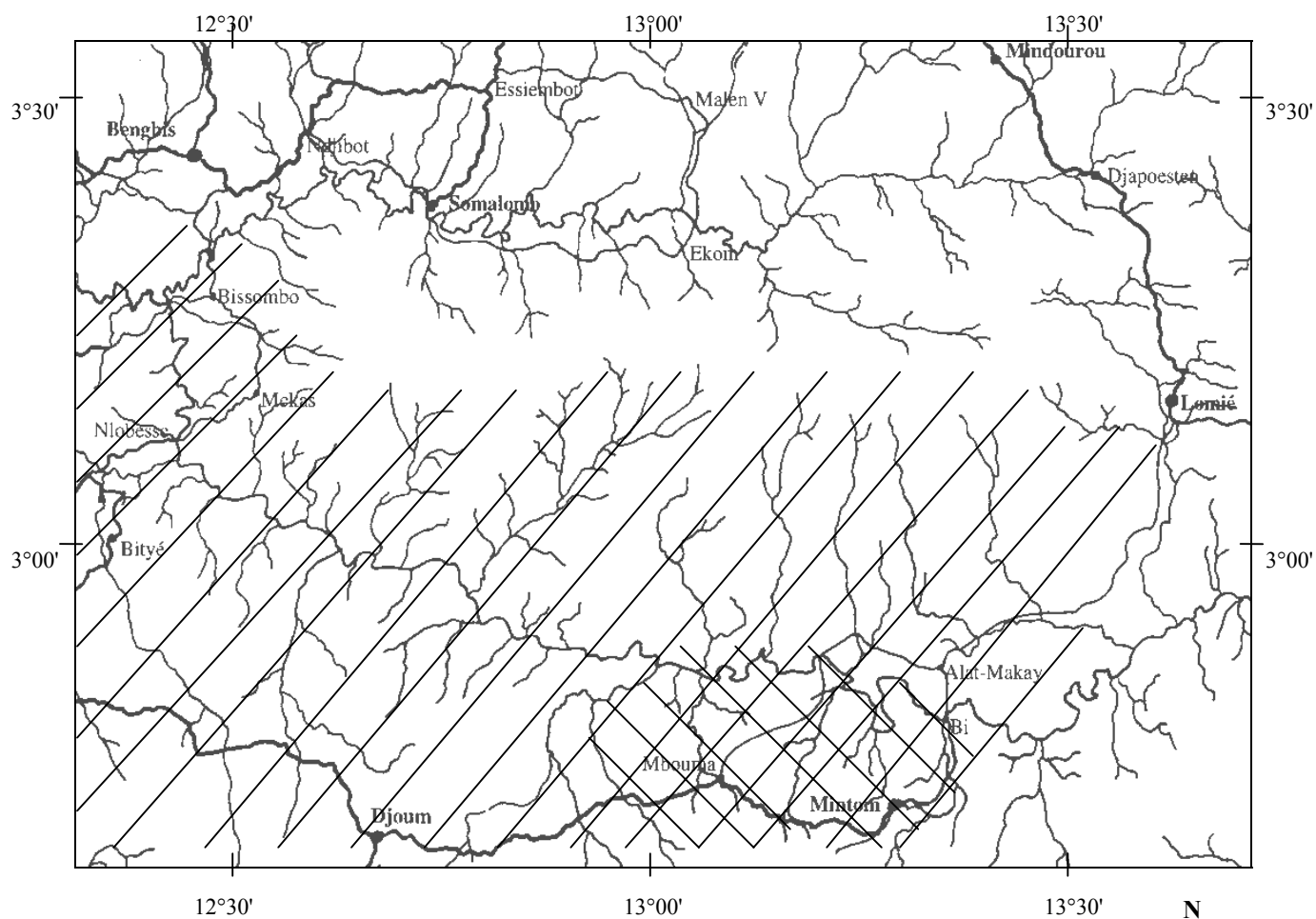


Figure 2 : Aire de distribution des différentes espèces inventoriées dans la Réserve de Biosphère du Dja et ses environs.

- 1 :** *Calamus deërratus*, *Eremospatha macrocarpa*, *Eremospatha* sp. 1, *L. secundiflorum* et *L. opacum*
- 2 :** *Oncocalamus mannii* et *Eremospatha hookeri*
- 3 :** *Eremospatha wendlandiana* et *Eremospatha* sp. 2

MANAGEMENT AND CONSERVATION OF FOREST RESOURCES OF THE CONGO BASIN: PRELIMINARY HYPOTHESIS OF THE DOMESTICATION OF RATTAN PALMS IN THE HUMID FOREST ZONE OF SOUTH CAMEROON

D.J. SONWA, D.Z. NZOOH, B.A. NKONGMENECK, L. ZAPFACK & L. DEFO

Summary

Many income generating non-timber forest products (NTFP) have just started undergoing domestication in the Congo Basin, whereas rattan is still being obtained from the wild. Silvicultural initiatives involving rattan are still at an embryonic stage in this region, such that a single silvicultural trial has been set up in an industrial rubber plantation of this region (Sunderland, this volume). Parallel to this initiative, it will be good to explore the feasibility of domestication in different farming ecosystems of the region. To our knowledge, there are yet no such studies in the Centre-South of Cameroon, whereas it is one of the centres of production and commercialisation of rattan in Central Africa. The objective of this article is to identify factors that would favour or inhibit the domestication of rattan palms in some human ecosystems in the humid forest zone of South Cameroon. It is also aimed at identifying channels that ease domestication.

Rattan palms play an important socio-economic and ecological role. Many animals (gorillas, monkeys, hemipterous insects beetles and ants) of this region feed or accomplish part of their life cycle on the stems of rattan palms. Rattan is an important source of revenue to harvesters/vendors living in the rural zones and artisans. Besides it sometimes contributes towards fulfilling other needs (health and food) of the daily life of populations. Among the anthropogenic systems found in this region, fallow lands and secondary forests reveal a resemblance to natural rattan palm milieu and can therefore be of use in preliminary silviculture experiments. The feasibility of domestication in other milieu also has to be explored. Research activities carried out by national, regional, and international institutions, are going on in the forest zone of the south of Cameroon. These are on station and in the farmers' environment. These institutions and their installations can very well be useful in the domestication process.

Research activities to be carried out ought to concern specific and genetic diversity of rattan palms populations. These include studies of the dynamics of the natural populations in relation to other living organisms of the milieu, the best ways of collecting, conserving and germinating seeds, the best silviculture conditions of rattan palms, the impact of this silviculture on forest dynamics, optimal harvesting techniques that are less destructive to the environment and the socio-economic impact of rattan palm domestication. One constrain to domestication of rattan palms is possible competition between these palms and other plants. Especially in ecosystem enrichment programmes where the primary objective is not the production of rattan. Effort has to be made to identify the best spatial arrangements that will enable a good expression of the components of each ecosystem where rattan palms could be domesticated.

Key words: Rattan, rattan palms, Congo Basin, humid forest zone of the south of Cameroon, domestication.

Introduction

Non timber forest products (NTFPs) amongst which is rattan, play a very important role in the economy of the populations of the Congo Basin (Clark and Tchamou, 1998; Defo and Sunderland, 1998; Ndoye and Perez, 1999). Some rattan palms grow spontaneously in fallow lands and cocoa plantations. However, farmers are increasingly trying to cultivate these NTFPs in cocoa plantations and home gardens. If many NTFPs have only started undergoing domestication in Central Africa, rattan on its part is still being obtained from the wild (Sunderland, 1999 and this volume). With the economic crises and a fall in prices of cash crops, rattan has become an important source of revenue in the forest zone of Cameroon (Defo, 1998; Ndoye, 1994; Sunderland, 1999). It is therefore important to think about its domestication. This should relieve natural stands, which are suffering from indiscriminate exploitation.

The initiative to domesticate rattan palms is still at an early stage in Central Africa (Leakey, 1995; Sunderland, 1999). Whereas in South-East Asia domestication is sufficiently advanced and dates as far back as the 1980s (Sunderland and Nkefor, this volume). In this part of the country, rattan palms are cultivated in a multi-strata system and rubber trees are especially used as support. Some years ago, the African Rattan Research Programme began work on the silviculture of *Laccosperma secundiflorum* in an industrial plantation of rubber trees in the Southwest Province of Cameroon. Such is a careful approach justified by the more or less similarity of local ecosystems to those observed in Asia. It is also evident that the Congo Basin is a mosaic of ecosystems, showing micro variations in climate, soils and vegetation. Coupled to this biophysical diversity, is also diversity at the socio-economic level. Exploring the feasibility of domestication in each ecosystem therefore becomes necessary.

The Centre South region of Cameroon has research and development advantages which allows us to think that it will be necessary to carry out a research-development programme on the development of rattan palms parallel to initiatives that are already underway. Added to its important rattan palm potential, the region hosts research stations whose results are likely to be extrapolated in the other countries of Central and West Africa (Brader, 1998). Besides, the high diversity of the ecosystems equally constitute an advantage for this zone such that it will be judicious to take this into consideration for the process of rattan palms domestication. After the silviculture programme started in an industrial plantation of the CDC (Cameroon Development Corporation), it is therefore timely to think seriously about the domestication of rattan palms on farmers' plots (Leakey, 1995; Sunderland, 1999). To our knowledge, there would not be any studies relative to the feasibility domestication in the Centre south region of Cameroon, whereas it is one of the important centres of production and commercialisation of rattans in Central Africa. The objective of this article is to identify factors that could favour or inhibit the domestication of rattan palms in some human ecosystems of the humid forest zone of Cameroon and identify research ways that will enable us better carry it out.

Rattan palms and the humid forest region of South-Cameroon

The evergreen Congo forest in its southern part and a Sterculiaceae and Ulmaceae semi-deciduous forest in the north dominate the humid forest region of South-Cameroon (HFZ-SC). The climate is the equatorial type with four seasons. The gradient of forest degradation is increasing as we move from the south to the north (EPHTA, 1996).

NTFPs occupy an important place in the economy of this region. These NTFPs are obtained from home gardens, cocoa plantations, fallow lands and the forests (Mollet *et al.*, 1985; Tabuna, 1998, Zapfack *et al.*, 1998). Rattan palms are exploited by 25% of households around Yaounde (Defo, 1998). This exploitation provides about 50.4% of their global revenue with 14.98% coming from harvesting and selling unprocessed rattan and 35.44% from rattan artisan studies (Table 1). Having artisans in the rural zone may reduce the number of intermediaries between harvesters and buyers, and probably increase the revenue of farmers, who are the harvesters. This will therefore be a means of avoiding police harassment as well as other forms of harassment associated to the transportation of rattans to the town (Defo, 1999b).

At the moment, rattan for commercial purposes is still obtained from the forest. Some people cut down the support tree in order to extract a good portion of rattan, especially the large diameter portion of the stems of *L. secundiflorum* (Nzooh, 1996), which is the most commercialised species in this region. Other exploiters carry out a complete harvest (Bene, 1994) which seriously compromise the regeneration of this resource (Nzooh *et al.*, in press). Generally, the traditional technique of pulling down the stems allows the extraction of less than 50% of the stem of *Laccosperma secundiflorum* and of *Eremospatha macrocarpa* (Nzooh, 1999).

These unsustainable exploitation practices push farmers further in to the forest to look for rattans. On the one hand this affects the profitability of rattan exploitation and on the other hand, it deprives the farmer of sufficient time for other agricultural activities. The regular intrusion into the forest has a consequence on the ecosystem. Hence, intensive exploitation may hinder the activities of animals that feed or accomplish a part of their life cycle on the stems of rattan palms (Table 2). It therefore becomes necessary to think seriously on the silvicultural process of rattan in ecosystems that are close to the farmers. Today, some factors are favourable to this domestication.

Some factors that are favourable to domestication

One favourable factor to rattan palms domestication (Table 3) is their importance in the lives of both rural and urban households. Today rattan provides a non negligible revenue to the populations of this region. It is used in making furniture and decorations (table 4). Farmers will be very interested in receiving or participating in setting up a technology that may help in optimising the management of their farming activities. With a decrease in public service revenue, many civil servants are today involved in agricultural production. These elite can very well invest in a new crop if it proves to be profitable.

From an institutional point of view, there are many other favourable factors which are mainly (see Defo, this volume).

Many institutions intervene in the humid forest zone of South-Cameroon in terms of experimental and development research. This zone was retained by the ASB (Association of Slash and Burn) programme as an experimental site which reconciles the socio-ecological conditions of the Congo Basin (Bandy, 1994). An experimental station exists in the heart of the Mbalmayo reserve. This station serves as a technology conception laboratory for the management of environmentally less degrading resources. More to this experimental station, a set of villages were chosen within the framework of the EPHTA (Eco-regional Programme in the Humid and Sub-humid Zone of sub-Saharan Tropical Africa) as participatory research sites for forest neighbourhood regions. In these villages, research is carried out in collaboration with farmers and Non Governmental Organisations (NGOs). Much information exists on these research sites and these could therefore facilitate research and the diffusion of studies on the domestication of rattan palms. The existence of a specific programme on rattan for Africa, the African Rattan Research Programme, which is based in Limbe, can enable the centralisation of national and international information, useful to rattan palms silviculture and hence facilitate all domestication initiatives.

Where to domesticate rattan palms

The domestication of rattan palms like all NTFPs requires pre-knowledge about their biology, phenology, and ecology. Rattan palms are climbing plants belonging to the family of Palmae (or *Arecaceae*). In Africa, they belong essentially to four genera. Until recently, their taxonomy remained not well known (Nzooh, 1996; 1997; 1998; Sunderland, 1997; 1998). One of the factors that hindered the understanding of their taxonomy is that the number of herbarium collection was low, particularly in the case of Central Africa (Morakinyo, 1994). The studies of Nzooh *et al.* (1998) enabled the identification of nine species of rattan palms in the wildlife reserve of Dja (Table 5). Two species are readily commercialised in the HFZ-SC. These are the large rattans (*Laccosperma secundiflorum*) and the small rattans (*Eremospatha macrocarpa*). Large diameter rattans grow in open places such as forest glades resulting from the fall of a tree or logging activities. Such glades can also be old village settlements and along elephant migration corridors (Nzooh, 1995). The fruits are generally dispersed by hornbills and primates (Sunderland, 1999; Nzooh, 1996).

In South-East Asia rattan is cultivated in oil palm (*Elaeis guineensis*) and rubber tree (*Hevea brasiliensis*) plantations; in timber plantations with species like *Pinus caribae* and *Acacia mangium*; in forests that have undergone logging operations and in fallow lands (Tang, 1992; Nur and Aminudium, 1992; Dransfield and Manokaran, 1994). The last two ecosystems are however among the most used sites for rattan palms silviculture. Cultivation in these systems is undertaken with some difficulties that are inherent to each ecosystem.

In the South of Cameroon, the most widespread land occupation systems are household gardens, cocoa plantations, primary and secondary forests, and fallow lands. For each human ecosystem, we have listed the favourable factors, difficulties and some points to clarify for the domestication of rattan palms (Tables 6 and 7). Secondary forests and fallow lands with a long fallow period are ecosystems very similar to glades within which rattans grow. One difficulty with highly managed systems (cocoa plantations and home gardens) will be the eventual competition between rattan and other crops.

What research to accompany rattan palms domestication

Many research institutions intervene in the domestication of rattan palms in the HFZ-SC. Even if initiatives on rattan palms domestication in Africa were still at an early stage (Leakey, 1989; Sunderland, 1999; Sunderland and Nkefor, this volume), some already carried out research or those still underway are likely to contribute to the domestication process of rattan palms. These research studies concern studies on rattan transformation sector (Ndoye, 1994; Defo, 1998; Defo and Sunderland, 1999); floristic, biological, and ecological studies on rattans (Nzoo, 1995; 1996; 1997); the typology of some ecosystems (Sonwa, 1998; Sonwa *et al.*, 1999; Zapfack, *et al.*, 1998); the dynamics of associative movements; customary law; the use of propagation frames for the multiplication of NTFPs (Tchoundjeu, 1999) and many others. But generally, a number of research studies will be necessary to better accomplish domestication (Table 7). The most urgent ones are the phenology of rattan palms, the relationship between rattan palms density and other plants in its environment, genetic diversity within different populations, what domestication of rattan palms represents to farmers and studies on the local know how on sustainable rattan management.

Conclusion

In the Congo Basin, and especially in the humid forest region of south-Cameroon, rattan is still exploited from natural populations. Its commercialisation provides important revenue to the rural as well as urban populations. Many advantages at the socio-economic level and at the level of research and development, allows us to envisage rattan palms domestication on farmers' plots with much optimism. Rattan is particularly used in artisan studies, but also for other consumption ends. Many research studies carried out in this region can facilitate rattan palms domestication. On station and participatory research infrastructure used by national, regional, and international research institutions, intervening in the forest zone can be used in the domestication of rattan palms. Research is necessary for the evaluation of specific and genetic diversity of populations, phenology, natural populations dynamics, the best means of collecting, conserving and germinating seeds, the best silviculture condition for rattan palms, the impact of this silviculture on forest dynamics, and optimal techniques of pulling down and obtaining rattan such that it is less destructive to the environment.

One constrain to rattan palms silviculture is possible competition between the rattan palms and other plants. Especially in ecosystem enrichment programmes where the primary objective is not rattan palms sylviculture. Of all the land use systems commonly

found in south-Cameroon, home gardens, cocoa agro-forests, secondary forests and fallow lands, the last two systems have already been used for rattan palms cultivation in South East Asia. These can serve in preliminary experiments in the humid forest zone of south-Cameroon but the feasibility of domestication within other ecosystems has to be explored meticulously.

Acknowledgements

Some of the tables used in this paper have been obtained from studies carried out within the framework of ECOFAC/CAMEROON and APFT/CAMEROON programmes. Dr. B. Sonke brought in commentaries during the write up of this paper. The staff of the African Rattan Research programme kindly offered the opportunity of presenting this communication.

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TABLE 1: THE IMPORTANCE OF RATTAN AND ITS PROCESSING IN THE GLOBAL ANNUAL REVENUE OF ALL RATTAN EXPLOITERS IN THE YAOUNDE (CAMEROON) REGION

Activity	Percentage relative to global revenue
Cocoa and coffee	8.73
Food crop and market gardening	17.63
Small scale livestock	0.40
Hunting	6.85
Extra-agricultural activities	13.56
Other NTFPs	3.08
Harvesting and selling of rattan	14.98
Rattan artisan	35.44
Total	100

Source: Defo (1998)

TABLE 2: THE ACTIVITIES OF SOME ANIMAL SPECIES ON THE STEMS OF RATTAN PALMS IN THEIR NATURAL ENVIRONMENT AROUND THE DJA WILDLIFE RESERVE (SOUTH-CAMEROON)

Animal	Animal's activity on rattans	Rattan species
Gorillas	They eat the pith of young rattan palm stems	<i>Laccosperma secundiflorum</i> <i>Oncocalamus mannii</i>
Birds (e.g. weaver birds of the genus <i>Malimbus</i> sp.)	They build their nests on rattan palm stems using the leaves of this same plant	<i>Laccosperma secundiflorum</i>
Monkeys squirrels and birds	They eat up rattan palm fruit pulp and ensure their dissemination	<i>Laccosperma secundiflorum</i> <i>Laccosperma Opacum</i> <i>Eremospatha macrocarpa</i> <i>Calamus deëratius</i> <i>E. hookeri</i> <i>E. wendlandiana</i> <i>Oncocalamus mannii</i>
Hemipterous insects	They feed on sweet substances of rattan palm stems	
Beetles of the <i>Sacaramideae</i> family	Some spend part of their life cycle in rattan palms stems	

Ants (e.g. <i>Pheidole spp.</i> , <i>Crematogaster spp.</i> <i>Etc...</i>)	They at times live in the cavities made by beetles and feed on the rest of the pith of the stem pushed out by hemipterous insects	
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Source: reconstituted from Nzoo (1996)

TABLE 3: SOME FACTORS ENCOURAGING RATTAN RESEARCH AND DEVELOPMENT OF DOMESTICATION IN THE HUMID FOREST REGION OF SOUTH CAMEROON

Nature of factor	Factors
Socio-economic	1) A greater part of rattan exploitation and commercialisation is carried out in Central Africa and within the forest region of south Cameroon. 2) Rattan exploitation can start and become important. 3) Rattan resources are beginning to get scarce in this region. 4) An important part of forests in this region is degraded and this constitutes a probable site for rattan domestication. 5) Some villages from where rattan is harvested are easily accessed, offering a possibility of rapid evacuation of this product. 6) The desire to diversify revenue sources by domesticating NTFPs is very much present in this region ever since the cocoa market crisis. 7) There exist many Non Governmental Organisations (NGOs) militating for a sustainable agriculture in the region. They can serve as a link in the spread of information on silviculture techniques. 8) The local elite are investing more and more in agriculture in preparation for retirement. The cultivation of cocoa and oil palms is one of their preferred activities but rattan palms silviculture if profitable, may interest them.
Local experience in research and development	1) Studies are underway to determine the typology cocoa plantations and fallow lands. These environments especially the second, are probable sites for rattan palms domestication. 2) Rapid multiplication techniques (propagation frames developed by ICRAF) for NTFPs are undergoing diffusion in the region. These can also serve in the rapid multiplication of rattan palms. 3) Some research studies that can be useful for in the domestication of rattan palms are currently going on or already complete in this region.

Human and material potential for participatory or on station research	1) Many national and international research institutions work in partnership in this region and can very well put together their efforts in the definition and execution of rattan palms domestication programmes. 2) The existence of an experimental station managed by the International Institute for Tropical Agriculture - Humid Forest Eco-regional Centre (IITA-HFEC) in the Mbalmayo reserve. This station can serve as a place for defining the best rattan palms silviculture techniques before any diffusion into the farmer milieu. 3) The existence of a set of villages chosen as participatory research sites at the periphery of the forests and within the framework of EHPTA and ASB programmes. It is within these villages that together with farmers, management methods that are less destructive to the environment have to be defined. Results obtained from these villages can then extrapolated to other countries of west and Central Africa (the Congo Basin). 4) The existence of a rattan research programme in Africa. It is an ideal tool for the centralisation of national and international experiences in rattan palms management. It can be of great use in the domestication of rattan palms in the humid forest region of south Cameroon.
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Table 4: Some uses of rattan in the humid forest region of south Cameroon

Uses	Species
Artisan studies for internal furniture	<i>Laccosperma secundiflorum</i> <i>Eremospatha macrocarpa</i> <i>Calamus deërratus</i> <i>Oncocalamus mannii</i>
Artisan work for the making of transportation and conservation containers, and utensils	
Artisan studies for the making of articles for decoration, service, presentation, ornamental objects	
Bridge gates	
Pygmy huts	
Food, vermifuge	<i>Laccosperma secundiflorum</i>
Tooth brush	<i>Eremospatha macrocarpa</i> <i>Eremospatha hookeri</i> <i>Eremospatha wendlandiana</i>
Construction ropes	<i>Eremospatha wendlandiana</i> <i>Eremospatha macrocarpa</i> <i>Oncocalamus mannii</i> <i>Calamus deërratus</i>

Source: field observation

Table 5: Rattan palms species found in the Dja reserve and its periphery (south Cameroon)

Scientific name	Local name (language)	Length (m)	Diameter (cm)
<i>Calamus deërratus</i>	Ndié (Badjoué), Nding (Bulu)	100 to 150	1 to 3
<i>Eremospatha macrocarpa</i>	Nlo'o (Badjoué) Nlong (Bulu)	50 to 150	1 to 3
<i>Eremospatha wendlandiana</i>		Varies	0.8 to 1.5
<i>Eremospatha hookeri</i>		Varies	
<i>Eremospatha</i> sp. 1	Nkonlo lo'o (Badjoué)	20 to 30	
<i>Eremospatha</i> sp. 2		20 to 30	
<i>Laccosperma secundiflorum</i>	Nkan (Badjoué) Maraka (commercial)	45 to 60	4 to 5
<i>Laccosperma opacum</i>	Aka'lo (Badjoué)	5 to 10	0.5 to 1.5
<i>Oncocalamus mannii</i>	Mfouop (Bulu)	50 to 150	3 to 5

Source: Nzoo et al., 1998

Table 6: Some research studies that may be useful in rattan palms domestication in the humid forest region of south Cameroon

Research work	Implicated research institution
1. A study of the rattan transformation sector in south-Cameroon (Ndoye, 1994; Defo, 1998; Defo and Sunderland 1999)	CIFOR (International Centre for Forestry research), APFT (programme on the Future of Tropical Forests People), UY I (University of Yaounde I), African Rattan Research Programme
2. Botanic, biological and ecological study of rattan palms (Nzoo, 1995; 1996; 1997)	ECOFAC (Regional Programme for the conservation and rational utilisation of Central African forests ecosystems) and UY I
3. Typology of cocoa plantations in the humid forests zone of south-Cameroon (Sonwa, 1998; Sonwa <i>et al.</i> , 1998)	IITA (International Institute for Tropical Agriculture), IRAD (Institute of Agricultural Research for Development), CIFOR, UY I
4. Typology of fallow lands (Zapfack <i>et al.</i> , 1998)	IITA, UY I
5. Delimitation of a participatory research site (whole villages) in a farmer milieu for forest neighbourhoods parallel to the Mbal Mayo experimental station (EPHT, 1996; Brader, 1998)	IITA, ASB (Alternative to Slash and Burn) programme
6. The dynamics of collective movement and their implication in natural resource management	IITA
7. Customary land rights (Diaw, 1997; Diaw <i>et al.</i> , 1999)	IITA, MINEF (Ministry for the Environment and Forests), SAILD (Service for Support to Local Development Initiatives, Cameroon)
8. The use of propagation frames for the multiplication of non timber forest products (Tchuondjeu, 1999)	ICRAF (International Centre for Research in Agro-Forestry)

Table 7: Advantages, inconveniences, and some research priority points to clarify in order to better domesticate rattan palms in some human milieu of the humid forest zone of south-Cameroon

Ecosystems and Advantages	Disadvantages	Some priority points to clarify
Secondary forests (whether reforested or not) 1. Natural rattan palms milieu. 2. Reforestation possibility. 3. Low use of lands reserved for other activities of the community.	1. Free access space (traditional and community forest reserve). 2. Could maintain the forest in a glade state. 3. Modification of biodiversity of the milieu especially the under wood. 4. The high human presence may disturb the environment especially in the case of intensive silviculture. 5. The growth of some rattan palms may be affected by maturation of the forest.	1. Specific and genetic diversity of rattan palms populations. 2. Dynamics of natural populations of rattan palms. 3. Rate of re-growth after rattan harvesting. 4. The best ways of collecting, conserving and germinating seeds. 5. The best silviculture conditions for rattan palms. 6. The impact of rattan palms silviculture on forest dynamics.
Fallow lands 1. Ecosystems with ecological similarities to the natural milieu of some rattan palm species. 2. "Abandoned" land. Rattan palms silviculture in such a milieu will not compete with other objectives of community land management.	1. In regions with a high land pressure, fallow lasts about five years. Rattan palms will require much longer time to be exploited. 2. Rattan palms silviculture may not favour the management leguminous plants during the fallow phase.	1. The precise periods to introduce rattan palms. 2. The best density necessary for a better growth of rattan palms. 3. Economic, social and ecological impact (e.g. soil fertility) as a result of rattan palms introduction in the fallow.

Cocoa agro-forests 1. Multiple strata system. There will therefore be support plants of all heights. 2. Disturbed environment that may show some similarities to secondary forests. 3. Diversification through the domestication of NTFPs is a common practice in these ecosystems ever since the cocoa market crisis.	1. Rattan palms and cocoa trees have a superficial root system. There is therefore a risk of competition between the two plants. 2. Rattan can destroy cocoa trees (if they are the support plants). 3. The intensive cultivation of rattan palms may disturb the expression of other components of the cocoa farm. 4. Rattan palms silviculture may disturb management methods (weeding, crop treatments etc) of the cocoa farm. 5. The growth of some rattan palms may be disturbed by intensive shading from cocoa trees and other plants in the plantation. 6. The biodiversity may be modified	1. The density and spatial arrangement of plants that could allow a better expression of rattan palms. 2. Evaluate the disturbance or amelioration brought by the introduction of rattan palms (from the biodiversity and carbon retention perspectives). 3. Social and economic repercussions of the domestication of rattan palms in cocoa plantations. 4. The best techniques of rattan palms cropping and harvesting that are less damaging to the other plants.
Other ecosystems (home gardens, oil palms plantations etc).	1. The management system of these milieu often keep them away from natural conditions of rattan palms expression. 2. The growth of rattan palms may jeopardise the expression of plants managed in this milieu.	1. Explore the possibilities of co-management of rattan palms with the other components of these ecosystems.

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KNOWLEDGE TRANSFER IN THE CONTEXT OF CONSERVATORY MANAGEMENT OF NON-WOOD FOREST PRODUCTS: POTENTIAL ADVANTAGES AND SOCIO-ECONOMIC CONSTRAINS TO THE INTRODUCTION OF RATTAN PALMS IN THE CROPPING SYSTEMS OF THE FOREST REGION OF CAMEROON

Louis DEFO & Théodore TREFON

Summary

Rattan palms have been domesticated in SouthEast Asia for close to one and a half-centuries. In this region, in the last twenty years, the cultivation of this non-wood forest product (NWFP) has been undertaken in significant areas in response to the considerable scarcity of natural stands linked to overexploitation. In Cameroon, given the pressure that natural population of rattan palms experience, the risk of shortages also exists in some regions. Considering the ecological and socio-economic role of high value NWFPs in Cameroon, such as rattan, it is imperative to put in place conservatory management measures for this resource. The introduction of rattan palms in the cropping systems of the forest zone of Cameroon, as has been undertaken in Asia, is one of the courses to follow. The Asian experience can therefore serve as a model on this subject.

This article is an exploratory reflection on the potential advantages and socio-economic constraints to an eventual introduction of rattan palms in the farmer milieu, within the forest zone of Cameroon. These advantages and constraints are of various natures: spatial, demographic, psychological, institutional, and economic. Among the most important potential advantages, we may retain the relative availability of arable lands, age sex, the educational level and some elements the perception of the first level target actors, as well as the existence of rural supervisory structures that serve as a link for diffusion. The most considerable hindering factors on their part are at the level of the character of target actors, insufficient labour force (especially in the Centre, East and South Provinces), land tenure systems and competition between rattan palms and other crops.

Key words: Rattan palms, South-Cameroon, forest zone of Cameroon, advantages, constraints, cropping systems, non-wood forest products.

Introduction

The importance of NWFPs in Central Africa is today well-established. Unfortunately, deforestation and encroaching commercial exploitation imposes a great pressure and significant threat to some of these resources (Clark & Tchamou, 1998; Wilkie, 1999). In Cameroon, rattan palms (especially *Laccosperma secundiflorum* and *Eremospatha macrocarpa*) belong to those NWFPs that are victims of this pressure.

Given that to date the exploitation of this service resource in this region is based only on natural stands, interested researchers for some years now are willing to make the domestication of rattan palms a priority objective in conservatory management (Béné,

1994; Ndoye, 1994; Defo, 1997; 1998; Sunderland, 1999). Most of these authors have based their recommendations on the SE Asian model and therefore envisage a south-south transfer of knowledge in this domain. This supposes that a number of factors among them socio-economic data of the target zone (South-Cameroon) have to be taken into consideration. These data on the social milieu are as determining as biological and ecological data. Their influence can be multiform and ignoring them will be a clear and instant prejudice to all attempts of propagating rattan palms in the farmer milieu of the forest region of Cameroon. Taking this into consideration, we think it important to carry out a prospective reflection on the potential advantages and hindering factors of the human environment of South-Cameroon, with the perspective of an eventual initiative of cropping this NWFP.

In an exploratory manner, this paper covers these potential advantages and constraints. These elements are at several levels: from space management to the eventual relationship between rattan palms and other crops, through demographic, psychological and institutional factors. This paper begins with a brief presentation of the Asian experience and a parenthesis consecrated on the necessity to cultivate rattan palms in Cameroon, as well as other initiatives in the same dimension.

Context of study and methodology

This communication is drawn from a work consecrated on the study of the entire rattan sector (the general course which is practically similar to "PCS approach")⁵ of South-Cameroon. Started in 1996, and supported by the programme *"Avenir des Peulpes des Forêts Tropical"* (APFT), this study focussed on the Yaounde region which is the most important rattan exploitation area in the country as the geographical framework for investigation.

In this context we carried out investigations based on direct observations, informal talks, interviews, surveys, measurements, tests and utilisation of four types of standardised questionnaires. These investigations took place mainly in Yaounde and in seven villages or the region, retained in function to their accessibility, the state of rural artisan, the number of harvesters, the range of income generating activities the size of the village and the degree of collaboration with the population. The seven village-sites studies were: Meyo, Ozom, Banga-Nkolmekok, Ngat-Bané, Fakeleu 2, Zoassi/Zock and Zamakoé. These villages are found essentially along the Yaounde - Ayos - Ebolowa road axis and fall within a radius of 100km from the city.

For this exploratory reflection on the possibilities of introducing rattans in the cropping systems of farmers in the forest region of Cameroon, our approach focussed on a comprehensive literature review and our own field data. Within the literature, information relative to the SouthEast Asian experience was especially noted as it is the model from which we can transfer technology or knowledge to Africa. For this reflection, we consider that there exist many biological and ecological similarities between rattan palm species in Africa and those of Asia.

⁵ PCS approach = production to consumption systems approach (Belcher, 1997).

Besides for a general appreciation of the parameters highlighted and the chances of success of an eventual introduction of rattan palms in the Cameroonian farmer milieu, one should have in mind this important extension principle which goes thus. An innovation is easily accepted when it does not require much changes or sensitive adjustments of the already existing production system. The more an innovation requires changes or hinders the pre-existing system, the lesser its chances of adoption by most farmers. If an innovation requires much changes in its pre-established order, for it to be diffused with success (putting aside extension conditions), it ought to be coercive, and/or able to generate or stimulate much profit (especially financial).

THE ASIAN EXPERIENCE, THE NECESSITY TO CULTIVATE RATTAN PALMS, AND LOCAL INITIATIVES ON DOMESTICATION

The Asian experience

The Asian experience being the reference model in our reflection, it is therefore timely to quickly bring out some of its aspects that concern us here. Rattan palm cultivation in Asia is well-established and rattans were first planted in Indonesia around 1850 (Vantuil, 1929; Tan, 1992). Around 1890, there existed rattan gardens planted by farmers in Borneo (Weinstock, 1983). In 1962 experimental plots for modern cultivation were set up in Malaysia by government institutions (Singh and Chin, 1999) and as from the 1980/1990, the cultivation took greater proportions, specially in Malaysia, Philippines and Indonesia (ATI/UNAC, 1995; Belcher, 1999; Sengdala & Evans, 1999; Sunderland & Nkefor, this volume). This cultivation is mainly in rubber plantations, fallow lands and degraded forests (secondary forests), and carried out by enterprises as well as individual farmers. In most cases, production comprises the following main operations: seed preparation, nursery preparation, sowing, watering, plant protection treatment, farming plots preparation, holing, transplanting, fertiliser application, weeding, pruning of surrounding trees, harvesting and conservatory treatment (ATI/UNAC, 1995; Belcher, 1999; Sengdala & Evans, 1999; Bacilieri *et al.*, 1999; Gengarajoo & Otilig, 1999).

The cultivation of rattan palms today covers significant surfaces in Asia and concerns many people. In 1994 for example, already close to 500 small scale farmers of the region of Perak and Pahang in Malaysia had 651 ha of rattan palms (Singh & Chin, 1999). In Philippines, an enterprise known as the "Paper Industries Corporation of Philippines" (PICOP) in 1994 had 5,000 ha of rattan palms plantation in the region of Bislig Surigao del Sur (ATI/UNAC, 1995). In 1996, the Peninsula region of Malaysia had 13,000 ha of rattan palms plantations (Appanah *et al.*, 1999). The cultivation of rattan palms in Asia was dictated by the conservation imperatives of the production potential of natural stands (considering over-exploitation), the desire to avoid scarcity of raw material and to develop the rattan industry.

The necessity to cultivate rattan palms and domestication initiatives of these climbers

The simplest logic holds that before thinking about the favourable factors and constraints to an eventual rattan palms cultivation initiative in South-Cameroon, we should seek to know if such an initiative is really necessary. This necessary question can practically be expressed with two questions: Is rattan important? Is it scarce?

Our results allow us to answer in the affirmative to the first question. For example, the use of rattan articles concerns close to 64% of households in Yaounde. In 1997, there were 124 rattan transformation units (TU) employing either permanently or temporarily 272 persons in this same town. In the same year, each TU had an average profit margin of 44,446CFA per month. The exploitation of rattan concerns close to 35% of households and about 60% of the population of surveyed villages. It generates an average of 216,979CFA per month to each artisan owning a TU in the rural zone. Rattan contributes up to about 50.4% to the global revenue of all rural exploiters and for them it is a great means of taking care of the present financial difficulties (Defo, 1997; 1998; 1999a; 1999b; 1999c). Besides this financial input, rattans are of great social and cultural importance to farmers at the domestic level (e.g. the building of huts and weaving of baskets). Its ecological importance is not negligible (Nzooh, 1995; 1997).

As to the second question, most (64.5%) of farmers encountered and researchers who are preoccupied by the subject (Béné, 1994; Ndoeye, 1994; Defo, 1997 & 1998; Ndoubé Manga *et al.*, 1997) hold that this resource is becoming rare. In effect the acceleration of the lucrative exploitation of rattan the increase of agricultural land surfaces, as well as the resorting to non-rational exploitation methods, imposes great pressure on rattan palms. In three of the seven study sites, the pressure on rattan palms is intense. This is indicated by the restriction of access into "private" forests, disputes on the subject of harvesting sites, frequent change of harvesting sites, the harvesting of less mature stems, and a noticeable increase in distances between village settlements and harvesting sites. Presently it is difficult to determine the precise level of degradation of rattan palms in Cameroon but with the indicators given above, we can affirm that the pressure on rattan is great in some regions (especially regions around urban centres and those of easy access). Sooner or later if conservatory management measures are not taken, we may get to a situation of advance degradation of the productive potential of natural stands similar to the case of most Asian countries (ATI/UNAC, 1995; Peters, 1997; Appanah, *et al.*, 1997). There is no doubt that it is this risk that has pushed the Ministry for Environment and Forests (MINEF) to talk obscurely of the scarcity and even the disappearance of some species and the "draining of the resource" (MINEF, 1995-PAFN). In our opinion, this is somewhat exaggerated.

Taking all these and the rational management of natural stands into consideration, it is imperative to think about the cultivation of rattan palms to guarantee the availability of this NWFP in the mid-term and long-term. This is what some of the authors mentioned above and many other researchers are emphasising given that until this moment the exploitation of this service resource is based only on the natural stands.

The idea of cultivating rattan palms in Cameroon is not a new one in reality because since 1927, Hedin wrote that "rattan is actively harvested in Cameroon... right now we have to

think about replacing or increasing natural stands through rational plantings" (Béné, 1994). But since then it seems the idea fell on forgetful ears. It is only in the mid 1990s with a rebirth of interest in NWFPs that this idea was brought back to the order of the day.

On a concrete basis, more rational initiatives also date back from the 1990s even though it is true that in the Mbidambani locality (more precisely at Assok, Dzeng District), cases of wildings and cuttings planting had been reported. Among these initiatives, we have mainly those of Denis Béné (in the context of his end of course memoir in the University of Dschang), and Doctor Ngeh. We equally have the Overseas Development Administration and the National Agency for the Development of Forests in Mbalmayo who had carried out rattan palms multiplication trials in the cuttings pen of the Mbalmayo Reserve in 1994. In 1998, we met an artisan in the Sangmélina region who had transplanted rattan wildings and set up trials on the germination of rattan fruits. Presently, in collaboration with the International Institute for the Environment and Development (IIED), the APFT Programme and the Non Governmental Organisation (NGO) known as Enviro - Protect, MINEF (Department of Forests) is setting up a micro project with one of its objectives being the putting in place of pilot trials of rattan management plantations at Oman (Méfou and Afamba Division). Finally, there is reason to mention the greatest cultivation initiative, which is that of the African Rattan Research Programme. In 1998, this institution started planting trials in a rubber plantation in the Southwest Province.

Potential advantages and constraints at the level of space management

Land is one of the determining parameters for agricultural activities. Human communities organise and manage this with respect to their culture, types of production, objectives, needs and their means. This organisation and management are subject to changes that interfere with one or more of these variables but the adjustment limits are not indefinitely flexible. In conformity with the principle we have stated above, exogenous innovations likely to be integrated in land management systems are those that will bring about less disturbance in the systems. Thus with rattans in particular, keeping aside other factors, we can say with certainty that the lesser the land management will require change, the greater its chances of adoption. Based on this principle, we can attempt to reflect on the chances of rattan palms from this point of view.

The first important element to consider is the global availability of arable land in the potential host milieu. More concretely, does there exist free forestlands (to first avoid talking about competition with other crops) on which rattan palm cultivation can be consecrated in South-Cameroon? Field observations and literature data allows us to answer this question in the affirmative. In this zone, rural population densities are relatively low at the level of many Divisions (5 inhabitants/km² in the Nkam, 6 inhabitants/km² in the Ocean, 7 inhabitants/km² in the Nyong and So'o) and the majority of exploiters still have forest reserves. In 1991 for example, Losch, Fusillier and Dupraz found out that 40% of farms in the Mungo Division had a land reserve. This rate was 66% for Meme Division and 80% for the Dja and Lobo Division. This is more than ten years now but the situation has not evolved dramatically at this level (in our opinion,

these rates have not dropped by more than 10%). Our surveys in the neighbourhood countryside of Yaounde (the zone below latitude 4°) show that despite the land pressures, which generally characteristic of regions around urban centres, most lineage still have land reserves or common forests. Even though these are seriously trespassed upon. Generally in the forest zone of South-Cameroon, there is much unused land and rattan palms can benefit from part of these lands.

These lands that have not been used for agricultural activities are not only but are of great advantage for rattans in many sectors given that they have already undergone industrial exploitation for timber. In effect as we have said, secondary forests or disturbed forests (gaps or glades) constitute one of the ideal ecosystems for rattan palms in Asia. African species especially *Laccosperma secundiflorum* and *Oncocalamus mannii*, like open environments (Nzooh, 1997; Sunderland, 1999). From this point of view, the forest zone of Cameroon has a great advantage because industrial forest exploitation started since 1909 (Etoga Eily, 1971). Since then, exploitation has penetrated many areas of South Cameroon starting from the coast and along road courses, bringing about significant forest gaps. Moreover this has amplified in the 1990s, thus multiplying glades that can be exploited for rattan palms planting. Lumbering companies are exploiting some of the surveyed sites for the second time. There is therefore a sure advantage here if we depend on the other eventual determinants.

Another non-negligible asset at the level of space management is the presence of farm fallows. In fact the dominant agricultural system in this region is that of shifting cultivation including slash and burn, which alternates farming and fallow in a cycle which ranges between 5 and 15 years or less in most cases (Neba, 1987; Santoir, 1992). Fallows as we have earlier said also constitute a very much appreciated cultural system in Asia. In the forest regions of Southern Cameroon, this might well provide a good opportunity for better valorisation of “empty” periods in the history of agricultural plots. It would as such be necessary for the fallow periods to be at least as long in duration as the maturation period for rattans, i.e. around 6 –15 years. The tendency to reduce the duration of fallows (often below 5 years), in certain villages is unfortunately of a nature as to seriously compromise or reduce the scope for this option. This is even more so since the tendency for shortening of fallow periods is primarily observed in villages of peri-urban sectors and easily accessible localities, that are also the very areas where rattan cultivation might be interesting.

Apart from the above mentioned ecosystems, it is possible to test the crop in a multi strata system (cocoa agroforestry, or coffee agroforestry systems) and even in timber wood plantations or palm oil plantations such as is done in Asia (Appanah *et al.*, 1999). In collaboration with other researchers (Sonwa *et al.*, this volume), we carried out a reflection on some of the above mentioned ecosystems with respect to the possibility of rattan cultivation.

In conclusion it is possible to say for the whole of this area without being irrational that the major constraints and handicaps would not come from availability of space. At this level the availability is non-negligible and this constitutes an undeniable potential asset.

The socio-demographic environment also comprises non-negligible advantages with respect to the cultivation of these NTFPs. Unfortunately limiting factors also exist at this level.

Potential assets and constraints at the socio-demographic, psychological and institutional levels.

At the socio-demographic level

The socio-demographic environment constitutes without doubt a fundamental aspect of all production activities. Subsequent rattan cultivation would without failure suffer from the multiple influence of this factor. The development factors and the inhibiting elements of factor might be found principally at the level of sex, age, level of education and work availability within the potential target groups.

It is possible to say without risk of error that the potential target persons within the populations of Cameroon's forest regions are the rattan harvesters. These people harvest and sell raw rattan stems as well as those who harvest and transform this NTFP because they are those who are primarily concerned with the exploitation of this resource. It is towards them in this respect that future initiatives should be addressed in order to introduce rattan into production systems. It is thus normal to sometimes focus the analysis on this category of actors.

It is known that 96% of rattan harvesters are males. At first glance this might constitute an asset in so far as men within that region have a relatively lighter schedule than the women even if it is true that socio-economic changes over the last decade have brought about a strong involvement of men in jobs that traditionally belong to women. Furthermore the harvesters are relatively young. In the region of Yaounde for example 85% of those who cut rattan and sell the raw stems are between 18 and 40 years of age while 63% of rural artisans are between 18 and 40 years⁵. This age group is composed of men with muscular strength capable of high levels of productivity and capable of handling the laborious and tiring tasks required in the cultivation and harvesting of rattans (nursery establishments, clearing, digging of holes and planting etc). It is also the fraction of the society from which the most dynamic, creative and receptive persons can generally be recruited. This is especially so since they have a far from insignificant level of education within the context of rural Cameroon; 98.8% of them possess at least primary school education and 38.8% have been to secondary school. On the other hand, it is important to mention that 78.8% of the target group are married and it is generally accepted that marriage stabilises individuals and renders them more efficient from an economic point of view. As such we find here demographic characteristics which are potentially favourable to rattan cultivation. These elements will probably favour the adoption of this crop by the populations of the forest regions of Cameroon.

In such an enterprise, with respect to adoption it would be possible to also count upon the strong natural predisposition of adaptation to change that most human groups of forest

⁵ According to the RGPH of 1987, 35.2% of Cameroon's population was between 15 and 40 years old.

Cameroon possesses. As an example the Beti groups showed proof of this after their migration from the savanna towards the forest in the 19th century, by adopting forest plants and by developing a mixed agricultural system associating plants from savanna zones (ground nuts, yams etc) to forest species such as plantains, cassava, and pumpkins (Santoir, 1992). Beti, Bassa, Mbo, Bakweri, and Lundu groups have also demonstrated this by quickly adopting cocoa and coffee as from the end of the 19th century, despite restrictions imposed at sometimes by officials of the service of agriculture with the pretext of fighting against plant diseases (Etoga Eily, 1971; Losh *et al.*, 1991). For some groups of the Centre-South in particular, this receptivity was much appreciated such that they all almost at the same time adopted short cycle varieties of groundnuts in order to better integrate cocoa in their production systems. Besides these groups succeeded in changing the status of cocoa farming which at some point in time had acquired a compelling nature to that of a prestigious activity (Alexander and Binet, 1958; Santoir, 1992).

These are several potential advantages of the socio-demographic environment and an eventual initiative on the introduction of rattan palms in to the cropping systems of the forest zone can benefit from this. But this same environment also has factors that are likely to slow down such an initiative.

Earlier on, we have talked about the relative youthfulness of rattan harvesters, who can constitute the main target group by merit, for the cultivation of this NWFPs. This youthfulness as said is a potential advantage but can also bring about hindering factors. Throughout these villages, we noticed that a good number of young persons are reluctant to get involved in activities that generate income only in the mid term and long term. They prefer activities capable of generating immediate financial benefits (hunting, woodcraft, NWFP gathering) or at the most, short term income generating farming activities like the cultivation of cocoyams, maize, etc. More so, it seems that this tendency to make profits is much advanced in persons who had lived in towns before returning to the village and this category of persons represent an important cross section of the population of our villages (more than 40% in the Centre-South, according to our estimates). Knowing that it takes long for rattan palms to be exploited after planting, (about 8 years for *Laccosperma secundiflorum*, and 10 years for *Eremospatha macrocarpa* according rattan harvesters in the Yaounde region; 6 to 13 years for the *Calamus* genus (Gengarajoo and Otigil, 1999) there is fear that this important proportion of the active population remains reserved on the idea of integrating rattan in their economic activities. This kind of a situation will be very much detrimental to rattan cultivation in some areas of South-Cameroon, where there is a low labour force for agricultural activities (Losh *et al.*, 1991).

In many parts of the Centre and South Provinces, we hardly obtain an average of up to three active persons per household. In Mevo and Ozom sites for example, we noticed a significant weakening of the active class (households having at most 2 active persons are many) and this is manifested by great human stress. An important rural exodus that is far from being counter-balanced by returned migration, which is as well significant, explains this situation. In recent years, with an increase in urban unemployment (for example in

Yaounde, unemployment rate passed from 7% in 1983 to 25% in 1993)⁶, family labour is rare and paid labour hard to find on the spot in the Centre-South. This situation is revealed in the remarks of this cocoa farmer at of Olamze (Ntem valley Division). "To maintain plantations in the past, farmers took advantage of Nigerian immigrant labour resident in Equatorial Guinea. Today, everything has changed and farmers are henceforth compelled to spend at times 6,000 CFA / month to maintain a hectare of cocoa. Those accepting these tasks are generally men with a punctual financial need (dowry, marriage, illness etc). After this they go away and you have to manage otherwise"⁷.

This insufficiency in labour force may be detrimental to an activity like that of cropping rattan palms, which comprises operations requiring (for the sake of efficiency) a slightly high number of persons for holing, setting up of plantation etc... Fortunately, in some villages, this deficiency is compensated for in some cases by different forms of mutual aid during farming operations requiring much instant labour. However, this does not globally resolve the labour deficit problem that may be detrimental to rattan palms farming in the Centre-South region. We should bear in mind that we are in a context where the family labour force (which is first of all low is already seriously absorbed by traditional cash crop (cocoa, coffee) farming and new cropping like food crop monoculture (maize, cocoyams) as well as oil palms farming. At this level everything risks playing on competition in the field. We shall come back to this much later but, before doing so, we find it timely to scrutinise the state of mind of potential target actors which according to us is one of the capital factors in such an enterprise.

At the level of perceptions

The mentality of the people is determinant in the adoption of specific behaviours. The decision to adopt rattan farming or not thus depends among other factors, on the farmers' perception relative to this NWFP. As already stated the potential target group is that of harvesters because, more than other persons they are the ones who will first be interested in an eventual cropping imitative. This is considering the importance of this NWFP to them.

One of the potential psychological advantages is of course the perception of the importance of rattan input relative to other sources of revenue. In effect for 54.1% off rural exploiters of rattan, input is perceived to be very important. This state of mind is likely to get harvesters to involve themselves in rattan production.

Another psychological parameter that can sensibly influence the behaviour of target actors is their perception of the availability of natural resources. At this level, interview results allow us to presage an adoption attitude because only 32.9% of harvesters in the Yaounde region actually think that this resource is not rare. Most of those interviewed (64.5%) can therefore think it timely to cultivate rattan because to them, it is difficult to find. But given the relative inflexibility of the acceptability index (close to 3/5 only) those who stand for domestication can not really be comfortable in their position. This

⁶ World Bank, 1995.

⁷ La Voix du Paysan no. 65, juin 1997.

vision is all the more true given that almost one out of every two exploiters think that rattan palms do not presently stand a risk of disappearance for various reasons (“they grow fast like grass”, “God can not cause rattan to finish because he knows it helps people”, “it is abundant in some forests” etc). Some of the harvesters to whom we may propose rattan palm cultivation and who have this perception may think it untimely to do so. This two subjects (scarcity and disappearance) placed side by side, gives a feeling of ambiguity a seemingly paradoxical result.

Following investigations aimed at understanding other aspects of harvesters’ state of mind on rattan, we asked them if the complete disappearance of NWFPs in their respective forests is possible. To this, 63.5% responded negatively and 30.5% in the affirmative.

Independent of the above questions, we asked harvesters how we could ensure the perpetuity of rattan palms. Their answers are summarised in the table below:

Table 1: ways of ensuring the perpetuity of rattan palms according to the exploiters of this NWFP

Ways	Number of responses and %
- “There shall always be rattan,” we do not need any action.	21 (25.3%)
- Cultivate rattan palms if possible.	17 (20.4%)
- Preserve forests, suppress bush fires.	13 (15.6%)
- Don’t know.	11 (13.2%)
- Forbid harvesting at some periods.	5 (6%)
- Create rattan palms reserves, carry out selective harvesting.	6 (7.2)
- State assistance, regulations, prohibiting harvesting.	5 (6%)
- Other responses.	5 (6%)
- Total responses.	83 (100%)

Source: This study.

In the context of this analysis, it is the second response (cultivation) that has to first retain our attention because such a response coming from rattan exploiters is just the aim of our preoccupation. While considering the other views of harvesters already mentioned and all other factors, with this proposal from harvesters, we can nurse some hopes relative to an eventual initiative on the dissemination of rattan palms cropping. This hope can be grater given that close to 80% of those interviewed in the Yaounde region say they are willing to cultivate rattan palms (the large proportion however does not stop magnifying the ambiguity of the opinion of harvesters as we already mentioned and this leaves the observer confused on the subject).

Harvesters with the willingness to cultivate justify this essentially by the fact that rattan is important (“a wealth”) and by the fact that they no longer want to cover long distances to obtain this resource. These elements are favourable factors that any cropping initiative can take advantage of. Those with no willingness to cultivate give reasons such as: “it is

God's gift", "it is God who has created it", "there is much in the forest", "I don't have much land", "other people shall come and harvest", "I have not yet seen how it is grown", "it will take much time to yield money", etc. These are important limiting factors fortunately, some of these can be reduced or simply banished by appropriate actions. The institutional environment can very well produce some of such actions.

At the level of the institutional environment

The influence of the institutional environment on the management of forest resources can be considerable on a rattan palm cropping initiative. This context also holds advantages as well as limiting factors.

The legislative and legal framework

The legislative and legal framework is an important aspect of the institutional environment. Land and forest being the main support for this crop, we shall first talk about these factors. In South-East Asia, the land tenure system is often cited as one of the constraint to the cultivation of rattan palms given that because of land insecurity, farmers are not motivated to cultivate crops that will take between 6 to 14 years to harvest (Seibert, 1999). In Cameroon, this insecurity also exists (even if most farmers do not really perceive it) because according to the modern legislation, it is the State that owns almost all lands and forests (except mainly for registered lands and trees planted by individuals, community and communal forests). On most of these lands and forests, populations have only traditional usage right, which in principle is essentially a subordinate right to obtaining an authorisation (decree no. 76/166 and no. 83/169). Thus for example with such a law, a farmer who may create a rattan palm plantation on an unregistered land or who may enrich a forest of the State Domain with rattan palm is not sure to reap the fruits of his/her labour. This is because the landowner (i.e. the State) can decide at any time to attribute an alternative use to the land. This state of things is not such as to favour rattan palms cropping in the South-Cameroon given that almost all the lands of the rural environment are still within the jurisdiction of State property. Fortunately, most farmers do not perceive as such this permanent land insecurity and confine themselves to the customary framework binding property and, land and forest exploitation.

From a strictly traditional point of view, the land tenure system and forest resource exploitation rules appear to be sufficiently neutral or cannot constitute an important limiting factor to the cropping of rattan palms in most of the forest region of Cameroon. In villages every lineage has its land estate and within the lineage all the members have the same rights to exploit land and forests. Any evidence of the first to cultivate is the main rule for appropriation. Besides the user and his descendants maintain pre-eminence on their plots even during fallow. From this point of view a farmer can for example (other conditions being favourable) introduce rattan palms in his plots under fallow being sure that together with his descendants, it can give them money. The neutrality of the customary framework and even its dynamic potential was proven during the introduction of cocoa and coffee farming in South-Cameroon. These crops became an important element for conquering and marking land. From this point of view, forest enrichment

practices using rattan palms can become a sensitive tool to the unrestrained rush to reserve plots within community land reserves, as has been the case in many villages for some years now. This state of things can thus constitute an advantage for *in situ* rattan palms cultivation. At this level, the unclear nature of village boundaries (within large forest blocks) may constitute a disturbing factor in the customary land context, to the cultivation of NWFPs.

We will end this topic on the legislative and legal framework by signalling that the two essential texts binding forest resources exploitation (law No.94/10 of 20th January 1994 and decree No. 95/531 PM of 23rd August 1995) and their practical application, to us does not seem inciting with respect to the cultivation of NWFPs. This leaves them vulnerable to over-exploitation thus making the aspect of cultivation, which is indispensable, a risky one in the eyes of these exploiters. Why do we have to worry about cultivating a resource that we can obtain from the wild? That we can exploit to the extent of draining its stock without being disturbed by preservation and natural management measures? Farmers can very well ask themselves these questions.

The activities of institutions intervening in development and/or conservation

Despite the loopholes just mentioned about the two official texts binding forest resources exploitation, it should be noted that rattan palm cultivation could benefit from the official awareness of the necessity to promote and conserve NWFPs. For rattan palms, this awareness among others has been manifested through the Cameroon National Forest Action Programme (CNFAP). In this programme, MINEF has scheduled a project on the inventory, silviculture and valorisation of rattan palms (project no. 59 of CNFAP). This project is an eventual advantage to the cultivation of rattan palms given that two of its components are to be concerned with the study of the reproduction biology of rattan palms, its silviculture and its extension. Much earlier we mentioned the MINEF – IIED – PNUD – APFT – Enviro – Protect at Omani. Such a pilot micro project is an advantage for the cultivation rattan palms in the South-Cameroon given that it can serve as a take off point for this initiative. This initiative can benefit from the expertise and lessons of Oman.

Finally, we have to note under this heading that, the presence of many institutions in this zone constitutes a potential advantage. This is considering that they play an efficient relay role in the extension of rattan palms farming. The following institutions pull our attention:

- The National Programme for Agricultural Extension and Research (NPAER formerly NPAE, initially called NPATAE) with close to 10 years experience in the domain of training and extension in the Cameroonian farmer milieu.
- Development and conservation projects like ECOFAC (Conservation and Rational Utilisation of Central African Forests ecosystems) and the Korup project, who are no longer new in the domain of rattan. These two structures have each carried out studies on rattan and undertaken actions of training artisans.

- NGOs, Common Initiative Groups (CIGs) and other organisations such as Enviro – Protect, Centre for Environment and Development (CED), Centre for Support to farmers’ Initiatives Ebolowa (CAIPE), Centre for Self-centred Development – Sangmelima (CeDAC), Rural Centre for Technical Support to Self – development (CRATAD) and the CIG Cameroon Palm who have already done a number of things in the domain of guiding the rural people.
- Big enterprises like HEVECAM (Cameroon Rubber Company) CDC (Cameroon Development Corporation) and SAFACAM, which own rubber plantations. These enterprises if possible may integrate rattan palms in some of their plantations like in Asia (Appanah, Abd Latif and Raja, 1999; Singh and Chin, 1999; Rice, 1995). Such a move can serve as a relay towards extension into the farmer milieu. SOCAPALM (Cameroon Oilpalm Company) has played a major role similar to this for oil palms, (*Elaeis guineensis*) in the Sanaga Maritime, and Nyong and Kelle Divisions. HEVECAM has equally done so for rubber in the Ocean Division.

The role of supervisory institutions in the rural world had been determining for the extension of rattan palms cultivation in some regions of the South-East Asia. For example, Singh and Chin (1999) reported the case of Pesak and Pahang regions where more than 500 farmers did set up close to 651 hectares of rattan palms under the supervision of their Department for Forests, of an enterprise called “Rubber Industries Small-Holders Development Authority”, and the Forests Research Institute of Malaysia (FRIM). These structures presented above can play a similar role in Cameroon and this will be an important potential advantage.

Advantages and potential constraints with respect to main factors of the production system

Besides some possible complementary points, the relationship between rattan palms and other agricultural productions can essentially be a relationship of competition at almost every level.

As examples of this complementary aspect, we can point out the introduction of rattan palms in the some fallow lands and also, their association to rubber plantations as in Asia. In the current conditions, the latter shall unfortunately be limited only to agro-industrial enterprises like the CDC, HEVECAM, PAMOL and SAFACAM that have rubber plantations. Almost all farmers shall be directly put aside given that very few of them cultivate rubber. As in Asia we could study the possibilities of associating rattan palms to oil palms. These associations could relieve some costs that ought to weigh on rattan palms alone and thus render such cropping attractive.

Competition between rattan palms and other crops may also be situated at the level of land, financial investment, and labour factor. We have already made some remarks on the possibilities of planting rattan palms from the perspective of land. We have said there are many advantages at this level. It is however relevant to point out that there can be a possible competition between rattan palms species that desire the most humid places

close to water courses (*E. macrocarpa* for example) and some crops like “dry season” tomatoes and maize which often occupy these places.

At the level of orientation of investments, the financial resources of farmers are very limited. This is considering the fact that we are in a context of poverty (according to the World Bank in 1993, 71% of rural households in Cameroon were living below the poverty threshold and this situation has degraded all the more since then). Besides the population of the forest zone of Cameroon have a great tendency to waste and it is not easy for a farmer to obtain credit. All these reduce the farmers manoeuvre range at the level of financial investments. Considering these financial burdens, there is going to be an arduous competition with other agricultural activities. In this competition, rattan palms are going to have serious handicap which is the relatively long time they take to attain productivity compared to other crops like maize and yams for example (see Tables 3 and 4). Is a farmer who is under the imperative of surviving going to plant maize or that he is going to harvest at the end of 4 months or invest in rattans which he will sell only at the end of 6 to 14 years? This duration really seems an eternity for someone with a pressing need for subsistence and a life expectancy hardly attaining 56 years. Even if rattans were excessively profitable, many farmers will not prefer them under such conditions. We had mentioned this constraint earlier when we talked about the perceptions of rattan harvesters.

Labour factors will constitute another arena of competition between rattan palms and other crops. This competition shall be much more severe considering that in most parts of this region, there is an inadequate labour force. Those who are going to get involved in rattan production are the same persons involved in the classical cash crops and lucrative food crop monoculture which is in fashion in most villages (especially in non-enclave villages and areas around urban centres). For this reason there shall be an important potential competition in most cases. Taking from remarks made on the phenology of *L. secundiflorum*, we notice that crucial periods of the technical planting procedure (fruits collection, and preparation, germination, setting up of plantation) of this essential species risks coming up in December/January and September. This is going to interfere with priority operations (or work peaks) such as clearing of farms for first cycle crops (February - March), planting, maintenance and harvesting of some annual crops and some market gardening products (March, April), maintenance and treatment against black pod disease, anti-capside, and early cocoa harvest (July, August).

Finally, it is the economic performance that is also determining. The fundamental factor that will determine for the most part farmers' choice of planting shall be profitability. As good economic agents however, they will lean towards the plant that offers the best economic performance (all other conditions being equal). Are rattan palms imposing from this perspective? By confronting Tables 2 and 3, we can only respond negatively in most cases.

Table 2: Production cycle and provisional exploitation budget estimate (1 ha) for some popular crops in South-Cameroon

Crop	Time taken to attain production (cycle)	Total expenditures in FCFA	Total returns in FCFA	Balance sheet for 1 st year/1 st season in FCFA
<i>Ananas comosus</i>	About 15 months	3 675 089	5 500 000	1 824 911
Plantain-banana	16 months and above	857 861	1 210 000	352 139
Yam (<i>Dioscorea</i> sp)	7 – 12 months	1 581 019	2 250 000	668 981
Maize (<i>Zea mais</i>)	3 – 4 months	529 089	700 000	170 911
Tomato (<i>Solanum lycopersicum</i>)*	4 – 5 months	261 644	437 500	175 856

* The surface area considered for tomatoes are about 1000 m²

Source: “La Voix du Paysan”, 1998

Table 3: Provisional net profits per hectare per year for the main rattan species in Malaysia

	Species	<i>C. trachycoleus</i>	<i>C. caesius</i>	<i>C. subinernis</i>	<i>C. manan</i>
REVENUE (PER HECTARE)	Cost RM*	4 600	5 500	3.80	6.80
	Yield Tons/pieces	1.6 tons	1.5tons	3 000pieces	4 500 pieces
	Time taken to maturity (years)	7	8	12	10
	Total RM	7 260	8 250	11 400	30 600
EXPENDITURE (PER HETARE)	Capital RM	2 660	2 660	2 660	2 660
	Management cost RM	24.50	28.00	40.00	40.00
	Interest at 9% RM	1 691.24	1 935.36	2 430.00	2 430.00
	Harvesting and pre-transformation cost RM	1 248.00	1 080.00	1 667.93	1667.93
	Total cost RM	5 263.74	5 703.36	6 797.93	6 797.93
NET PROFIT	Total RM	7 736.26	2 546.64	4 602.07	23 802.07

*RM = Ringgit (Malaysian currency). The exchange rate between the RM and the French Franc is not fixed. We can however take it to be 1 RM = 1.5 to 2.12 FF (150 to 212 Francs CFA) in order to remain within the fluctuation range of recent years.

Source: Ram Sing Gengarajoo and Francis Otigil, 1999 (Translation).

Of course data for rattan in Cameroon is not the same as that of Asia. It is however probable that if we draft a provisional exploitation budget estimate for *L. secundiflorum* or *E. macrocarpa* in our context, we shall have an equally low or simply less attractive profit margin compared to that of some competing productions. This hypothesis is all the

more possible considering that in Cameroon, rattan sells cheaper (close to 25 – 27 F CFA only, per meter of *L. secundiflorum* compared to about 210 – 270 F CFA for a meter of *Calamus subinermis* in Malaysia for example) compared to the selling price in South-East Asia. By simple arithmetic procedure, we can estimate that Asian prices for raw cane are 7 to 8 times higher than those of Cameroon. In our opinion, given the socio-economic environment of South-East Asia, it is difficult that the cost of production in Cameroon is 4 to 8 times lower than that of Asia, to maintain the same proportion of production cost/sales price ratios. In such conditions we can find ourselves in a situation where the profit margins of rattan in Cameroon is much lower. This will make rattan inferior to other crops like cocoyams, oil palm, pineapple, and yams. If with relatively higher sales prices in Asia, farmers state sales price as a major limiting factor to the cropping of rattan palms, (Belcher, 1999), what then shall be the case for Cameroon where this NWFP is clearly cheaper.

To minimise this limiting factor in Cameroon, production cost of rattan also needs to be as low as the selling price. Besides, we have to bear in mind that the time taken for rattan palms to attain maturity is relatively long. In such a circumstance, the expected revenue is very low. In the Philippines for example, Rice (1995) found out that the net profit for a hectare of *C. merrilli* plantation stood at 140.90 pesos and concluded that it would be difficult for an investor to engage in such an activity.

With respect to rattan palms, food crops in our context have another important advantage. This is that they have a wide consumption market which is almost stable and in full expansion (urban demand in Cameroon and export to neighbouring countries). Presently in Cameroon, the low selling price and highly flexible character of the market disfavour rattan.

The Asian cases mentioned above concerns essentially the cultivation of rattan palms in degraded forests. In this case, profitability has been found to be low. The association of rattan palms to other productions shall certainly produce more interesting economic results. An association of rattan palms to rubber trees for example should (putting aside technical aspects) logically increase the profit margin for rattan and increase its chances in the competition with other agricultural productions.

Conclusion

Throughout this paper, we have tried to bring out the forest region of Cameroon from the human context, the essential factors that are susceptible to favour or hinder the eventual introduction of rattan palms in the agricultural production systems of farmers. As we have noticed these factors are of various nature. Among the most important potential advantage, we have relative availability of arable lands, age, sex, the level of education, and the mind frame of some of the first order target actors. We also have the existence of rural supervisory structures, which can eventually serve as a link for extension. The most sensitive potential impeding factors according to us seems to be at the level of insufficient labour force in some region, the land tenure system, and competition between rattan palms and other agricultural productions.

As has been repeated several times, this is an exploratory reflection. For this reason, it is far from touching all the aspects of this topic and therefore has loopholes. This is unfortunately the shortcoming of such a pioneer work. More so for some aspects we have reasoned at the scale of the entire forest region of Cameroon. This at times imposes the necessity for meticulous appreciation that cannot be ignored considering that the South-Cameroon is very diversified at the physical as well as human perspectives. Any eventual extension initiative should first of all incline on the specificity of the concerned population. Similarly, at a general level in the transfer of technology from Asia to Africa, which is the tendency now, it should not be forgotten that the Dark Continent has its unique particularities which, are not always close to those of South-East Asia.

Considering the socio-economic factors that we have talked about throughout this presentation, if we would want to make rattan palms cultivation a cardinal instrument in the conservatory management policy of this NWFP, actions should be essentially in two directions:

1. Develop potential advantages (for those that offer this possibility) or set up conditions that are likely to favour a maximal exploitation of these favourable factors. We think for example about the sensitisation of farmers in an effort to expel from them perceptions that are against the cultivation of rattan palms; the effective implication of the principal target actors to all the stages of this process, especially for *in situ* trials, in the setting up of appropriate post harvest rattan conservation methods, etc...
2. Reduce, if not purely and simply eliminate constraints and errors. From this point of view, one of the most sensitive levers that absolutely have to be manipulated is competition. Natural and social science researchers have to find the cropping formula (combination with other agricultural productions, management of labour factor, optimal localisation of planting sites) which should enable rattan palms to be financially competitive. More so, profitable openings should be identified for rattan as a raw material and for its derived products in order to render its cultivation attractive. Such an enterprise requires many actions (improvement of technical and managerial knowledge of artisans, training of the latter in design; rationalisation of the sector).

Acknowledgements

We are very grateful to the staff of the APFT (“Avenir des Peuples des Forêts Tropicales”) programme for their various supports. Our gratitude goes especially to Fr. Pierre de MARET, to Dr. Edmond DOUNIAS, Serges BAHUCHET, Alain FROMENT, Olivier MANDJEK, and Eric GARINE. This gratitude also goes to Pr. J-L. DONGMO and GWAN ACHU.

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TECHNOLOGY TRANSFER BETWEEN ASIA AND AFRICA: RATTAN CULTIVATION AND PROCESSING

Terry C.H. SUNDERLAND & Joseph NKEFOR

Abstract

The international trade in rattan is currently worth some US\$6.5 billion per annum with the majority of this trade being dominated by the rattan-producing countries of SE Asia (ITTO, 1997). Undoubtedly driven by this thriving market, rattan research and development in Asia, and in particular Malaysia, is arguably 15-20 years ahead of the rattan sector in Africa. In Asia, great strides have been made in rattan cultivation, in both plantation and forest enrichment planting schemes coupled with the development of low technology methods of processing and transformation ensure that rattan products are of the highest quality. Attempts are now being made to develop the rattan sector in Africa, and many government and development agencies are advocating the introduction of cultivation schemes to mitigate resource scarcity in the wild. The poor quality of finished products through poor processing and transformation has also been flagged as a significant constraint to the development of the rattan industry in Africa.

In this regard, it is essential that lessons are learnt from the long-established rattan industry in Asia and, whilst admittedly operating under differing economic conditions, the rattan sector in Africa has a great deal to learn from that of Asia. In order for the meaningful development of rattan to take place in Africa, it is not necessary to “re-invent the wheel” but to learn from the experiences gained through the many years of research and development of rattan undertaken elsewhere.

This paper summarises the findings of a visit to Malaysia and describes the activities and experiences of the key rattan research institutions of Malaysia and a number of private enterprises in Peninsula Malaysia and Sabah concerned with both large-scale rattan cultivation and processing. Recommendations and suggestions are made with regard to the adoption of potential interventions appropriate to the African rattan sector.

Introduction

Rattans are climbing palms in the sub-family Calamoideae, the flexible stems of which are used in basketry and furniture manufacture. The majority of the known 600 species of rattan occur in SE Asia, Malesia and the Pacific, although 20 species also occur in the lowland tropical forests of Africa. Despite this diversity, the trade in rattan is dominated by the use of a relatively small number of species which possess the desired properties of strength, flexibility and uniformity required for high quality transformation. In Malaysia for example, of the two hundred or so species that occur there, only about 25 are of commercial value.

For millennia, rattan canes have been utilised by forest dwellers where they occur. Indeed, Manokaran (1990) suggests that the importance of rattan to life in Asia is such that he terms it a “rattan civilisation”.

Rattan cultivation

In Kalimantan, Indonesia, small-scale rattan cultivation has long been practised by forest dwellers. Rattan seedlings are removed from the forest and then incorporated into abandoned farm fallows soon after the harvest of the annual crops. The rattans grow and develop along with the surrounding secondary vegetation. When the land is cleared again after a fallow period of up to 15 years, the rattan is harvested and either sold or is retained for household use.

However, in terms of the world market, the scale of such cultivation is negligible, and the majority of the cane entering international trade originates from the wild. Along with this wild harvesting, intensive logging activities and the associated increase in forest conversion led to shortages of rattan became apparent in the early 1970's and forest departments in the SE Asian region began to investigate the possibilities of commercial rattan cultivation. The first steps taken towards this aim resulted in a complete taxonomic inventory of wild Malaysian rattans and the establishment of research plots that have been used to determine optimum conditions and subsequent guidelines for the cultivation of rattans (*A Guide to the Cultivation of Rattan*: Dransfield and Manokaran, 1992). To date, commercial plantations have been established in Peninsular Malaysia, Sarawak, Sabah, China, the Philippines, Indonesia and Papua New Guinea. Whilst there remain many unsolved problems concerning the cultivation of rattan, over 20,000ha of plantations have been established in Malaysia alone. However, as discussed below, the economic conditions that previously made the cultivation of rattan so attractive for some countries have changed significantly and the prospects for intensively cultivated sources of rattan are not quite as good as they were 10-20 years ago, particularly for Malaysia.

In Africa, until recently, no cultivation of any of the species of commercial importance is being undertaken, nor has there been any proven history of indigenous planting. However, the regular supply of raw cane to a thriving domestic cottage industry has been affected by over-harvesting and poor management of the wild resource to a significant extent. In order to mitigate the effects of this scarcity, many calls have been made by both government and development agencies for the inclusion of African rattans into cultivated systems. It is only recently that the commercially important species have been identified and subsequent work into the cultivation of rattans of Africa has led to the development of a rattan arboretum at the Limbe Botanic Garden, Cameroon. Latterly, in collaboration with the Cameroon Development Corporation, this propagation work has also resulted in the establishment of a one-hectare trial of *Laccosperma secundiflorum* in an obsolete rubber plantation. Now that the cultivation requirements of the commercial species are understood, feasibly, it is now possible to incorporate these species into a wider range of cultivation systems, as has been undertaken in SE Asia, particularly in Malaysia.

In Asia, the large-scale cultivation of rattan has concentrated on:

- The development of plantation systems with the use of a parent tree crop (rattan is a climber than needs arboreal support). Rubber (*Hevea brasiliensis*) has been predominantly used, but latterly a wider variety of tree crops have been experimented with. The majority of the commercial cultivation schemes favour this type of cultivated system.
- Enrichment planting with rattan after logging in secondary forest. Rattan is planted and maintained in logged-over lowland Dipterocarp forest.

Plantation schemes

Planting rattan in plantation situations began in Malaysia in the early 1980s. *Calamus manan*, a solitary cane that produces only one stem, is the most widely planted but there are also commercial plantations of *C. caesius*, *C. ornatus*, *C. subinermis* and *C. merrillii*. The parent crop for the majority of these schemes has predominantly been rubber, planted in association with *C. manan* where the solitary nature of the cane does not restrict access to the rubber stems for continued tapping. Planting with clustering rattans (i.e. those that produce many stems from an individual clump) provides a significant hindrance for access to the plantation, and species with this habit are far better suited to enrichment planting schemes. Other parent tree crops currently under assessment include timber species such as *Araucaria cunninghamii*, *Albizia falcata*, *Acacia mangium* and *Pinus caribea*, but many of these species have weak branches that tend to break as the cane matures. This is a particular problem with the robust *C. manan*.

Enrichment planting

Timber exploitation in Malaysia is a long-established activity and much of the forested land in the country is secondary re-growth that has undergone at least one harvest of viable timber. The fundamental nature of logging in Asian forests is wholly removed from the selective logging that occurs in the highly heterogenous African forests where 1-3 tree are felled per hectare. The domination of the Dipterocarpaceae in Asia, the members of which are highly valued for their timber, and the homogenous nature of the forests they occur in, means that many more trees per hectare are harvested and the effects of logging operations are more marked. Enrichment planting of logged forest with Dipterocarp timber species has long been a response to the high intensity of logging in such forests and a means of re-stocking. More recently, rattan has also been the subject of this enrichment and, to date, over 17,000 ha of logged-over forest in Peninsular Malaysia and Borneo have been under-planted with rattan seedlings.

After logging activities, a full forest inventory is undertaken to determine the value of the residual stand. Logged forest with few remaining timber trees is classed as “marginal forest” and as such is deemed suitable for under-planting with timber and/or rattan.

Table 1. Advantages and disadvantages of plantation and enrichment planting schemes.

System	Advantages	Disadvantages
Plantations	• Economic benefits from parent crop (esp. if timber species) • High establishment and low levels of initial mortality (<10% mortality)	• Capital intensive; usually undertaken by commercial concerns only • Biologically and ecologically de-pauperate; few species and uniform canopy • Harvesting difficult due to high canopy and inter-twining of rattan stems • Canopy support for rattan stems often weak; much crown damage • Theft of mature stems before harvest
Enrichment planting	• Biologically/ecologically diverse systems with species diversity and multi-strata canopy • Multi-tiered canopy; better support for rattan stems • Capital extensive • Easily adopted by small-holders and small-scale farmers • Lower canopy = easier harvesting of mature rattan crop	• High initial mortality and low establishment due to high light interception from canopy and competition from undergrowth (up to 40% mortality) • Need canopy manipulation • Conflict with valuable timber species

General observations regarding rattan cultivation

Light

Light penetration is the most crucial element in the establishment and growth of rattans in both plantation and enrichment planting situations. Although a degree of shade is required during the establishment phase, stem elongation is most influenced by the availability of incidental light through the canopy. In plantations, parent crops with a limited canopy or a pronounced deciduous nature (e.g. *Hevea brasiliensis*; *Albizia falcata*) enable the satisfactory development of the rattan under-crop. Beneath parent crops with dense canopies (*Pinus caribaea*, in particular) rattan growth has been recorded as particularly slow in nature, with initial establishment being extremely low (<10%). In enrichment forest planting schemes, a good deal of canopy manipulation is necessary to ensure adequate light penetration for rattan development. Much of this canopy manipulation takes the form of girdling and/or poisoning surrounding trees. However, in some regrowth areas where the regenerating forest contains many species of value for timber, these species take priority and are not removed, often to the detriment of the developing rattan crop. Experimental data shows that the optimum growth of a rattan under-crop in enriched forest is on a south-facing slope where light penetration through the canopy is at its maximum. The spacing of the rattan under crop also influences the light availability; this is discussed further below.

Fertiliser application

The shallow laterite soils that dominate much of Malaysia and Borneo are relatively infertile and many cultivated systems that include rattan have incorporated the use of high levels of general N:P:K fertiliser. In general, however, the benefits of fertiliser application are now generally considered to be negligible for the following reasons;

- Fertiliser addition not only induces and increases the growth of the rattan crop, but also stimulates the growth of the weedy vegetation within the cultivated system. If not intensively weeded, the weed growth often out-competes the rattan crop and in this respect, establishment has been as low as 10% for new rattan plantings.
- Fertiliser is expensive, and recorded costs are as much as US\$140 / ha / annum¹; notwithstanding the additional costs of controlling fertiliser enhanced weed growth.

Spacing

Until recently, the accepted spacing for rattan plantations and enrichment planting schemes is 6 x 3m (i.e. 6m between the rows and 3m between the individual plants within the row). However, once the rows are cleared for planting, this does not allow for adequate light penetration, particularly in enrichment planting schemes where the forest canopy grows back to fill these narrow areas cleared extremely quickly. More recently, double-spacing schemes have been experimented with and have proven effective in allowing sufficient light penetration. Double-spacing entails the clearance of a 4m-wide strip through the forest. Each of these cleared strips is 7m apart. Within the cleared 4m strip, two rows 3m apart are set out, with the spacing between the individual plants in the row being 2m. Initial trials have proven that the extra light penetration from clearing a 4m strip through the forest has a beneficial impact on establishment and growth.

Pests and diseases

In general, pest and disease attack of rattans, both in the wild and in cultivated systems is minimal. In *Calamus manan*, there is some borer damage of the immature stem, which can affect the development of the stem apex. Mature stems in contact with the soil are also prone to termite attack. This termite problem may be controlled by ensuring that mature stems are fully supported by the tree canopy; thus the stems do not make contact with the soil.

Harvesting

The harvesting of rattan is undertaken by hand and is a notoriously difficult activity. This is no less the case in cultivated systems where the spatial density is high and where rattans become extremely entangled both with the parent tree crop, and with each other. Often, in these situations, harvesting requires the use of a tree climber who cuts the upper leaves caught up in the tree canopy, allowing the lower stem sections to be dragged down far more easily. FRIM have also worked on mechanised harvesting; using a 4 x 4 vehicle to drag down the stems. However, this method has been proven to be prohibitively

¹ At a stocking of 555 stems/ha with fertiliser addition of 200g per plant; the standard practice for the cultivation of *Calamus manan*.

expensive and is obviously only suitable where there is adequate road access. In plantation situations, the timing of operations it is desirable that both crops will reach maturity and could be harvested at the same time (timber and rattan), although in enrichment planting systems, this is not possible. Harvesting the mature crop remains one of the highest capital inputs in rattan cultivation.

Commercial harvesting cane from both the wild and plantations is almost exclusively undertaken by contractors. One harvester can harvest up to 50 sticks a day and the harvester is paid a standard US\$0.10 per stick, although the roadside value of each stick US\$0.80. This disparity is one of the reasons why the reported theft from rattan plantations is so high (Shim pers. comm.).

Comparisons in yield: plantation vs. enriched forest

As the spacing and ecological conditions between plantation systems and enrichment planting of logged forest are similar, harvest yields between the two systems do not vary in particular. In general, both systems would expect a yield of 4,000 sticks² per hectare of large diameter species and 7,000 sticks of the small diameter species. The roadside value of each stick is currently US\$1.10; a return of between US\$4,400 to US\$7,700 per hectare. This does not include the additional benefits of harvesting parent crops for timber, nor the continued tapping of latex of rubber during the life of the plantations.

The sale of propagation material

During the 1980's and early 1990's the prospects for rattan cultivation were such that the seed for commercially important species was in high demand. Indeed the early rattan plantations made more money from the sale of seed to commercial concerns than from the harvest and sale of the cane itself. In particular, *Calamus manan* seed was highly sought after and some plantations were making an enormous profit on its sale and distribution. Fruits were sold to processors for US\$0.02, the seed cleaned and then re-sold for US\$0.06. With each female plant³ producing up to 3,000 seed per annum, this represents an important source of alternative income, and initially spawned a thriving industry in the sale and processing of the seed. With the prospects for rattan cultivation now somewhat diminished (see below) the demand for rattan seed has fallen accordingly.

Provenance trials and crop improvement

Although large areas of Malaysia have been planted with rattan, very little work has been undertaken on the selection of improved varieties to ensure the maximum yield and quality from a particular crop. To date, provenance trials of one species only, *Calamus*

² The unit of trade is the "stick". The sticks of large-diameter canes are 3m in length; one mature stem might produce 6-7 sticks. The sticks of the more flexible small-diameter canes are 7m in length.

³ The majority of rattans, including *C. manan*, are dioecious (i.e. they have male and female individual plants). Proportionally, around 20% of any plantation of *C. manan*, is made up of female (and hence seed producing) plants, with 35% male and up to 45% of indeterminate sex (i.e. they are harvested before they reach reproductive maturity).

subinermis, are in effect. Fourteen provenances, of this species, from a wide range of habitats are currently being evaluated in Sabah. The criteria for the improvement of this species, and indeed rattans in general, include the possession of the following desirable traits:

- Rapid growth rates
- Reduced armature of leaf sheath
- Clustering (and number of stems). *C. subinermis* can be solitary or clustering; in terms of potential yield, the clustering habit is desired for increased yield as is a maximum number of stems. This is not an issue with solitary species.
- Long internodes. Rattans with long internodes produce a better quality raw cane.
- Post-harvest cane quality. Selected for flexibility, strength and durability

The economics of rattan cultivation

Traditionally, rattan markets have focussed on the major transformation centres of Singapore, Hong Kong and Taiwan; countries with very little rattan of their own, and reliant on the import of raw cane from countries such as Indonesia, Malaysia the Philippines, and other countries within the SE Asian region.

The ban of raw cane from Indonesia in the early 1990's ensured that other source countries such as Malaysia could continue to supply raw cane to these international transformation centres. These markets ensured that there was a constant and regular demand for raw cane, not only from the wild, but also from cultivated sources, making the trade in cane and cane products highly profitable. This demand, coupled with the scarcity of raw cane from much of Malaysia's forests, has stimulated the high level of activity in the field of rattan cultivation and has led to the establishment of the large areas of plantation and rattan-enriched forest encountered today. The relatively short rotation of rattan also ensures a reduced discounted period, especially when compared with the planting of timber species. Hence the cultivation of rattan was initially economically viable, and potentially highly profitable.

Unfortunately, for two reasons, all that has now recently changed.;

- The crisis in the Asian "tiger" economies of the late 1990's has led to the devaluation of many of the regional currencies. One of the worst affected has been the Indonesian Rupiah. In order to obtain foreign currency, in early 1998, Indonesia lifted the ban on the export of raw cane and now cheap supplies of wild-harvested rattan are flooding the market. Due to high labour costs, coupled with a relatively strong domestic currency, Malaysia and a number of other supply countries cannot now compete with these Indonesian exports. Indeed, Malaysia has also recently begun to import raw cane from Indonesia, as it is more economically viable to do so than rely on the domestically produced raw material. There is no confidence that this situation will change in the near future and many commercial concerns are now dramatically cutting the costs of their stock of

processed rattan just to be able to sell their remaining supplies to the end-users of raw cane.

- Recent advances in oil palm research in Malaysia now mean that palm plantations are now productive within three years and ironically, rattan cultivation is now considered too long a rotation. Coupled with the continually buoyant world market for palm oil and its products, many commercial agricultural operations are now planting oil palm.

This has now resulted in a loss of confidence in the cultivation of rattan and many commercial concerns in Malaysia in particular are harvesting and clearing their remaining areas under rattan cultivation and planting oil palm. Huge swathes of secondary forest are also being cleared for oil palm plantations. Almost without exception, all those consulted with during this field visit stated that the cultivation of rattan was no longer economically viable and that the future of the rattan industry would rely on material harvested from the wild, either from Malaysia, or from other sources of supply.

This situation is also reflected in the priorities for forestry research. The emphasis has recently shifted dramatically from rattan to other oil palm and timber species and the future of the existing experimental trials is uncertain. A more thorough review of the cultivation potential of Asian rattans, in both technical and economic terms, is covered in the recent publication: *Rattan cultivation: achievements and prospects* edited by Bacilieri and Appanah.

The African situation, however, is somewhat different. High levels of harvesting to supply the thriving domestic markets are creating significant scarcity around many urban centres, making raw cane often unavailable to artisans. In addition, the opportunity costs of harvesting from the wild are transferred to the final product, making cane and cane products relatively expensive. Recently, the community management of forest lands has been written into the forest codes of many African countries. This means that the benefits of forest management and the products contained therein will, for the first time, accrue to the communities concerned rather than the State. Many of these forest lands include vast areas of secondary forest and farm bush that are currently the focus for improvement and valorisation through the introduction of high-value non-timber forest products in agroforestry systems. Now that the African rattans have a proven cultivation potential, it is also possible to enrich such forest with rattan through under-planting and subsequent management. The benefits of such community-managed enrichment-forest systems, coupled with better management of the wild resource, include;

- Increased revenues from high value forest products, such as rattan, which accrue to the communities concerned
- Continued, and guaranteed, supply of raw material to rattan artisans whilst alleviating pressure on the wild resource
- Diversification of otherwise de-pauperate forest lands

- Maintenance of a forest canopy and multi-strata cultivation system (high species diversity and retention of ecological integrity).

In short the economic and social conditions in Africa make low-impact, enrichment-based, cultivation of indigenous rattan a viable proposition, particularly if combined with coherent social forestry programmes.

Rattan processing & transformation

The African situation

Processing of raw cane essentially entails the removal of the epidermis (skin) from the stem and the drying of the raw cane prior to its use. Immature stems, or the very apex of mature stems, where the leaf sheath is also present are not used, and are often left or discarded at the time of harvest. The processing of raw cane throughout much of Africa is undertaken manually, with the stems being scraped with kitchen knives to remove the skin followed by drying, usually undertaken in the open air. This rudimentary means of processing is not only labour intensive, but also results in inferior quality cane being available for artisan use. This inferior quality has led to speculation that the quality of cane in Africa inherently poor. However, this has not been substantiated by thorough anatomical or mechanical studies as yet and it is possible that, if processed and transformed more efficiently, cane from Africa could, in terms of quality, rival that of Asia.

The Asian experience

The formal processing of rattan is often undertaken as a separate activity to the transformation of the raw cane into finished products. Indeed a long-established industry concerned solely with the processing of raw cane remains a thriving aspect of the rattan trade in Malaysia. These processors take freshly harvested (“green”) raw cane, and transform it into a suitable raw material for later transformation into finished rattan products. Despite the presence of a domestic industry, much of the processed cane is destined for the major transformation centres of Singapore, Taiwan and Hong-Kong, but some is also exported further afield to Europe and N. America. Rattan processing is a basic, technologically simple process yet provides significant improvements in the raw material available for transformation.

For more details of rattan processing and transformation, the Rattan Information Centre has produced a booklet on the *Guidelines for the selection and preparation of rattan for industrial use* by Abd. Latif Mohmod.

Specifications for selection of cane for processing and transformation

A set of informal guidelines exists for the selection of cane for industrial processing and transformation. These are summarised below and are immediately applicable to the African taxa. In general, the quality of the cane is dependent on its age and maturity. The age at which a rattan matures depends on the species with small-diameter canes maturing sooner than the large-diameter canes. The use of young or immature (top portion) of rattan often gives rise to low-quality end products due to defects such as shrinkage, cracking, discoloration and coarse surfaces. The criteria for the selection for rattan for harvesting are as follows;

- Leaves, and leaf sheaths about the dry and peel or already having done so.
- Basal portion of stem turns dirty-green or yellowish, and increasingly free of thorns (where present).

Table 4. Specifications for rattan for industrial use.

Specification	Notes
Raw cane should be free of defects	• Genetic defects such as short internodes • Environmental defects (e.g. shrinkage, tapered ends and non-uniform diameter) • Biological defects (worm and borer holes) • Mechanical defects (cracks, splits, imperfect cutting and scratch due to dragging during extraction)
Colour and surface appearance	• Uniformity of colour along the stem • Glossy and bright
Physical characteristics (in general canes should be straight, cylindrical and firm)	Desired characteristics • Elasticity • Fine and smooth surface for easy sanding • Strong adhesive characteristics for absorbing glue and varnishes • Ease of drying • Can withstand heat during bending and shaping • Does not break or split during bending • Requires a minimum time for steaming

Treatment and processing

The quality of cane depends on how well they have been treated. Initial treatment of raw cane entails boiling the stems in diesel or coconut oil (or a mixture of the two) at an average temperature of 280°C for 20minutes for large diameter cane, and 10 minutes for small diameter cane. This boiling process is beneficial for the following reasons:

- The latent moisture content of the cane is reduced dramatically, facilitating the later drying process and reducing the risk of deterioration during storage.
- The boiling process kills any pests and diseases that might be present in the raw cane.
- Boiled rattan is more durable during storage and is less prone to borer damage and fungal attack.
- Boiled rattan possesses a rich tan colour and a glossy and bright surface, often negating the need for the addition of varnish after transformation.

Immediately after the boiling, the excess oil is cleaned off with sawdust or coconut fibre. The “cooked” stems are then stacked in the open to dry. When the stems are reduced to 15% moisture content, they are then ready for decorticating, sanding and, in the case of small-diameter canes used for weaving, splitting. Straightening of large-diameter canes is

also sometimes necessary, particularly at the nodes. These procedures are undertaken using machines specially designed for rattan processing.

After cleaning, further processing of the small diameter canes often entails fumigation of the canes with sulphur for twelve hours in a closed-case system. This fumigation provides further protection against insect attack.

The profits from rattan processing are relatively high; “green” canes are purchased for around US\$0.80 and re-sold after processing for US\$2.15. Labour costs are relatively low⁴, and the low technology involved in rattan processing ensures that capital investment and expenditure is also minimal. A medium-sized processing plant processes around 4,000 sticks of rattan per month.

Transformation

The transformation of raw cane is also extremely low-tech. However, simple improvements and knowledge of the limits of the raw materials, coupled with basic improvements in processing as described above, the high quality of the finished products is maintained. Basic differences between the transformation process in Asia *vis a vis* that of Africa, include the following:

- Bending of the cane is undertaken using steam, rather than a blowgun, thus reducing discoloration and tarnishing through scorch marks. Where a blow-gun is used, the heat of flame is such (bluish) that scorch marks are negligible and if they occur, they are immediately sanded off.
- Nails are hardly used. Staples, 0.5-2.5 inches long, driven by compressed air staple guns, are more common means of attaching cane sections. Joints are then sealed using binding or weaving.
- The use of dowels and intricate jointing is also a common means of attachment and avoids the use of “metalwork” at all.
- After completion, finished products may be bleached to obtain uniformity of colour, especially when different species of cane are used.
- Dipping in kerosene is also common; this provides yet more protection against insect attack.
- Varnish is applied in two coats; the first coat is applied and then lightly sanded prior to the application of the second coat. This ensures an even and long-lasting finish.

Immediate implications and interventions for the African rattan sector

- The success of enrichment planting as experienced in Malaysia, coupled with its ecological desirability, make the inclusion of rattans into agroforestry systems based around farm fallow and marginal forest lands a feasible option to mitigate the scarcity of raw currently being experienced in many parts of Africa. The

⁴ Although the use of immigrant labour from Bangladesh and China ensures that this situation remains so.

added social advantages of inclusion into community-managed forest systems, add credence to this possibility. *Further trial planting of rattans undertaken by ARRP and LBG will now concentrate on enrichment planting in farm fallows, and secondary forest.*

- The inadequate nature of rattan processing and transformation throughout much of Africa suggests that even small improvements would make a considerable impact in the quality of finished products. *To that end, funds have been made available to the African Rattan Research Programme to organise a training course in rattan processing in the Botanic Garden in Limbe, Cameroon in early 2001.* The course will be run by a staff member of the processing unit of FRIM and will target key artisans within the rattan artisan trade in Cameroon, identified as being “nodes of operation” from where any new knowledge will filter out. This is a pilot exercise, the success of which (in terms of adopted technology) may determine the potential for future courses to be held elsewhere in Africa.

Acknowledgements

Initial discussions with Dr John Dransfield highlighted the potential transfer of knowledge between the rattan sectors of Asia and Africa and John also made useful suggestions regarding the itinerary in the planning stage. In Malaysia, particular thanks go to Drs Nur Supardi Mhd. and Lee Ying Fah for being such gracious and informative hosts. We are also grateful to P.S. Shim, and Drs. Raja Barizan Raja Sulaiman and Abd. Latif Mohmod for their participation in enthusiastic and stimulating discussions regarding the pros and cons of rattan cultivation and transformation. The Central African Regional Program for the Environment (CARPE) is also acknowledged for its continual support of the work of the African Rattan Research Programme.

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THE IMPACT OF RATTAN EXPLOITATION ON THE PRESERVATION OF FORESTS IN KINSHASA

MINGA Minga DAVID

Introduction

The local exploitation of timber and fuelwood harvested by the population and street vendors is the cause of serious forest degradation in the Democratic Republic of Congo. To slow down deforestation, alternative strategies that are likely to replace the use of timber should be envisaged. Among non-wood forest products likely to replace timber, rattan occupies a distinct place with respect to furniture production. In effect, rattan which is an under-utilised forest product that can be exploited with little ecological disturbance of the forest.

This hypothesis allows us to demonstrate that the promotion of rattan consumption notably in the making of furniture could reduce the timber consumption, particularly in Kinshasa, and preserve the surrounding forests. To verify this hypothesis, we carried out a study to evaluate the demand and supply of rattan furniture. The main questions this study attempted to answer were with regard to:

- The sources of rattan supply,
- The volume of rattan used in Kinshasa,
- The quantity of rattan furniture commercialised in the city of Kinshasa,
- The buyers of rattan furniture,
- Rattan furniture promotion.

This paper is intended to show that rattan is an alternative resource for timber and its use could be part of a strategy in reducing over-consumption of wood used in carpentry workshops. In order to attain these objectives, we proceeded by participatory observation aimed at identifying the major rattan furniture fabricating sites and the rattan distribution channel in Kinshasa. Seven rattan furniture fabrication sites were identified. These are; Binza Delvaux, Bandal, Bongolo, Kasavubu, Limeté Mosquée, Limeté 7ème rue and Limeté Mombele. In these sites, an inventory revealed 114 production units and 29 basket weaving centres employing close to 555 workers and apprentices, plus 29 basket weavers.

The actual investigation proceeded with a pre-investigation that took from the October to December 1997. This involved addressing a structured questionnaire to fabricators (artisans and basket weavers) and consumers. With respect to the number of production units and basket weaving centres, 32 artisans, 14 basket weavers, 4 artisans-basket weavers, and 50 consumers of various categories randomly questioned (discussions and interviews).

The types of rattan palms exploited in Kinshasa

Artisans in Kinshasa use three types of raw material; the true rattans, “*nkau*” (*Laccosperma secundiflorum*), “*liane*” or “*osier*” (*Eremospatha macrocarpa* and *E. haullevilleana*) and *bois-rotin*, wood that has been passed through a machine, imitating the shape of cane. Field investigations enabled us to discover that almost all the artisans use the *bois-rotin* to a greater or lesser extent in the place of *nkau* (*Laccosperma*) to make furniture. They explained that one of the reasons urging them to use *bois-rotin* is the difficulty they have in shaping rattan to obtain their desired model.

Supply

In Kinshasa itself, rattan is obtained essentially from wholesale suppliers. Most (80%) of the rattan comes from the Provinces of Bandundu, Bas-Congo and Equateur. This supply is somewhat erratic. At times it is suppliers who come and inform artisans and basket weavers that they have brought rattan, at other times they bring rattan directly to the production units of artisans. There is neither any reference depot nor any sort of formal sales point; hence the supply is not regular. Actually furniture makers do not know how long it will take them to get a fresh supply and this brings about production disturbances. In short, investment in the wholesale trade of rattan is almost non-existent. Generally, it is those selling some form of processed cassava who buy rattans from villagers to resell them when they go to the sell in the market at Kinshasa. Artisan and basket makers in Kinshasa do not have any adequate supply policy. They first of all sell their finished products to re-acquire fresh stock of raw material. The little output they provide is due to lack of capital to constitute stocks. The average cost at purchasing is 15 US \$ per bundle of 15 to 20 pieces of *Laccosperma* and 15 US \$ per bundle of 35 to 40 pieces of *Eremospatha*. The running cost (finished furniture, customer credit and various forms debts to the production unit) is evaluated at an annual average of 750 US \$ for artisans and 144 US \$ for baskets weavers.

To avoid rattan conservation related problems, artisans and basket weavers of Kinshasa have put in place a series of strategies capable of helping them avoid stock wastage and preserve capital. These strategies involve keeping rattan in cool shady places or burying the stems in soil. The transformation cost is a key factor in determining the selling price of all products. This investigation revealed that the most used means of transport for rattan into the city of Kinshasa is the motor vehicle. The continuing deterioration of the road infrastructure accounts for the recent instability of the cost of rattan. The second popular means for the transportation of rattan is by river, but the irregular nature of boat transport makes this supply route somewhat unreliable.

Rattan furniture production

The average age of rattan furniture artisans is 32 years and 55 for basket weavers. This difference is due to the fact that basket weaving requires less physical effort. More so, around 1940, the colonial government established professional or handicrafts schools among which was the training facility for basket weavers at Kimwenza (to the west of Kinshasa).

The rattan trade is carried out by those who have attained a certain level of education (64% have been to secondary school) and responsible persons (72% are married). Since 1975, the Democratic Republic of Congo is experiencing a serious economic recession. This was aggravated by the 1991 and 1993 “pillages”. These problems were at the origin of artisans’ interest in rattan craft between 1976-1980 (18%) and between 1991-1995 (32%) against 2% between 1965-1970 and 2% between 1971-1975. Many production units identified by our investigations were created during these periods of economic hardship.

In all of these rattan furniture production units, there is no structure, which responds to the managerial norms with the division of labour. The working conditions in workshops are low input and low technology. In effect, other than huts used in keeping finished furniture, rattan artisans and basket weavers are exposed to sun, rain and other adversities; the sector is purely informal. No legal criteria such as living cost, level of education, etc are taken into consideration for salaries. In some workshops, salaries do not exist and benefits are shared out only after sales. It should also be noted that the proliferation of administrative taxes is not such as to encourage owners of production units.

The quantity of rattan consumed in Kinshasa

To determine the quantity of rattan consumed in the city Kinshasa, we should recall that the artisans and basket weavers use pure rattan and *bois-rotin*.

On average, to make a salon set (“ngoma” or “satellite”), furniture makers use:

- *Laccosperma secundiflorum* (*nkau*): 3 bundles of more or less 20 pieces per salon;
- *Eremospatha macrocarpa* and *E. haullevilleana* (*liane*): 3 bundles of more or less 35 pieces per salon;

Each workshop produces an average of three such furniture sets per month. Considering that 114 workshops were censused in Kinshasa, it is estimated that each month, rattan consumption will therefore stand at:

- *Laccosperma secundiflorum*: 3 bundles x 114 workshops x 3 salons per month = 1,026 bundles x 20 *Laccosperma* used in tying the bundle = 20,520. Given that one fresh *Laccosperma* of 4 m or more in length weighs more or less 4 kg, the total weight is therefore 20,520 *Laccosperma* x 4 kg = 82,080 kg.
- *Eremospatha* spp.: 3 bundles x 114 workshops x 3 salons per month = 1,026 bundles x 35 used in tying the bundle = 35,910. Given that one fresh *Eremospatha* spp. of 4 m or more in length weighs more or less 2 kg, the total weight is therefore 35 910 *Eremospatha* x 2 kg = 71,820 kg.

To make a rocking-basket, the standard basket used for storage and transportation, weavers on their part use:

- *Laccosperma secundiflorum*: 1 bundle of more or less 20 pieces.
- *Eremospatha spp.*: 1 bundle of more or less 35 pieces.

Given that each weaver weaves 8 baskets per month, with 9 specialised weavers, we shall have:

- *Laccosperma secundiflorum*: 1 bundle x 9 weavers x 8 baskets = 72 bundles x 20 *Laccosperma* used in tying the bundle = 1,440 *Laccosperma*. But one fresh *Laccosperma* of 4 m or more in length weighs more or less 4 kg. The total weight is therefore $1,440 \times 4 \text{ kg} = 5,760 \text{ kg}$.
- *Eremospatha spp.*: 1 bundle x 9 weavers x 8 baskets = 72 bundles x 35 *Eremospatha* used in tying the bundle = 2,520 *Eremospatha*. But one fresh *Eremospatha* of 4 m or more in length weighs more or less 2 kg. The total weight is therefore $2,520 \times 2 \text{ kg} = 5,040 \text{ kg}$.

In Kinshasa, monthly consumption can therefore be estimated at 164,700 kg of rattan. That is 153,900 kg by artisans and 10,800 kg by weavers.

Increased commercialisation of rattans in Kinshasa

The above figures show that artisans and weavers consume significant amounts of rattan in Kinshasa. However, the rattan market is highly disorganised. The only rattan furniture sales points are their places of fabrication. Artisans and basket weavers are sellers and producers at the same time. The prices differ slightly according to market sites. The highest prices are obtained at the “Référence de Binza” site. The maximum prices at this site are 350 US \$ for arm chairs “ngoma” and 0.2 US \$ for the smallest dimension of flower container. Whereas in other sites these are 300 US \$ and 0.15 US \$ respectively. To attain an increase in production and sales, it seems necessary to develop the organisation of work. We have to be able to dissociate the three traditional functions of production, which are supply, production and sales. This is because our investigations revealed that the eventual customers of rattan furniture do not really know the sales points of these furniture and other weavers’ products.

Rattan exploitation and preservation of the forest

Sustainable rattan exploitation has a positive impact on forest preservation. In effect rattan is a non-timber forest product that can bring about a reduction in the consumption of timber and wood for artisan studies. It is therefore imperious to assert its social and economic importance as a material that is likely to substitute furniture wood. Irrational exploitation of forest resources constitutes a barrier to economic development in general, and to the city of Kinshasa in particular.

The analysis of environmental problems, their understanding and the search for solutions implies that the environment and the economy be treated systematically like two entities that are at the same time independent and interactive. That is why the long or mid-term amelioration of the environmental quality of the hinterlands of Kinshasa city can only be by providing resources that shall reduce the over-use of timber.

Forest exploitation can be an economic necessity as is the case of rattan exploitation, which is a source of revenue for artisans and basket weavers. From a social point of view, the commercialisation of rattan seems to be a job creating activity and one that favours the integration of people. In effect, immigrants from the hinterlands of Kinshasa integrate easily in this sector because of their mastery of weaving.

Rattan transformation is also an activity that promotes traditional African culture. Rattan is effectively present in every use: the construction of huts, basket weaving, artisan studies, hunting and fishing materials, dressing (sandals, caps) etc. one cultural value of rattan is that it is part of the Congolese cultural heritage. In museums there are rattan made objects such as: boxes (*mingedi* which is an object used in conserving food and *mishweek* used by the “Kuba” people for storing traditional costumes and other items), mats for public audiences.

Conclusion

Without doubt our studies show that the promotion (advertisement, creation of sales points, creation of powerful associations of artisans and basket weavers) of rattan furniture and weavers products in Kinshasa could enable the reduction of wood consumption in this city and maintain the forest equilibrium in its hinterlands. However, strategies must be developed to harvest rattan in a sustainable manner.

THE INDUSTRIAL USE OF RATTAN BY THE DISABLED IN ZAMBIA

George TENATI

Introduction

Macro-economic setting

Zambia is a tropical land-locked country located in Southern Africa and sharing borders with seven (7) countries: Angola, Botswana, Democratic Republic of Congo, Mozambique, Namibia, Tanzania and Zimbabwe. Its land area covers 752,620 km² with a population of about nine (9) million people. About 53% of the population lives in the rural areas and 47% in the urban areas.

The country is geographically and administratively divided into nine (9) provinces and sixty-one (61) districts. The rain season covers a six (6) months period from November to April- Annual rainfall is between 800mm - 2000mm with the heaviest rainfall occurring in the two (2) rattan growing provinces of Luapula and North-Western. This is attributed to their proximity to the equatorial rain forest of the Democratic Republic of Congo.

Economically Zambia is a poor country with a per capita income of US\$300. The main economic activity is copper mining which is mined on the Copperbelt Province. However, the agriculture sector is by far the biggest employer and 67% of all formal employment is found in the agriculture sector and about 50% of the country's population depends on agriculture for their livelihood (Zambia Economic Report, 1998).

The Forest Sector

Total forest cover in Zambia is 450,000 km². This represents 60% of the total land area of Zambia. Most of this forest area is savanna woodland. However, the most prominent woodland feature is the Miombo, representing 50% of the forest cover. Miombo woodland is a two-tiered woodland with an open or light canopy of semi-evergreen trees, 10-20m high. Generally, the forest resource is intact although deforestation rate is estimated at between 250,000-900,000 hectares per year (ZFAP, 1997).

Land Tenure

Zambia has two (2) types of land tenure: statutory and customary. The government is responsible for the administration of land fully under statutory law. This includes forest reserves and "open land" for allocation to investors. Under statutory law, the President of Zambia allocates land on a 99 year lease period.

Customary or Trust land falls under the authority of the respective chiefs. The chiefs are responsible for allocation of land to their subjects. The size of the land allocated depends on the respective family needs. However, one cannot obtain title for such land

unfortunately this arrangement has created confusion as to who is responsible for ownership of trees in the customary lands.

Government policy on the disabled vis-à-vis employment creation

Following independence in 1964, the government of the Republic of Zambia was faced with the daunting challenge of providing a comprehensive social service at almost 400,000 and most of these were without any vocational skills. Currently the population of the disabled is estimated to be 900,000.

In order to forestall this growing challenge, the government in 1968 passed a bill called the Handicapped Persons Act. This bill saw the creation of the Zambia Council of the handicapped as a statutory body. The Council was charged with the responsibility of among, many, the provision of Vocational Rehabilitation to all categories of the disabled. The Council working in collaboration with the relevant United Nations Organisations, notably the International Labour Organisation established a total of fourteen (14) vocational rehabilitation centres throughout the country. Additionally, provincial offices were opened in all of the nine (9) provinces and in some districts.

However, the most successful Vocational Rehabilitation Centre has been the Kangonga Production Centre situated on the Copperbelt province. The Centre's major activity is the production of rattan furniture and basketware.

This paper will highlight the organisational structure of the Kangonga production Centre, the production of rattan furniture/basketware, processing techniques, skills available, the level of technology, tools/equipment used and marketing of the products. This paper will also bring to the fore constraints in the activities highlighted. Further, the status of the raw material base and current research efforts that are underway will be highlighted (Tenati, 1996).

Kangonga production centre

Organisational Structure

Kangonga Production Centre is headed by a Centre Manager, who is responsible for co-ordination of all production and marketing activities. Immediately under him is a Branch Manager responsible for operations of the Basketry Department. Under the Branch Manager are the production Supervisors: one responsible for training of newly employed disabled persons and the other for production. Below the Production Supervisors are Group Supervisors responsible for quality control, allocation and supervision of production in the rattan and basketware departments.

Other personnel include the Accountant, Personnel Officers, Warehouse Supervisor, Sales Personnel, and Secretarial.

Production

Rattan Furniture Department

The rattan furniture department employs forty full-time employees and twenty casual workers. Most of the disabled in the department are physically disabled. The visually impaired (the blind) are few and are mainly responsible of binding work after the rattan furniture frames have been assembled by the physically disabled.

The department is headed by two Production Supervisors: one responsible for training and designing of products and the other for planning and scheduling of jobs. The two Senior officers are assisted by two group supervisors who are responsible for quality control and supervision of the workers. Products made embrace lounge suites, dining suites and outdoor furniture. Apart from manufacturing its own range of furniture for sale, the centre also accepts individual orders for customers bringing their own designs. This of course attracts an additional cost.

Employees are allocated different tasks of production as the furniture is being assembled i.e. assembling of the frames, binding and nailing.

Processing Techniques

The raw materials varying in length from 3 metres to 6 metres is sun-dried for a period of two to three weeks in the dry season. After acceptable levels of moisture content are reached, the raw material is then ready for production. The raw rattan is then sorted according to diameter size and then straightened using a blowtorch. The large diameter rattans are used for making the frames of the furniture, whilst the small diameter canes are used for the support. Additionally, the smaller diameter rattan pieces are selected for milling of rattan core used in basket-ware production.

Before production, the rattan poles are first soaked in water, dried and then the nodes are trimmed using sharp knives. Finally, the rattan poles are vigorously rubbed using a cloth dipped into paraffin. This is done to remove dirt as well as smooth the surface.

Tools & equipment used

Only the very basic of tools/equipment are employed in the production of rattan furniture at Kangonga. These are the blowtorches or lamps. The heat generated by the blowtorch is used for softening the raw rattan so that it is easy to shape to the appropriate design. Hammers and nail guns are used in the nailing of frames, whilst hacksaws are used for cutting the raw rattan to specified measurements and knives for rimming nodes.

Technology used and skills available at Kangonga

The level of technology employed is very basic. Whereas well established rattan industries in South East Asia use sophisticated technology in terms of designing of models, assembling of the frames and spraying. Kangonga depends on practical experience. Aspects of designing are done through templates. When new models of

furniture are to be introduced, the supervisory staff develop prototypes. These are the subjected to appraisal by the whole production team. Following a critical appraisal models are perfected and introduced as new lines of production.

As a production centre, with well over twenty years in rattan furniture production, Kangonga has developed its own on-the-job training programme for newly employed clients. The level of production skills is therefore quite high because of the way experience of the supervisory staff. Only persons who have proved themselves with a high degree of competence are appointed to supervisory positions. The great demand for the centres furniture is a strong testimony of this.

Harvesting of raw rattan from the wild

Harvesting of raw rattan from the wild is conducted during the dry season, between April and October. The Kangonga Centre recruits casual employees and this involves some ten villages. The men are paid a wage per bundle of raw rattan harvested. Each bundle has about twenty poles of rattan of about six metros in length and fetches the equivalent of US\$2.

Once enough raw rattan has been harvested to meet Kangongas' demand of usually ten metric tons, a truck is dispatched from Kangonga to collect the rattan. This is a distance of slightly over one thousand kilometres away.

The harvesting methods are however, very destructive. Both immature rattans and mature are cut indiscriminately. In addition, some of the mature rattans are not wholly collected as some portions are left hanging in the trees.

Diversity and distribution

Rattan diversity is very limited in Zambia as only one species is known to occur: *Calamus deerratus*. The distribution of *Calamus deerratus* is confined to one locality, Chiengne in Luapula Province, where it is found growing along the Luao river. The extent of the actual resources is not known as no studies have been conducted. However a consultancy undertaken by a Thai national, Professor Isara Vongkaluang, indicates that there would be a 50 per cent decline in the rattan to be harvested in future years (Vongkaluang, 1992). This pinpoints the fragility of the raw material base.

Basketware Department

The Basketware Department employs 120 disabled persons, most of whom are blind. The supervisory staff consists of a Branch Manager, two Production Supervisors and six Group Supervisors. The Production Supervisors are responsible for the overall administration of the department, whilst the Group Supervisors deal with the technical details of basket production.

The product range embraces all types of basketware for domestic use and industrial use, mostly in hotels. The main product however is the shopping basket, which is very popular among Zambian housewives.

The raw material for the production of basketware comes from processed raw rattan. The centre has two aging milling machines which were bought from Singapore in 1986. After the raw rattan has been processed as described above, it is sorted out into equal diameter and length sizes. The raw rattan is then fed into the milling machine, oval rattan core in diameters of 3mm and 6mm is obtained for production of all kinds of basketware. The milled core is then packed in 3mm and 6mm bundles in 3 metre lengths and sent to the warehouse for storage.

Marketing of rattan products

Kangonga Production operates three marketing outlets on the Copperbelt, and one in the capital city Lusaka. Rattan products of basketware and furniture are sold through these outlets. In addition to this, the Centre has customers from the Hotel industry throughout the country and leading shopping outlets, some of which are operated by multi-national companies.

The warehouse at Kangonga serves both as a wholesale outlet for those customers buying in bulk and as a retail outlet. The Centre has a seven-ton truck that transports finished products to those customers who do not have transportation. It is worth mentioning that among the notable customers are unemployed disabled persons. They buy rattan products in bulk especially basketware for resale in other towns. This therefore indirectly offers employment opportunities to additional numbers of disabled persons.

All in all the Centre rattan products enjoy a very good market share, especially given the facts that the products are of good quality, durable and Kangonga being the sole manufacturer of rattan furniture and basketware. On average, between thirty million Kwacha (K30 million) and forty million Kwacha (K40 million) is derived from sales. This is equivalent to about US\$16,000 per annum.

Current research efforts and the potential for further development of the rattan sector

Research on rattan conservation and utilization

The Zambia Council for the Handicapped came to see the need for conservation of the rattan resource through artificial regeneration of the species some years ago. Since then, the Council has formally been collaborating with the Forest Research Division of the Forest Department. Jointly, the two organisations have made a number of tours to the rattan growing area in Chiengi. These trips were aimed at studying the ecological and silvicultural requirements of rattan. Simultaneously efforts were made to collect rhizomes and seeds for experimental plantations. These were planted on the Copperbelt in 1992 and germination of the seeds collected was very good but after a while the

seedlings died due to lack of knowledge in tending the nursery. The rhizomes did not germinate.

Simultaneously a project proposal for the artificial regeneration of rattan was written and submitted to the I.D.R.C. in 1995. Although the proposal met the criteria, I.D.R.C. could not fund it due to some policy constraints then. This same proposal was then submitted to the local Food and Agricultural Organisation (FAO) offices who subsequently forwarded to Rome for a technical review. FAO offices in Rome were satisfied with the proposal and advised the local office in Zambia to scout for possible donors. This culminated in the co-operation with Finnida in 1996.

Finnida, through their project in Zambia called the Provincial Forestry Action Programme (PFAP) commissioned me to do an in-depth study of fibres in their project area. The project area for Finnida covers three provinces. The Copperbelt, Central and Luapula. The PFAP projects' major objective is not only the promotion of the utilisation of Forest products but also their conservation through community participation. Following my in-depth study fibres which made recommendations for enrichment of the resource base and improved utilisation,, the PFAP incorporated rattan in their project document. The overall project document is now in the process of being signed by the government of Finland and Zambia.

International Fund for Agricultural Development (IFAD) Zambia Forest Products Project

In 1996 the International Fund for Agricultural Development (IFAD), began formation of a project for promotion of Forest products in two provinces, Luapula and North western Provinces. This was after the Zambian government had made a request to the organisation. Subsequently IFAD sent a technical team in November 1996 to carry out a study. The study team was in the country for a month and following their detailed study a project document was written and submitted for joint discussion with Zambia government officials (IFAD, 1996). I participated in that meeting.

In late 1998 an appraisal team was sent by IFAD and among the experts was one in bamboo and rattan. This project will be for a period of six years. As at the time of writing this paper the project was almost read for signing. The Project envisages the modernisation of Kangonga production rattan department, the training of staff in designing techniques, improvement of manufacturing technology and the development of rattan/bamboo plantations using the community approach. In addition, the project will also promote the establishment of cottage industries using rattan and bamboo as raw materials. These cottage industries will involve both the disabled and other vulnerable groups in the two provinces mentioned.

Constraints

The level of production and thus income at Kangonga Production Centre would be much higher than the current levels. If it were not for the following constraints:

- Poor processing technology: Poor processing methods in rattan have contributed to lowering the quality of the raw material and the finished products. One major problem with the rattan at Kangonga is deterioration which leaves unsightly spots on the rattan surface.
- Inferior tools & equipment: The lack of appropriate tools/equipment is seriously limiting the production of quality products and the volume of production.
- Poor harvesting methods: Current harvesting methods do not take into consideration the quality of the raw material. By the time the rattan poles are transported to Ndola, the process of deterioration has already begun.
- Land Tenure: The current land tenure law places rattan in a very precarious situation. As the situation stands, the Forest Department has no control over the rattan reserves, since they are located in trust land. The traditional Chief not realising the importance of rattan, may make a decision that can result in the destruction of the resource base.

Conclusions

As can be seen from the above developments rattan has indeed gained acceptance by the authorities in Zambia and International Organisations. Its potential for creation of employment opportunities for the vulnerable members of society has been recognised. As a result of this realisation, the authorities have also come to appreciate the need to conserve the raw material through establishment of rattan plantations.

Therefore the potential for the development of the rattan industry at Kangonga is very high given the high level of attention from both the government and the International Community. This will positively contribute to poverty eradication.

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RATTAN AS A SUSTAINABLE COTTAGE INDUSTRY IN GHANA: THE NEED FOR DEVELOPMENT INTERVENTIONS

A. A. OTENG-AMOAKO & B. OBIRI-DARKO

Summary

Rattans when sustainably managed can be a source of income for rural people which will alleviate poverty among marginalised groups of people. They can be used as substitutes for timber trees, for food security, carbon sequestration and rehabilitation of degraded lands. More than 0.7 billion of the world's population are involved in rattan trade which is worth some 6.5 billion US dollars annually. Whereas the annual domestic market of rattan in South-East Asia is worth some 7.5 billion US dollars that of the countries in tropical Africa is almost non-existent, because the sector is poorly developed.

In Ghana, the rattan industry sector is not well developed when compared to that of Asia, but the future looks bright due to increasing demand for rattan products. The sector is however threatened by unavailability of raw rattan stems, poor processing facilities and ineffective pricing and marketing of products. Therefore, there is urgent need to increase rattan stocks by way of improved harvesting method to enhance natural regeneration, establishment of plantations and enrichment planting on degraded lands and logged over forests. Other interventions needed are effective preservation methods, better processing tools and a standard grading for sale of rattan products. A call is made to mobilize primary stakeholders into a formidable association for financial assistance and to effect positive policy change in the sector.

Introduction

The consequences of rapid depletion of tropical forest resources are quite enormous: global warming, soil erosion, endangered biodiversity and shortage of timber trees are but some of the many problems. Non-timber forest products such as rattans and bamboos have a potential role in solving some of these environmental and developmental concerns. Rattans sustainably developed can be used to alleviate poverty among marginalized groups and serve as a source of income for rural people. Rattans as substitutes for timber from natural forests can contribute significantly to carbon sequestration and biodiversity conservation. As a means for food security, rattans are a potential resource for rehabilitation of degraded lands, conserving topsoil for watershed management and food production.

In spite of its enormous potential, the development of rattan sector in Ghana has been neglected, a situation which is not different from other tropical countries of Africa. There is therefore urgent need for interventions which can lead to sustainable development of the resource and reap its full economic, ecological and food security benefits.

There are six main constraints facing the sector as identified by rattan primary stakeholders including collectors, processors, weavers and traders. They are as follows:

- Quantity and quality of rattan resource ;
- Inadequate rattan resource base;
- Inefficient processing and poor quality of raw rattans and finished products;
- Outmoded policies and legislations which stifle stakeholder aspirations;

- Lack of adequate markets for rattan cane and finished products;
- Unavailability of common platform for the primary stakeholders to voice their concern.

The paper takes a critical assessment of these constraints and suggests practical and prudent development interventions (including those recommended by the primary stakeholders) which can sustain the sector and bring economic prosperity to the collectors, processors and traders of raw rattans and finished products.

Development interventions

The long and medium term development interventions identified by the primary stakeholders in Ghana include the following: increasing and sustaining the quality and quantity of rattan resource base; efficient processing for quality rattan products and their marketing in an enhanced local and international competitive markets. In addition, these primary stakeholders should financially, socially and politically be empowered as an Association or pressure group to lobby for revamp of policies and legislation which hampers their aspirations (Fig. 1). The paper reviews these interventions essential to achieve sustainability and efficiency in the rattan industry sector.

A Sustainable Resource Base – How?

There is no inventory record of rattan resource of Ghana. What is known, however, is that rattans occur mainly in the forest reserves of the wet evergreen forest which covers an area of 6,570 square kilometers or eight percent of the total Ghana forest area of 81,342 square kilometers. Rattans hitherto found in the moist semi-deciduous forest around Asamankese, Enyiresi (near Nkawkaw) and Nyinahin (near Kumasi) has depleted (Fig. 2). Enyiresi on the Kumasi to Accra road, which used to be a very important base for the rattan cottage industry is virtually no more; collectors and weavers from this village have migrated to the cities of Kumasi and Accra. These primary stakeholders from urban areas buy rattan stems from village collectors and middlemen or they are members of “gangs” of urban dwellers who invade rattan growing areas of Western region to collect rattan stems for sale or use in the urban areas.

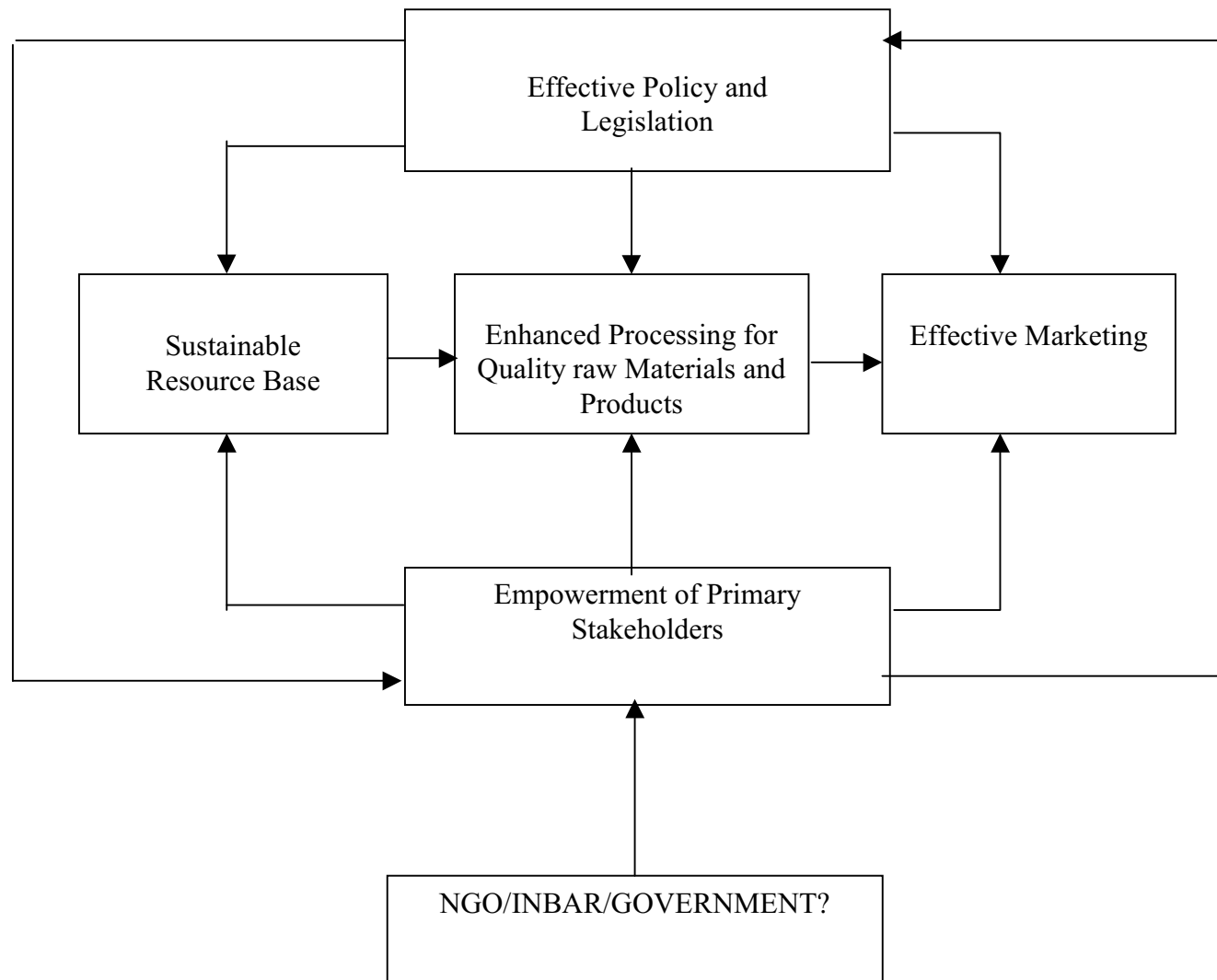


Fig. 1: Development Interventions of Rattan Industry of Ghana, Which way?

Meanwhile, the rural people who live on the fringes of the forest reserves of the Western region, and whose average annual income is about 413,000 cedis depends on rattan collection (Table 1), have complained about walking a distance of about 10 kilometers amidst fatal injuries to collect rattan stems and carry their head-load collections in bundles to the village or roadside, for transportation by road to urban centers for sale. The apparent shortage of rattan cane, especially Mfea (*Eremospatha macrocarpa*), according to the village collectors and weavers, has been caused by over-harvesting and poor management of the resource.

The scarcity of rattan raw material should be addressed rather expeditiously with the involvement of rattan collectors as major players to forestall the sector from eminent collapse. First and foremost, there is a need to improve upon the collectors' knowledge of seed collection, storage and raising of seedlings through nursery establishment. This should be followed by technology transfer for transplanting seedlings in the field which is as crucial as silvicultural regimes needed for enrichment planting, establishment of community plantation and agroforestry crop with research on vegetative propagation being addressed. Enrichment planting of nursery seedlings or wildings should be done in gaps on logged-over forests, fallows or degraded lands caused by over-logging, bushfire or shifting cultivation. A success story of enrichment planting in Malaysia where more than 17,000

hectares of logged-over forest has been planted with *Calamus* species could serve as a guide (Dransfield and Manokaran, 1992; Aminuddin, 1995.)

Planting rattan in plantation is another option. Rattan plantation has been successfully developed in Malaysia since the 1980s for planting *Calamus manan*, a solitary cane in association with rubber trees (*Hevea brasiliensis*). More recently, Sunderland *et al.* (1999) have established a one hectare plantation of *Lacosperma secundiflorum* under obsolete rubber plantation in Cameroon. Caution however should be exercised in selection of planting distance for rattan species of Africa to avoid possible hindrance of access to plantation tree due to the clustering nature of the species. Establishment of community rattan plantation will serve as an arboretum for future collection of superior seeds for raising seedlings and as a demonstration farm for future growers. Provenance trial of species on degraded lands should follow once the basic technology for plantation establishment has been established and can easily be adopted by small holders and rural farmers.

The incorporation of rattan into agroforestry system is well known in South East Asia. Agroforestry offers the rattan farmer the benefit to reap seasonal crops on the farm while he waits about five to six years for planted rattans to grow to maturity. A harvest yield of 4,000 and 7,000 sticks per hectare of large and small diameter cane (Sunderland and Nkefor, this volume) makes rattan plantation a possible profitable venture. Therefore an establishment of a community rattan agroforestry farm with full involvement of the village community should be implemented taken into consideration selection of trees and food crops and the clustering nature of our rattan species.

Rattans are known to generate if harvesting of mature rattan is done judiciously. The fewer the number of mature stems removed from a clump, the height rattan stem is harvested and the removal of the entire stem with leaves to create gaps and increase light generation are few of the many variables advanced by collectors. These variables need scientific investigations with findings being disseminated to collectors for adoption. Research on growth rates should assist to make judicious decision on planting distance, harvest intensity and rotation period.

Table 1: Major Occupations of Rattan Collectors.

Major Occupation	Average Income	% Collectors
Farming	129,000	53
Rattan Collection	413,000	40
Trading	2,000,000	3
Tailoring	15,000	3
Mechanic/Fitting	150,000	1



Fig 2: Vegetation zones of Ghana. (Rattans are found mainly in the dense evergreen forest (x) and in some areas of moist semi-deciduous forest around Koforidua – Nkawaw and Kumasi areas (arrowed))

Efficient processing for quality finished products

A comparison of the primary processing system in Ghana with that of South East Asia shows that the latter system passes through a stringent process which ensures quality of raw material a condition for quality finished product. Whereas rattan processing in Ghana starts with scraping of skin, processing in most parts of South East Asia, starts with “boiling” the stem in diesel or coconut oil to reduce moisture, fungi and borer infestation as well as colour enhancement of the stem (Latif, 1991; Sunderland and Nkefor, this volume). The use of steam instead of blow gun to bend rattan avoids scorching marks; the use of staples and dowels instead of nails and liberal application of varnish on finished products need further evaluation on our indigenous species for possible adoption in Ghana and Africa.

Transformation or weaving of rattan stem into quality finished rattan products depends among others on the quality of rattan stem. For quality finished products, rattan should be matured, have long internodes, devoid of major seasoning defects such as shrinkage, cracks, discolouration, fungi and insect damage. The strength properties, especially elastic properties are particularly important. A comparison of our processing tools with those of South East Asia is needed with the objective of selecting for possible adoption the more

efficient tools of South East Asia that will help our indigenous weavers to improve upon the efficiency and quality of the rattan stem and finished products. Rattan processing centers, where weavers can share the use of modern and efficient machine, could be set up at selected weaving centers to boost quality and quantity of rattan production.

Transfer of technology on modern design, finishes and use of modern processing machinery from South East Asia may be necessary. To facilitate technology transfer, there will be a need to improve upon the only existing training center in Accra and establish new ones at selected processing centers. These centers should be manned by master craftsmen who will organize periodic workshops to train weavers. Sunderland (1999) was aware of the problems in processing rattan in Africa (including Ghana) when he stated that “small improvements would make a considerable impact in the quality of finished products”.

Quality and quantity of rattan cane

Rattan canes, which are exploited for commercial use in Ghana, come from the following species:

- *Eremospatha hookeri* (Mfea)
- *Eremospatha macrocarpa* (Mfea)
- *Laccosperma secundiflorum* (Eyie)
- *Laccosperma acutiflorum* (Eyie)
- *Calamus deerratus* (Demmere)

The growing stock of rattan in the forest of Ghana has no thorough inventory. Furthermore, the taxonomy and quality of rattan species in Ghana are needed to identify other species in the forest for possible use. Within a species, an overwhelming 91% of the weavers preferred stems with long internodes because they are reportedly flexible, easy to split, bend, peel and scrape well. Therefore, research on strength properties and technology for raising further stocks of preferred morphological qualities should be intensified. The possible introduction of exotic rattan species with superior morphological qualities as future plantation crop needs consideration. The quantity and quality of rattan in our forest and clarification of all taxonomic confusion will pave the way for thorough inventory of the resource in Ghana for a sustainable development of the sector.

Product Promotion and Marketing

The international trade in rattan is currently worth some US 6.5 billion dollars a year (ITTO 1997) while the annual domestic market in South East Asia is conservatively estimated by Manokaran (1984) to be worth 2.5 billion US dollars. An estimated 0.7 billion of the World's populations are reportedly involved in the trade of rattan and rattan products (Dransfield and Manokaran 1994). Unfortunately, the international trade of rattan is dominated by countries of South East Asia and Africa's share of the international market is insignificant. Recently, Sunderland (1999) has reported export of raw cane from Ghana and Nigeria to South East Asia and establishment of flourishing export trade from Nigeria to Korea (Morakinyo, 1995). This notwithstanding, 59% of the processors and weavers in Ghana complains about poor price and irregular supply as the most important constraint in marketing of rattan products (Table 2).

Table 2: Problems and Constraints in Marketing of Rattan as reported by Primary Stakeholders

Constraint	% Traders
Proper and irregular product demand and price	59
Improper Shelter	25
Harassments by officials of Forestry Department	7
Depletion of Rattan stock	5
High Marketing Cost	2
Inadequate Finance.	2

Ghana and for that matter other African countries should take advantage of restrictions on trade of raw rattan by some major producing countries of South East Asia to boost their international export. Francophone and Anglophone countries of Africa should take advantage of their historical trade links with France and United Kingdom respectively to increase rattan export to these and other countries. In addition, trade within and between countries of West and Central Africa, which is reported to be growing significantly (Falconer, 1994; Morakinyo, 1995; and Sunderland, 1999) should be encouraged.

The need to increase Ghana and therefore Africa's share of international trade in raw and finished rattan products brings to fore better promotion of raw rattan and rattan products through better processing and transformation. Appropriate grading and standardization of price of raw rattans and their products should be introduced and private capability developed to increase market for quality rattan products. Better packaging of graded products are essential as well as bulk freight of local and export goods to cut down transportation cost. Furthermore, processing centers should be set up in urban and rural processing areas to allow weavers access to modern tools and equipment to process products and display centers to exhibit raw rattan and especially finished products. Special promotional fairs and advertisements should be organized by an empowered Rattan Entrepreneur Association in collaboration with Ghana Export Promotion Council and National Board for Small-Scale Industries to increase public awareness and for consumers to appreciate rattan products.

Trade restrictions and export levy should be relaxed as incentives for primary stakeholders to boost market supply. Rattan entrepreneurs should be encouraged by way of sponsorship to attend international trade fairs to exhibit their products. Marketing intelligence for rattan products should be conducted periodically to ensure fair and equitable price for the commodity especially in the international market. It may be necessary to establish direct link between local producers and foreign buyers to eliminate middlemen and with better income accruing to the local producers. There is little doubt that the upsurge of hotels, restaurants and other service centers, the increasing number of expatriate community and foreign businesses in Ghana, could increase local demand provided quality finished products like rattan furniture are produced.

Effective policy and legislation

Until the promulgation of the current National Forest Policy in 1994, policies or legislations on the forestry sector emphasized the supply of timber for the wood industry without any recognition of the non-timber forest products, including rattan, for the development of rural

economies. Consequently, NTFPs were not considered in forest management and the only management tool was an expensive permit system with a duration period of 24 hours to enter the forest reserve, a royalty fee paid for any stick or bundle of rattan harvested, and issuance of conveyance fee to transport rattan from the forest. These fees did not encourage stewardship among rural collectors who live on the fringes of the reserve and who see products from the forest reserves as their God-given right. Therefore the primary stakeholders find the process of applying for permit, conveyance and royalty fee not only cumbersome, but exploitative and expensive. Consequently, many rural collectors chose to enter the reserves illegally, which resulted in confiscation of their collections with heavy fines when caught by forest guards. In fact, harassment by forest guards is reported by 28% of the collectors as the most important problem facing the rural collectors. In spite of these punitive measures, “illegal” collection of rattan continues unabated.

The new Forest Policy of 1994 which encourages the involvement of private and particularly rural people in forestry decision making and encourages individuals, organizations and communities to grow, protect, manage and utilize their own forest resources should be vigorously pursued under the Community Forestry Management Programme. In this way, local people may be allowed to pay paucity as permit and royalty fee but made to collect rattan on sustainable harvesting basis. Involvement of the local people in decision making and management of the reserves will motivate them to see themselves as part owners of the forest reserve and therefore harbour no apprehension to cultivate it through enrichment planting or agroforestry plantation.

Table 3: Problems and constraint in Rattan Collection

Problems and Constraint	% Respondent Collectors
Harassment by forestry guards and expensive permit system	28
Accident and injuries	28
Depletion and scarce rattan resource	18
Intensive and high labour harvesting	9
Inadequate business finance or capital	8
Expensive transportation cost	7
Ineffective Rattan Associations	1
Harassment by Police.	1

Empowerment of primary stakeholders

The financial, political and social empowerment of rattan entrepreneurs is a must if the industry is to flourish and achieve sustainability as a cottage industry.

Our study indicates that about 30 percent of rattan collectors, primary processors including weavers belong to some form of rattan association. Although most of these associations were formed to seek financial, political and social welfare of their members, these in most cases have not been achieved. Therefore, the first and foremost intervention is to empower the primary stakeholders and mobilise them into a formidable dynamic association. A four-tier system of Association is recommended – Rattan Collectors, Rattan Growers, Rattan Weavers and Rattan Entrepreneur Associations. Whereas all entrepreneurs in the rattan sector will belong to the Rattan Entrepreneur Association (REA) as an umbrella organization – the collectors, growers and weavers – will each belong to their own

association. The rattan collectors, growers and weavers association will each address the special problems of their members while REA will address the over all problems facing the sector.

The Associations will coordinate the activities of rattan workers including standardized grading and pricing of raw rattans and finished products. They will lobby for loans, grants and subsidies; for flexible permits, lower royalties and conveyance fees, and provide technical assistance in processing, marketing and establishment of more display centers. A well-organized Association could rally resources from members for acquisition of inputs such as machines and equipments at proposed processing centers for general use. The financial problems facing the sector, the obsolete legislation and policies which hinder sustainability and efficiency of the sector should also be vigorously pursued.

The Association should make its presence felt by linking with governmental, non-governmental, financial, international and local research and teaching organizations. A linkage with the government through the Ministry of Lands and Forestry should press for the necessary inputs to boost the sector as contain in the new Forest Policy and Ghana's Vision 2020 document – the year set for Ghana to move from developing to developed country status.

Many non-governmental organizations like Friends of the Earth and Action Aid Ghana have as part of their mission to assist rural cottage industry. Therefore, a thorough understanding of the missions of all the NGOs' and close collaboration with them could help. Local and international financial institutions such as the Rural Banks and Prudential Bank which assist export of non traditional goods, Ghana Export Promotion Council, National Board for Small Scale Industries, the International Fund for Agriculture Development (IFAD) and USAID should be consulted. Finally, the Association should seek close collaboration with research institutions such as FORIG to address the unanswered research issues, which will form the basis to forge effective development for a sustainable and profitable rattan industry sector.

Summary

A national forum on rattan industry sector (to be organized) should be convened as a matter of urgency by the Rattan Entrepreneur Association in collaboration with all other related institutions, organizations and other stakeholders. The forum should address the social, political, economical, technical and other problems facing the sector including those recommended in this and other papers. Pragmatic and sustainable development interventions with achievable goals should be addressed. Above all, frantic efforts should be sought for financial assistance from donor countries and international organizations to fund the development interventions.

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A SOCIO-ECONOMIC PROFILE OF THE COMMERCIAL RATTAN TRADE IN CAMEROON

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TAMNJONG*

Introduction

Rattan and rattan products have long been regarded as one of the major non-timber forest products of the forest zone of Cameroon (Shiembo, 1986; Pokam-Wadja, 1987; Sunderland, 1999a; 1999b; Defo, 1999). Although both unprocessed rattan and finished products are widely traded and form the basis of a thriving cottage industry, this trade is a component of the “invisible” markets for forest products that are only now being understood (Clark and Sunderland, 1999; Ruiz-Perez *et al.*, 2000). It is only in recent years that non-timber forest products (NTFPs) such as rattan have become the focus of research and development initiatives that are concerned with the increased valorisation of a wide range of these “minor” forest products. Indeed, this paradigm shift has been so marked that non-timber forest products are now regarded as having a significant role to play in contributing to conservation and development initiatives through product promotion and sustainable development (Wilkie, 1999). It has been argued, however, that in order for this to happen, the promotion and development of high value NTFPs must take place in the context of appropriate forest legislation. This can then provide the framework that allows the equitable distribution of benefits, community participation in resource management and the realisation of formal forest product-generated revenues (Wilkie, 1999; Laird, 1999; Profizi, 1999; Cunningham, 1999).

The markets for non-timber forest in Central Africa

Although the historical importance of the trade in forest products in West and Central Africa has been well recorded (Oliver and Fage, 1975; Liniger-Gomez, 1986; Vansina, 1990; Iliffe, 1995; Oliver, 1999), it is only relatively recently that the scale and importance of contemporary markets for forest products in Central Africa has been realised (Ndoye, 1994; Falconer, 1994; Clark and Sunderland, 1999; Sunderland and Obama, 1999; Liengola, 1999; Yembi, 1999; Kimpouni, 1999; Tabuna, 1999; Ruiz-Perez *et al.*, 2000). Indeed, studies of selected markets within Ghana (Falconer, 1994; Holbech, 2000) Cameroon (Ndoye *et al.*, 1999), Equatorial Guinea (Sunderland and Obama, 1999), Congo (Kimpouni, 1999), Gabon (Yembi, 1999) and DR Congo (Liengola, 1999) show that the trade in non-timber forest products is significant. Furthermore, this trade is often regional, rather than national, in scope, with a great deal of cross-border trade in forest products, particularly focussed on Cameroon. For example, there is significant NTFP trade from Cameroon to Nigeria, (Bokwe and Ngatoum, 1994; Sunderland and Tchouto, 1999), Cameroon to Equatorial Guinea (Sunderland and Obama, 1999) and from Cameroon to Gabon (Yembi, 1999; Ndoye *et al.*, 1999). There is also substantial export of non-timber forest products from the wider Central African region to supply expatriate Africans based in Europe and North America. The cultural importance of these products is such that consumers are willing to absorb the extra costs of packaging, export and transportation despite the local availability of lower cost substitute products (Tabuna, 1999).

In short, the markets for forest products in West and Central Africa are robust, demand-led and support the livelihoods of many thousands of people; from the forest harvester to the urban trader (Ruiz-Perez, *et al.*, 2000). As such, the need to “develop the markets for NTFPs” as has been advocated for forest conservation efforts in Latin America (Padoch, 1987; Padoch, 1992; Clay, 1992; Gentry, 1992; Richards, 1993) and SE Asia (Peluso, 1992; Gan and Weinland, 1996) is unnecessary in the African context as there is considerable evidence that the sector is significantly market driven (Clark and Sunderland, 1999; Ruiz-Perez *et al.*, 2000). What is essential, however, is the recognition and evaluation of those markets allows the capture of benefits such that these forest resources are able to contribute to the formal forest sector of the countries in which they originate.

The rattan trade in Cameroon

Recent studies of the African rattan trade have concentrated on the importance of the trade within individual countries (Falconer, 1994; Morakinyo, 1995; Defo, 1997; Sunderland 1998; Defo 1999; Oteng-Amoako and Obiri-Darko, this volume). Interestingly, the patterns of exploitation and trade of the rattan resource are remarkably similar in each of the countries studied and distinct similarities within the sector are apparent. In Cameroon, rattan has long been identified as an extremely important forest product, both at the household level (Shiembo, 1986; Thomas *et al.*, 1989; Defo, 1997; Trefon and Defo, 1998; Sunderland, 1999a; 1999b; Defo, 1999) as well as being widely traded (Shiembo, 1986; Pokam-Wadja, 1987; Sunderland, 1999a; 1999b; Defo, 1999). This paper presents the findings of two independent studies of the commercial rattan trade in Cameroon, and the socio-economic conditions under which this trade operates. Primarily based on the work of Defo and Sunderland (1999) the findings of a smaller study of the production-to-consumption system for rattan in Cameroon, funded by INBAR, by Ndam *et al.* (1999) are also included.

Methodology

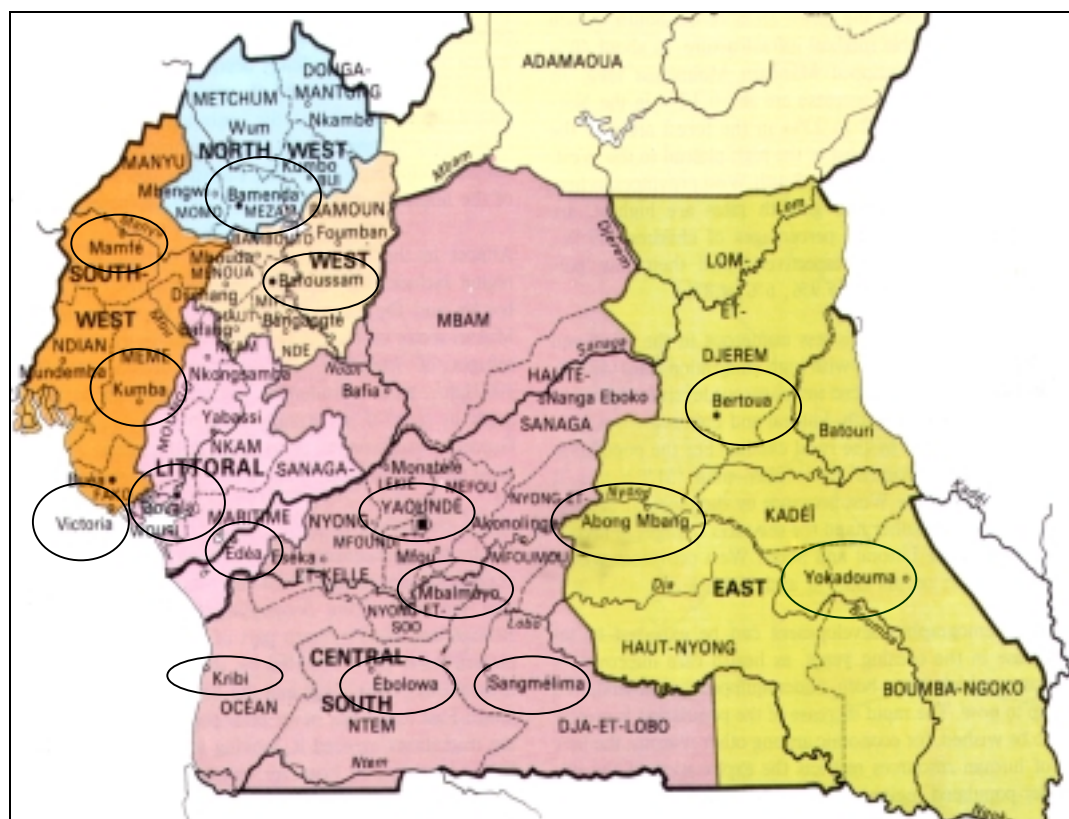
Selection of study sites

Concentrated in the southern half of the country, the forest zone of Cameroon comprises an area of some 20 million hectares and encompasses a wide range of cultural and socio-political conditions. The rattan trade, artisan industry and markets in 15 of the most representative urban areas were studied. The study sites were selected on a combination of cultural and economic importance, as well as a consideration of the proximity and importance of the rattan resource. In addition, two towns outside of the forest zone (Bamenda and Bafoussam) where the transformation of rattan is of particular importance were also sampled. Additional surveys were undertaken in towns where passing trade is important (e.g. Bertoua and Yokadouma, situated along the Central African Republic to Cameroon trade route). Likewise, Abong-Mbang was also included due to its continuing economic development and rapid population increase (nearly 5-fold from 1967 to 1987).

The survey sites selected were based on the following categories of rattan consumption identified by Shiembo (1986), Pokam-Wadja (1987), Defo (1997) and Defo (1999).

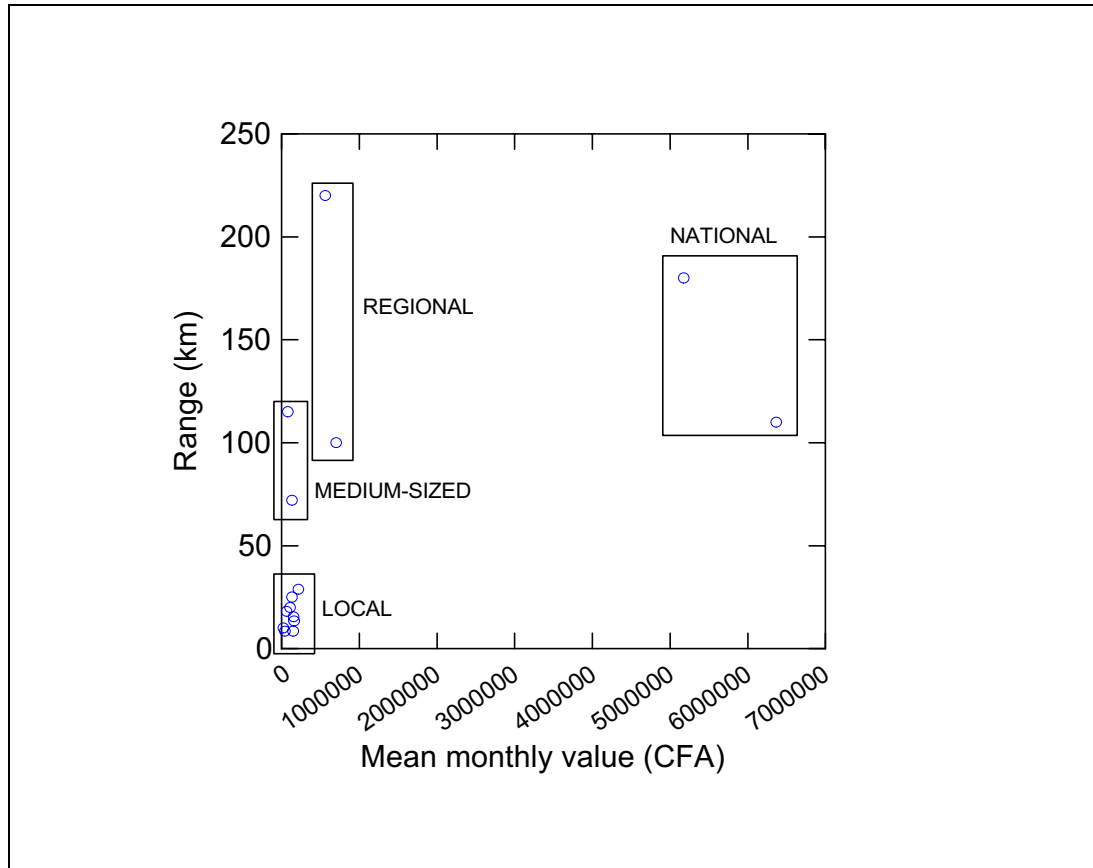
- Small local markets with a high level of self-sufficiency¹. These markets sometimes act as exchange places and supply the regional and national markets (Yokadouma, Abong-Mbang, Ebolowa and Bertoua);
- A group of medium-sized markets of regional importance with a moderate level of self-sufficiency. These markets often act as assembly points for the two large urban markets (Kribi, Limbe, Sangmelima, Mamfe, Kumba, Edea and Mbalmayo);
- Large regional markets with a weak degree of self-sufficiency, having to rely on more distant supply areas (Bamenda and Bafoussam);
- The two large urban markets of Douala (Marché des Fleurs) and Yaounde (Mvog-Mbi) with weak degrees of self-sufficiency and relying on distant supply areas. Combined, these markets comprise the majority of the rattan trade in Cameroon, and can be regarded as national in proportion.

Figure 1. Map of southern Cameroon. Sites surveyed during this study are ringed.



¹ As related to range, or distance, of supply.

Figure 2. Scatterplot of size of market and distance of supply



Sampling methodology

Information was gathered using a standard questionnaire modified from techniques developed through the implementation of a number of well-known general marketing studies (Padoch, 1987; Falconer, 1994; Martin, 1995; Alexiades 1996; Ndoeye *et al.*, 1999). The questionnaire was developed and modified to enable the gathering of both qualitative and quantitative information as a means of assessing the socio-economic nature of the rattan industry. The methodology was successfully tested in a pilot study of the rattan industry in the city of Bata, Equatorial Guinea (Sunderland, 1998). In total, 174 artisans in 15 urban markets² were interviewed over a two-month period from July to September 1998, representing a mean sampling percentage of 81% (Defo and Sunderland, 1999).

² There is a strong correlation between population and the number of artisan units per urban market (Pearson correlation coefficient $r = 0.96$, $P = 0.01$) and there is, on average, one processing unit for each 6,150 head of population.

Table 1. Study sites and sampling

	Population	Registered ³ number of artisans	Number enumerated for this study	% (percentage) sampling
Douala	809,852	96	24	25%
Yaounde	649,252	124	31	25%
Bafoussam	112,681	20	20	100%
Bamenda	110,142	25	22	88%
Kumba	70,112	16	13	81%
Edea	50,609	11	6	55%
Limbe	44,561	8	7	88%
Bertoua	43,402	8	8	100%
Mbalmayo	35,390	13	13	100%
Ebolowa	34,771	2	2	100%
Sangmelima	23,261	8	8	100%
Kribi	21,507	7	7	100%
Mamfe	13,844	8	7	88%
Abong-Mbang	12,565	3	3	100%
Yokadouma	11,235	2	2	100%
		353	174	Mean = 81%

Rattan harvesting and supply to the urban markets

The resource base

Although eighteen species of rattan occur in Cameroon, only three form the basis of the trade; the large diameter canes, *Laccosperma secundiflorum* and *L. robustum* and the juvenile stems of *Eremospatha macrocarpa* (Sunderland, this volume). Although there is considerable spontaneous use for most species, only a very few species possess the qualities suitable for the commercial production of processed products.

Customary laws and State legislation

Without exception, rattan artisan workshops rely on a regular supply of unprocessed cane from the forest. Throughout its range, rattan is considered an open-access resource and, as such, is generally not subject to customary laws relating to land and resource tenure. This is also reflected in the formal State forestry sector; although, in theory, a *permis d'exploitation* is required for the commercial harvest of non-timber forest products these are rarely, if ever, issued for the harvest of rattan. This shortfall provides a convenient mandate for forestry officials to apply an “informal taxation” system when unprocessed rattan is transported. Hence, the harvest of rattan, in common with many other forest products, is unregulated and uncontrolled, and the benefits are felt in the informal sector, rather than the formal forestry sector.

³ Registered refers to those enterprises actually recognised in urban council records. It is very difficult for most enterprises to operate without formally registering with the local council. Figures were obtained through reference to local council registers.

Production-to-consumption

The supply of cane to urban markets is predominantly undertaken by local villagers and farmers. Although artisans also harvest rattan themselves, this is more commonly the case only where the urban market is in close proximity to a significant supply of rattan (such as Yokadouma and Abong-Mbang). The “production to consumption” (Belcher, 1999) of rattan harvest and supply in Cameroon is presented below.

Figure 3. Production to consumption rattan flow in Cameroon

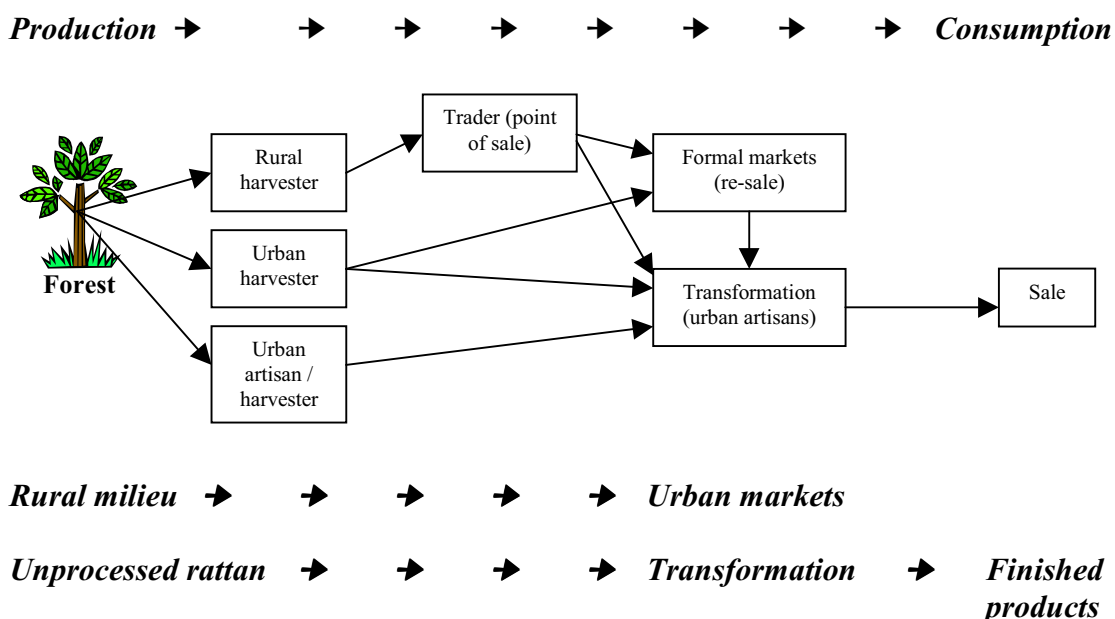


Table 2. Percentage of artisans who harvest their own cane

Town / city	Artisans / harvesters	Artisans only	Source of cane if not harvested by artisans
Mbalmayo	92%	8%	Bought directly from villagers / traders
Bertoua	62.5%	37%	Bought directly from villagers / traders
Yokadouma	100%	0	Collected directly from forest
Abong-Mbang	100%	0	Collected directly from forest
Limbe	0	100%	Bought directly from villagers / traders
Kumba	-0	100%	Bought directly from villagers / traders
Mamfe	50%	50%	Bought directly from villagers / traders
Tiko	-	100%	Bought directly from villagers / traders
Sangmelima	37%	63%	Bought directly from villagers / traders
Ebolowa	50%	50%	Bought directly from villagers / traders
Kribi	29%	71%	Bought directly from villagers / traders
Edea	34%	66%	Bought directly from villagers / traders
Yaounde	0	100%	Bought from formal urban market
Douala	0	100%	Bought from formal urban market
Bafoussam	0	100%	Bought from suppliers, buying from Douala
Bamenda	0	100%	Bought from suppliers, buying from Douala
	35%	65%	

Range

The range, or distance, that unprocessed rattan is transported to each urban market varies significantly across the forested zone. To some extent, this is reflected in the unit price of the cane.

Figure 4. Mean range (or distance) of rattan supplies

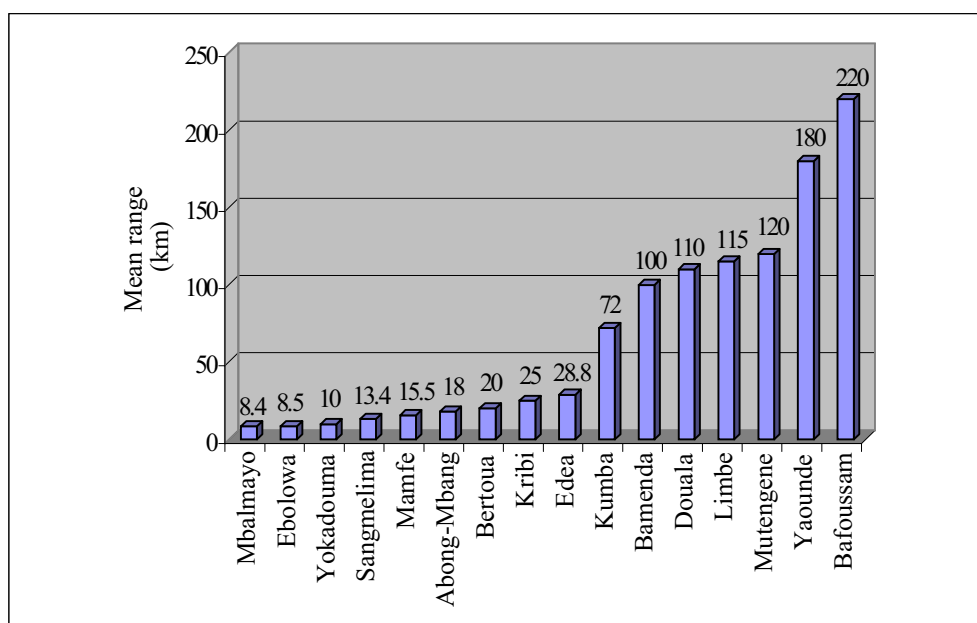
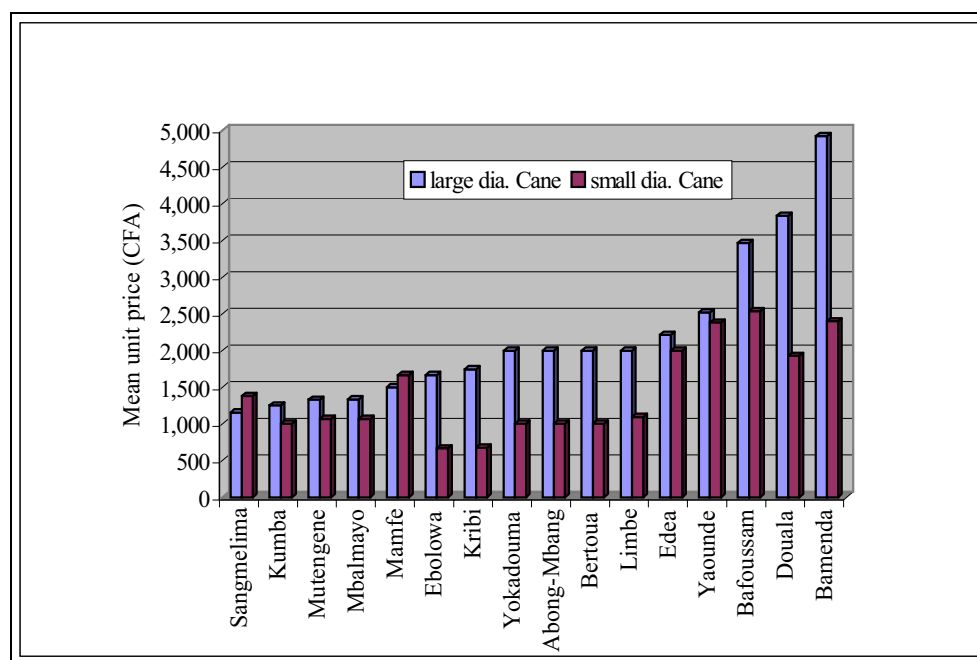


Figure 5. Urban price paid per unit

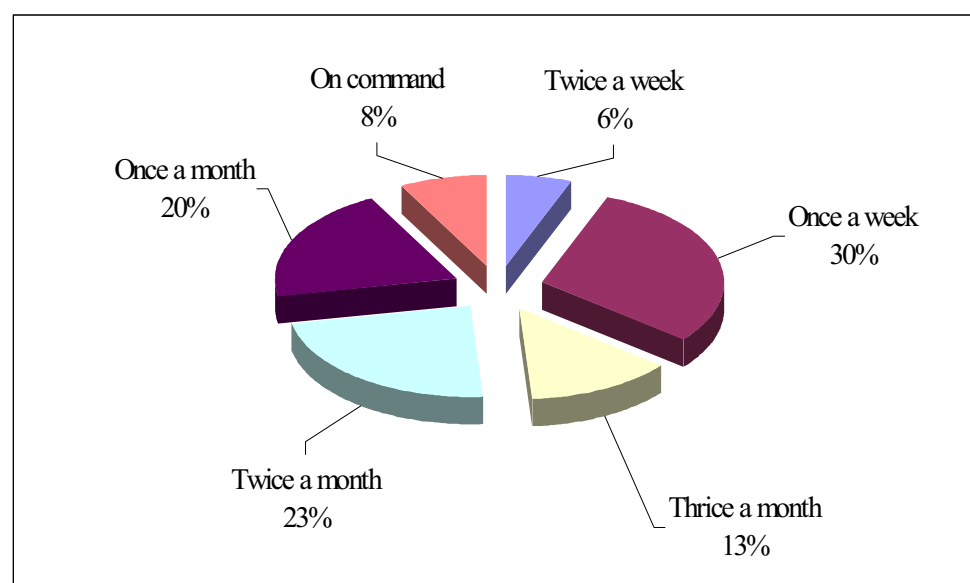


Frequency of supply and purchase

There is a regular supply of cane from the harvest sites to the urban markets. In the main, artisans are not able to store large quantities of cane for long periods as it deteriorates and becomes unworkable. In addition, most enterprises lack the capital to buy bulk quantities of cane even if they could store the unprocessed cane prior to transformation. Hence, more commonly, small quantities of cane are purchased on a

regular basis. For the same reasons of lack of storage and capital, some artisans will not buy unprocessed rattan on a regular basis at all without actually having commissioned work. These artisans will only purchase raw material “on command”, i.e. when rattan products are commissioned.

Figure 6. Frequency of wholesale rattan purchase by artisans ($n = 174$)



Rattan artisan enterprises

Introduction

Almost without exception, the majority of commercial rattan enterprises currently operating in Cameroon are privately owned. These enterprises produce a wide range of rattan products, mainly concentrating on furniture and other household items such as woven lamp shades and flower baskets. The production of temporary market baskets for “buyam sellums” is an important component of the rattan artisan trade.

Number of workers and sources of labour

In general, artisanal enterprises are small operations and invariably consist of a single owner / artisan. However, some craftsmen are supported by a number of apprentices. These apprentices are trained by the owner/artisan, and they are primarily responsible for the processing of the cane prior to transformation⁴. In general, apprentices are not paid a wage. In fact, quite the opposite is the case and, ordinarily, the families of apprentices pay the artisan for the training provided. Other sources of labour include

⁴ In the African context, processing of raw rattan essentially entails the removal of the epidermis (skin) from the stem and the drying of the raw cane prior to its use. Immature stems, or the very apex of mature stems, where the leaf sheath is also present are not used, and are often left or discarded at the time of harvest. The processing of raw cane is undertaken manually, with the stems being scraped with kitchen knives to remove the skin followed by drying, usually undertaken in the open air. This rudimentary means of processing is extremely labour intensive. For a more detailed discussion of the processing of rattans in SE Asia and potential application to the African context, see Sunderland and Nkefor (this volume).

that provided by family members, particularly from children, who contribute to the more mundane tasks.

Figure 7. Summary of the types of products produced by Cameroonian artisans ($n = 174$)

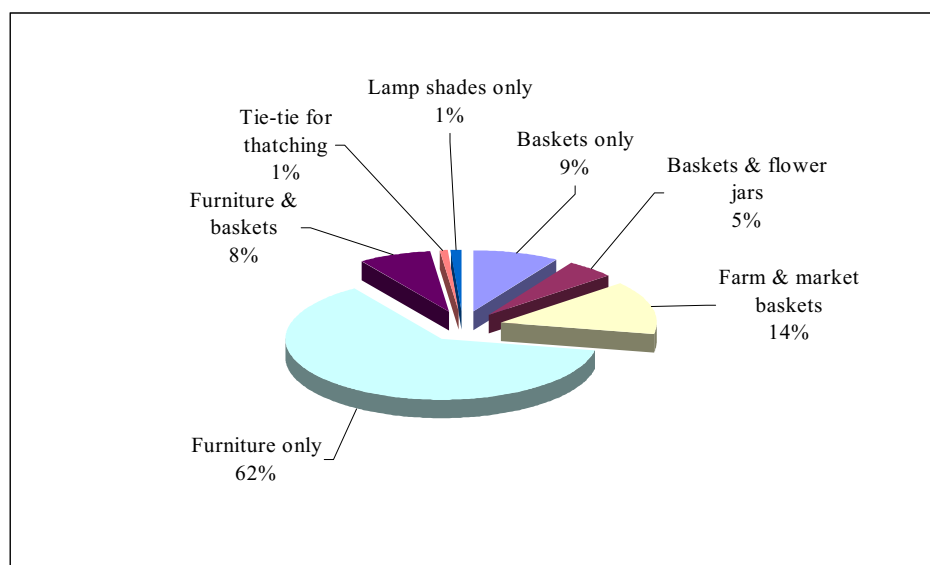
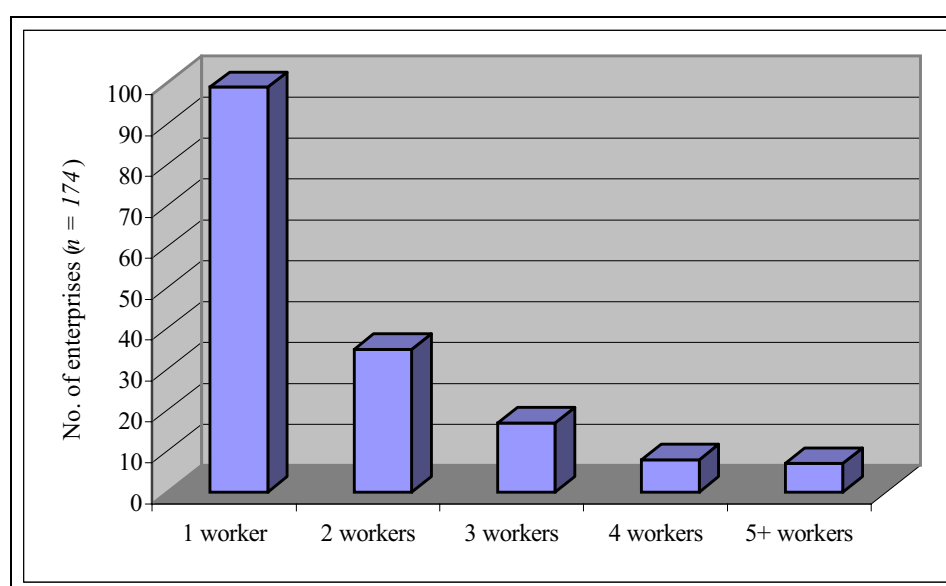


Figure 8. Number of workers per enterprise



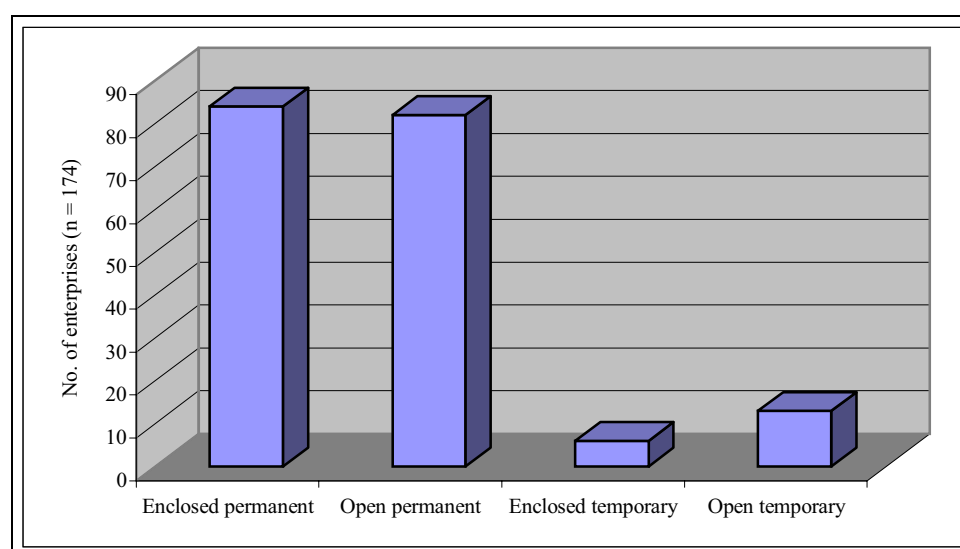
Types of enterprise

Rattan enterprises in Cameroon, as they are in much of West and Central Africa, are housed in conspicuously modest surroundings. Many of these enterprises are essentially “open-air” workshops, although the working area may be covered with a simple roof structure of palm fronds or zinc to protect the workers from the vicissitudes of the climate. However, there is generally little protection for the unprocessed rattan, or the finished products. Because of this, many open-air workshops do not operate during the rainy season. Enclosed, permanent enterprises

are also common. These may be cement-block houses, which also serve as residences, or timber structures (with both walls and roofs) utilised solely for the use of the enterprise.

The location of the workshop is crucial to eventual sale of finished products and many, if not all, are situated along roads, where finished goods are displayed. In the majority of the urban areas, the rattan enterprises are generally grouped together in one area of the town. Where rattan is sold in a central market, such as Mvog-Mbi in Yaoundé, or the *Marché des Fleurs* in Douala, this area is usually exclusive to the formal central markets where other forest products are traded. This is also the case for the sale of finished products; rattan is traded a distinct, and separate, commodity from other forest products⁵.

Figure 9. Types of rattan workshop in Cameroon



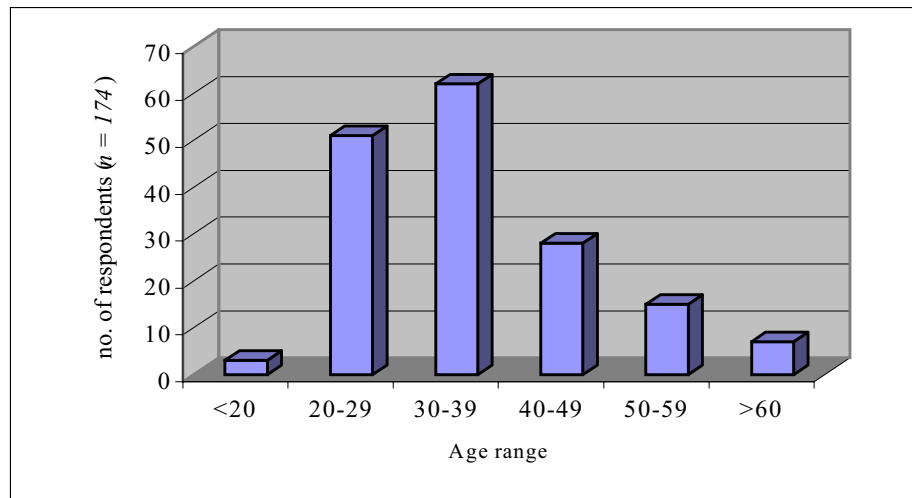
Socio-economic profile of the urban artisans

Age range

In general, rattan enterprises are operated by relatively young to middle-aged men, the majority of whom are married (70% +). Many of the older artisans interviewed suggested that the work was very much for younger, fitter men and that as they have become older, their work outputs, and subsequent profits, have decreased. Unlike many rural artisans for whom rattan transformation is often a secondary activity to farming, urban-based artisans are almost always engaged on a full-time basis.

⁵ Although a relationship between rattan harvesting hunting for bushmeat has been highlighted by Trefon and Defo (1998) and Defo (1999).

Figure 10. Age range of the primary owner / worker



Gender

Although Ndoye (1994) reports that women are sometimes involved in harvesting activities, this is relatively rare (Defo, 1997; 1999; Sunderland 1998; 1999a; 1999b). Correspondingly, the processing and transformation of rattan is predominantly a male activity, however, some women are involved in the weaving of baskets, notably in Bamenda.

Ethnicity

The ethnic background of the urban artisans is extremely variable and in all of the urban markets studied, there is no domination by any single ethnic group in rattan processing and transformation. This is particularly the case in the larger towns and cities, which have a tendency to be more cosmopolitan. However, somewhat unsurprisingly, a pattern does emerge that a greater proportion of artisans within an urban market, originate from there. This is particularly the case in smaller urban markets.

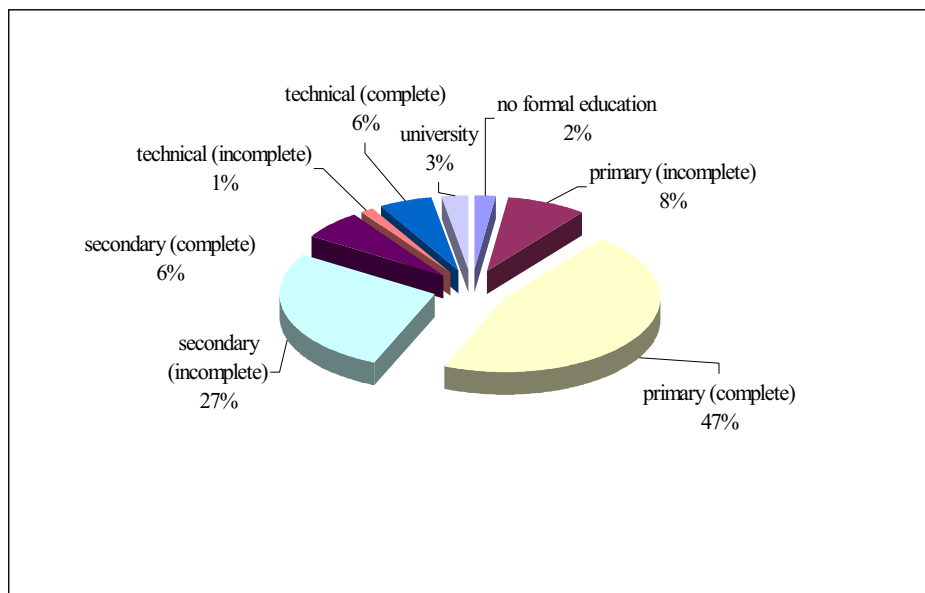
Educational background

As would be expected from a semi-skilled manual labour force such as rattan artisans, the educational level of the majority of the artisans in Cameroon is relatively poor. However, there are exceptions to this and some artisans are educated to secondary or even to first-degree level. Interestingly, artisans who state they have originated from a “technical” background often includes those who have undertaken rattan artisan training in the context of rehabilitation, such as that provided by the prison service. Rattan artisan training is one of the major rehabilitation programmes of the Cameroon prison service as it is both cost-effective⁶ and enables the prisoner to enter gainful employment upon release. The fact that many of the artisans in Cameroon are ex-prisoners is testament to the success of this rehabilitation. For obvious reasons, many

⁶ The prisoners harvest, transport and transform the rattan themselves (under close supervision, of course).

artisans would not admit having undertaken such a training programme, however, and it is not possible to ascertain the proportions of those having gone through the rehabilitation process.

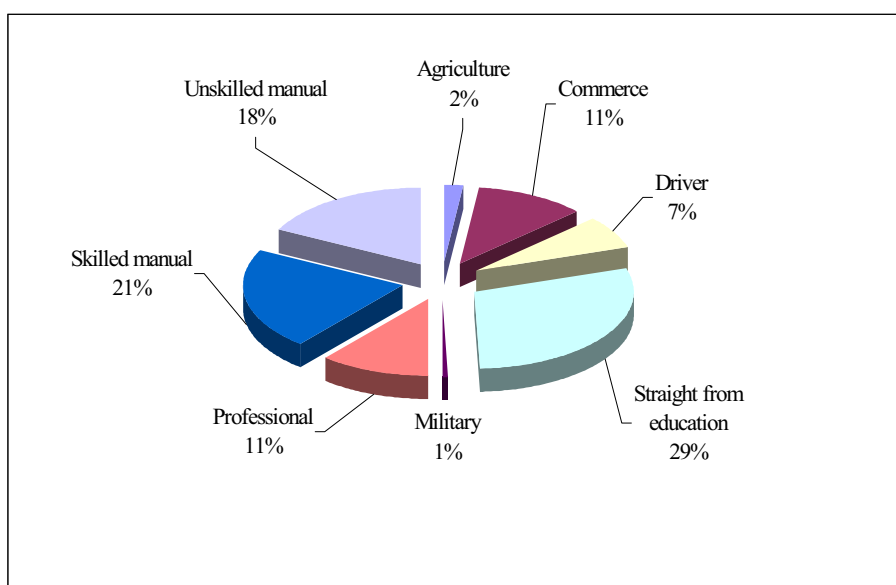
Figure 11. Educational level of rattan artisans



Previous occupations

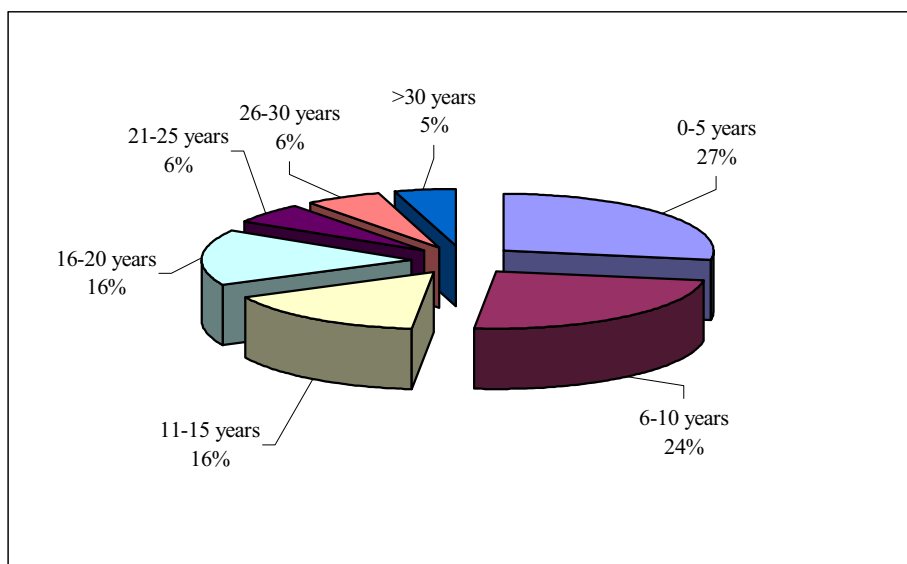
A large number of the artisans sampled have been previously employed, commonly in unskilled and skilled labour occupations, although some have also come from a professional background. In addition, a substantial proportion of artisans have come directly from full-time education.

Figure 12. Previous occupation of rattan artisans



In terms of longevity, the majority of rattan artisans have been active in the industry for less than 10 years.

Figure 13. How many years spent in the trade?



The scale of the trade

Amounts and values

The amount and value of rattan being transformed in the forest zone of Cameroon is significant. In this respect, the rattan sector in Cameroon is similar in scale to that of other countries in West and Central Africa.

Table 3. Amount (in metres) and value (in CFA) of unprocessed rattan consumed each month per urban market.

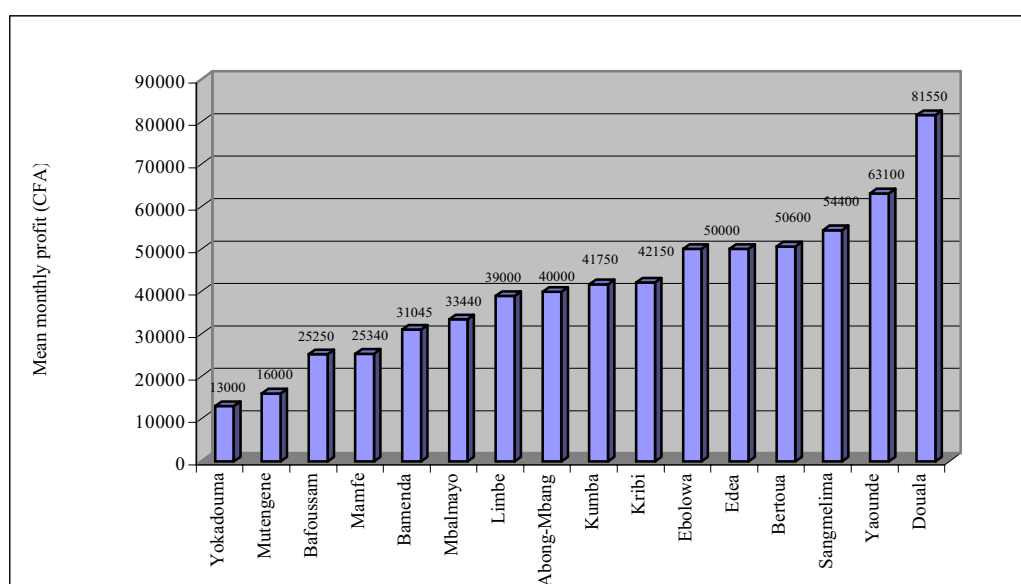
	Amount of cane used / month (m)		Value of cane used / month (CFA)	
	Large dia. cane	Small dia. cane	Large dia. cane	Small dia. cane
Douala	107,700	115,500	4,138,740	2,230,400
Yaounde	92,660	119,060	2,342,740	2,833,340
Bafoussam	10,800	7,380	374,500	187,250
Bamenda	5,700	20,990	250,710	450,150
Kumba	5,900	10,785	50,480	85,950
Edea	8,820	4,805	126,050	93,000
Limbe	3,315	2,510	56,000	24,500
Bertoua	4,880	1,040	97,600	10,400
Mbalmayo	9,290	2,550	124,000	25,600
Ebolowa	2,000	1,350	33,300	9,000
Sangmelima	7,275	5,480	84,085	76,975
Kribi	4,095	9,250	71,500	62,500
Mamfe	4,390	6,585	58,800	98,200
Abong-Mbang	1,760	300	35,200	29,800
Yokadouma	400	140	8,000	14,000
Totals =	285,805	307,725	7,851,365	6,231,070

Based on these figures, the annual consumption of rattan in the forest zone of Cameroon is estimated to be 3,225,660m of large diameter cane with a market value of US \$157,020, and 3,692,700m of small diameter cane with a market value of US \$124,620. Thus, the trade in unprocessed rattan alone is an estimated US \$281,640. As this figure does not capture the value of finished products, nor the substantial household and rural utilisation of rattan (and therein lies scope for future study) this trade, as postulated, is significant.

Profitability

Despite the lamentations of many of the artisans interviewed, incomes and profit margins from the transformation and sale of rattan products are relatively high. Given that the average monthly income for an employed semi-skilled or skilled labourer in most regions of Cameroon is 30,000 CFA, most artisans are comparatively well off. However, there are considerable fluctuations in monthly profits, particularly during the rainy season when transport difficulties increase the costs of rattan entering the market, if indeed the rattan can be transported at all.

Figure 14. Mean monthly profits of rattan artisan per urban market

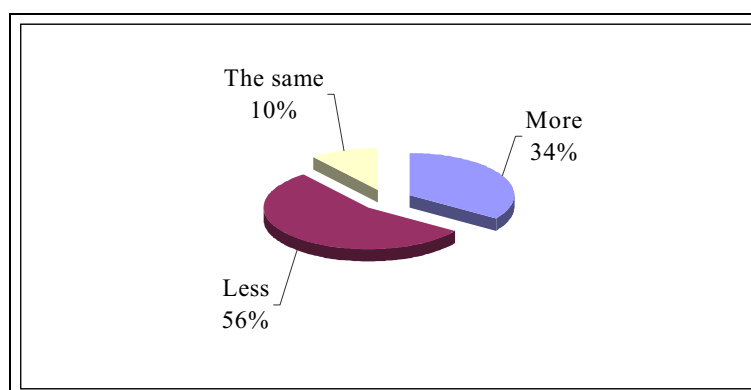


The nature of the trade

Decline or growth?

Although some studies have suggested that the trade in rattan in Cameroon is growing (Defo, 1997), very little evidence is provided in this regard. During the interview process, the artisans sampled were requested to provide information regarding the growth or decline in their own consumption of rattan. Regarding this growth or decline, if they responded in the positive or the negative they were also asked to provide reasons why, in their experience, this is the case.

Figure 15. Is there more cane being used this year (1998) than in the previous five years? (Based on numbers of responses $n = 174$)

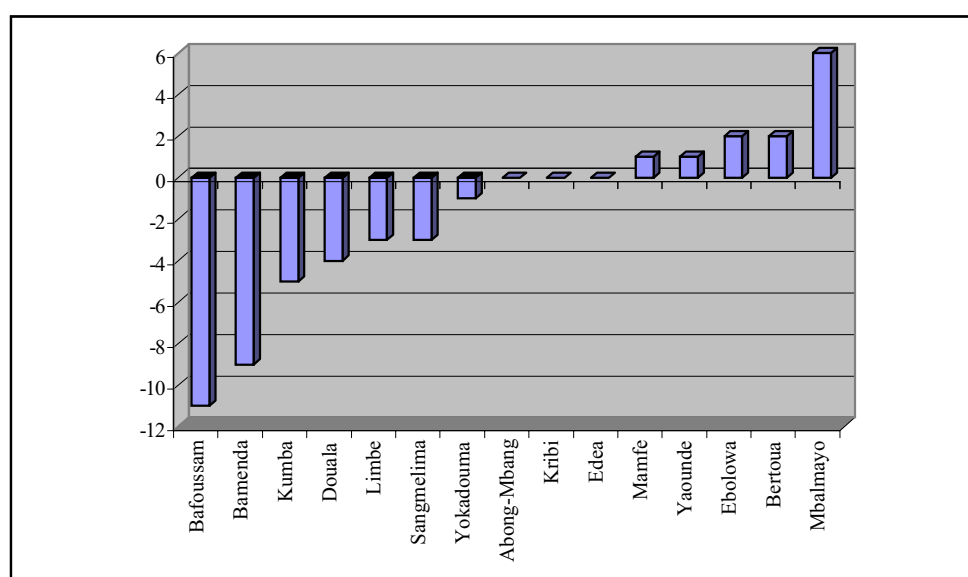


In order to determine the general trend for each urban market, and for the sector as a whole, the responses outlined above were ranked as follows:

- more cane used now than previously +1
- less cane used now than previously -1
- unchanged 0

These responses were then added together for each urban market to detect qualitative trends in the amounts of unprocessed rattan being consumed.

Figure 16. General trend of rattan sector per urban market (positive = growth of sector; negative = decline of sector; 0 = no change)



The cumulative figure, when all of the individual urban rankings are added together, (-24) provides strong evidence that the rattan sector in Cameroon is currently in some decline.

Figure 17. Cited reasons for decline in rattan sector in certain urban markets. (Based on numbers of responses $n = 125$).

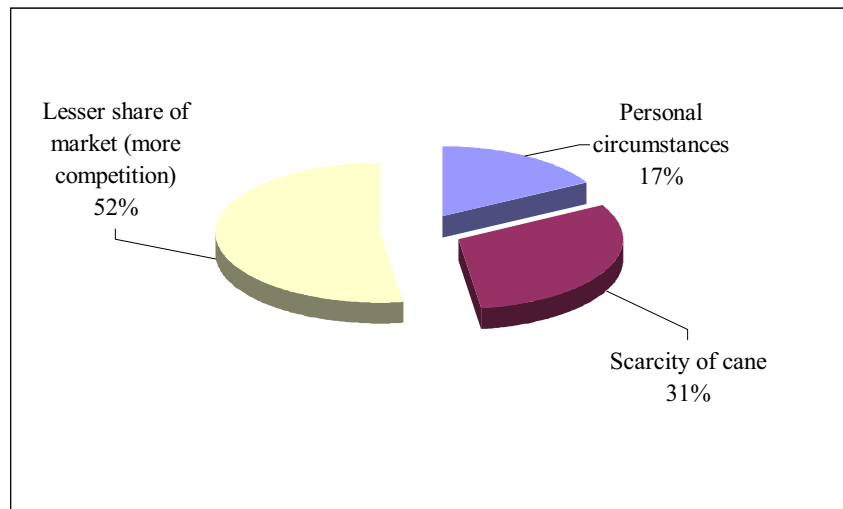


Figure 18. Cited reasons given for growth of rattan sector in certain urban markets (figures given are per response)

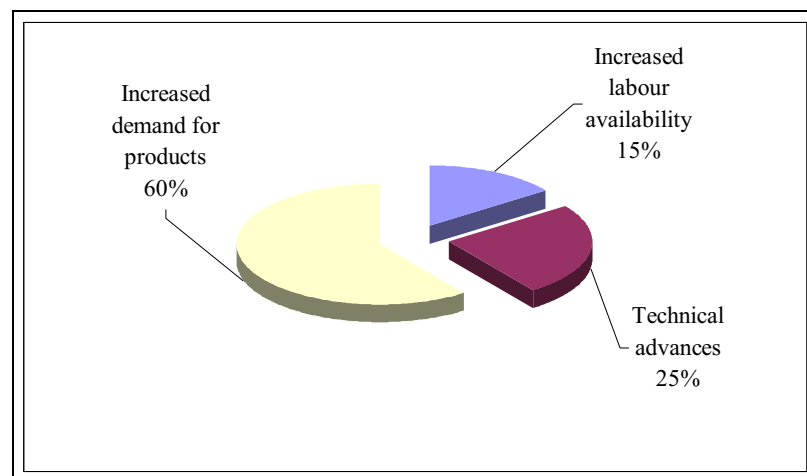


Table 4. Major constraints to the development of the rattan sector in Cameroon. (Based on number of responses).

Rank	Constraint	No. of responses (n = 363)
1	Scarcity of raw material (rattan)	125
2	Competition between artisans (lack of custom)	52
3	Lack of technology for processing & transformation (labour intensive)	44
4	Lack of capital	35
5	Open workshops and storage (adversely affected by weather)	33
6	High costs of inputs (nails, plywood etc)	28
7	High taxation (formal and informal)	19
8	Rattan considered “poor man’s furniture”	8
9	Transport of finished products to market	6
9	Poor quality of cane	6
11	Dangers of cutting cane in forest	3
12	Lack of artisanal union	2
12	Poor state of National Economy	2

Table 5. Recommendations of artisans for the stimulation of the rattan sector in Cameroon.

Rank	Recommendation	No. of responses (n = 279)
1	Form artisan unions (price fixing)	56
2	Greater access to raw material	55
3	Provision of machinery for processing and transformation	38
4	Access to credit	27
5	Exhibition / promotion of rattan products	21
6	Central enclosed workshops	19
7	Training in improved artisan techniques for better quality products	18
8	Increased markets	16
9	State support in sector	12
10	Develop export markets	10
11	Lower prices for inputs (subsidies)	9
12	Cultivation of rattan	4
12	End of harassment by police and forestry officials	4

Discussion

“La crise” and the increased reliance on forest products

It is clear from the surveys results presented above that a number of artisans originate either from a high educational level and / or from previously successful professional trades.

The main reason for this is due to the economic crisis that hit Cameroon in the late 1980’s and early 1990’s. The general world recession of the 1980’s that resulted in falling prices of oil and agricultural produce (which accounts for 90% of GDP) affected Cameroon deeply. This was compounded by a large and top heavy civil service. Unemployment increased from 12% to 25% during the late 1980’s, civil service salaries were reduced by 70% in November of 1993 followed by a 50% devaluated of the CFA franc in January 1994. The immediate result of this economic

downturn has been an increased reliance on subsistence farming by all sections of the population, as well as the uncontrolled exploitation of medicinal plants, bushmeat, and other forest products. Although the economy has picked up significantly since the mid- to late 1990's, the reliance on forest products remains strong.

For this reason, many of those leaving education and unable to find employment, or are forced to leave education to support the family, or those simply finding themselves unemployed, have turned to the forest sector for employment. Aside from the relatively high educational and professional levels of some rattan artisans, further evidence of this is illustrated by our survey results. These also show many of those involved in rattan transformation are relatively recent entrants into the sector < 10 years and are of an increasingly young age.

Aside from the economic crisis, although perhaps related to it, the fact that many rehabilitated prisoners enter the rattan artisan trade directly from serving their prison terms also accounts for the wide variation of the social background of rattan artisans. Again, this factor certainly accounts for some of the higher education and professional levels of some of the artisans operating in the sector, although due to the sensitive nature of this issue, this is difficult to assess.

Hence, due to this economic crisis, the growth of the rattan sector in the late 1980's first reported by Shiembo (1986) and Pokam-Wadja (1987) led to the establishment of many artisan operations in Cameroon. This has had two major impacts:

- The increased number of artisans in a market that, despite also undergoing some growth for the same reasons⁷, has resulted in the saturation of artisans enterprises in some urban markets. This has led to increased competition to the extent that profit margins have been cut significantly;
- This increase in processing and transformation has accordingly resulted in increased harvesting of rattan from the wild.

Sustainability

There is no doubt that the current exploitation of rattan in Cameroon is unsustainable and it is clear that the present intensity of harvest is exceeding that of regeneration and growth. The reported scarcity of supplies for many urban markets (Shiembo, 1986; Pokam-Wadja, 1987; Defo, 1997; Defo, 1999) and the fact that the harvest range is increasing steadily is strong evidence to support this. The over-exploitation of rattan has been facilitated by the provision of greater access to the forest through increased logging activities during the same period.

Increased range = increased price?

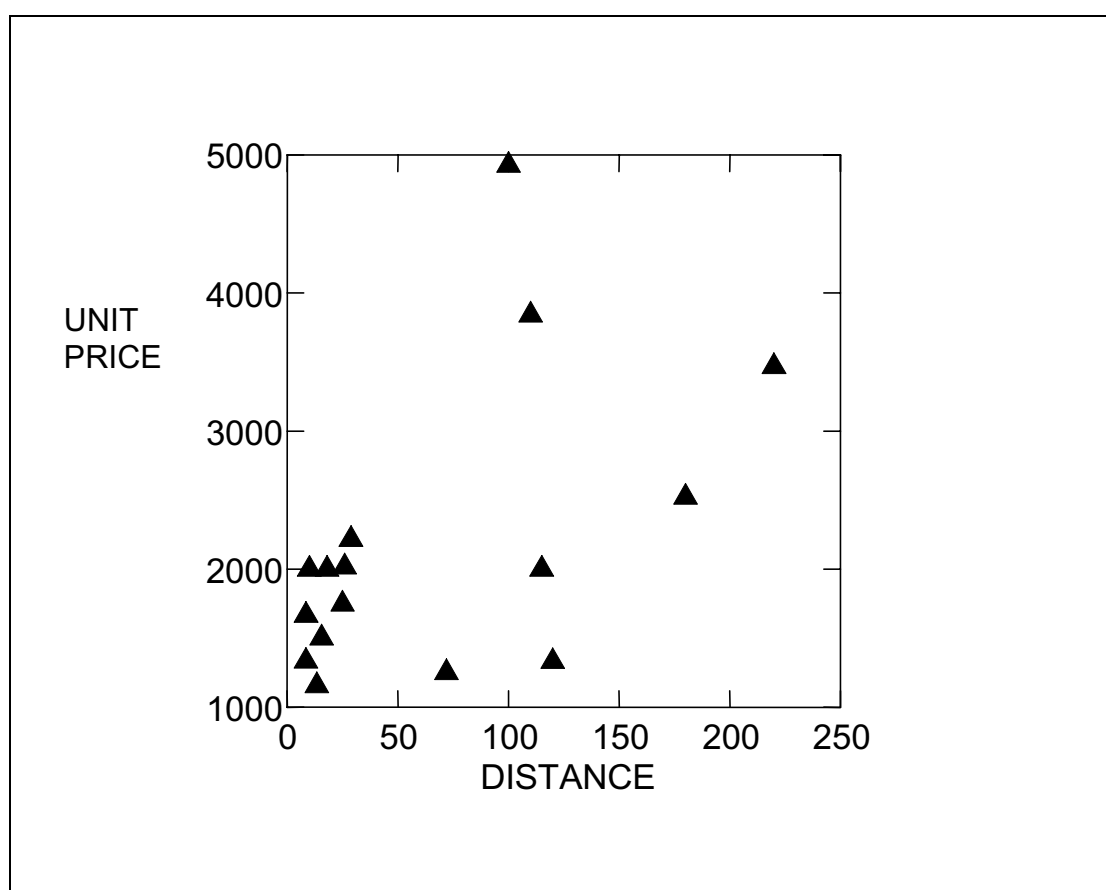
As the distance that rattan has to travel increases due to this scarcity, there is also a corresponding increase in the opportunity and transport costs of harvesting rattan. Whilst there is a correlation between the distance rattan travels from the harvest site to

⁷ Increased rural and urban poverty meant that consumers had to purchase furniture they could afford and they could no longer afford expensive wood products, but began to rely on substitute products such as rattan. Hence, for many Cameroonians, the stigma has persisted that rattan products are a "poor man's furniture".

the area of transformation and the wholesale price of unprocessed rattan the correlation is not as strong as might be expected (Pearsons correlation coefficient, $r = 0.524$, $P < 0.01$). The reasons for this are complex, but are, in the main, due to two main factors:

- The type of road along which the cane is transported (100km on a tar road is a much easier journey, and with more transport opportunities, than 10km on a very poor un-graded road);
- The number of police checkpoints on a given stretch of motorable road. “Informal taxation” by members of the police, gendarmerie, military, and forest services is common when transporting rattan (and indeed, many other products). Transport routes, such as the Douala-Yaounde road, are characterised by a high concentration of checkpoints and result in increased costs of transportation of rattan, along with the inevitable delays this causes to the journey.

Figure 19. Correlation between range (distance km) and costs of rattan (CFA)



Profitability and size of urban market

Although, to some degree, profits are determined by the size of the urban market concerned, and there is a correlation to suggest as much (Pearson's correlation coefficient $r = 0.729$, $P < 0.01$), cultural and socio-economic factors are also somewhat influential in this regard. For example, towns with little economic status

where the rattan market is aimed primarily at the indigenous, and often poorer, proportion of the population, have smaller profit margins (Yokadouma and Mamfe). Towns with greater economic status, higher incomes and greater concentrations of ex-patriots⁸ have greater profit margins (Kribi and Limbe). Cosmopolitan cities such as Douala (the economic capital of Cameroon) and Yaoundé (a large proportion of the population of which is comprised of civil servants and their dependants) provide rattan artisans with the highest incomes. Both these latter cities also have large concentrations of expatriates.

An industry in decline?

Our studies have concluded that the rattan sector in Cameroon is currently in some decline. However, it should be noted that this decline is currently only relative to the quantities of rattan being transformed and not currently in terms of a decline in the overall value of the sector. The reason for this is simple and unanimously agreed upon by the artisans interviewed during these studies. At present, demand is such that local scarcity has forced gradual increases in the price of unprocessed cane which are currently being absorbed by the consumer. Whilst the quantities of finished products are decreasing, the corresponding increases in the price of raw material, which are then passed to the consumer, is not as yet manifesting in a significant reduction in income for most artisans. As such, most enterprises remain profitable. Obviously, this situation cannot continue *ad infinitum* and eventually, if present harvest rates continue, the price of raw material will exceed more than the “willingness to pay” of most consumers.

However, some decrease in profitability has been identified by this survey. This is not ultimately due to scarcity of supplies, but to increased competition. Price wars between enterprises have recently been in operation, particularly in the large urban markets, and these have led to a small reduction in real incomes as enterprises struggle to maintain competitiveness. One positive action that most artisans identified that could have an effect on this is the establishment of a rattan union that would be responsible for setting a pricing framework for standard finished products. This would then avoid being under-cut by competitors. Whilst, in theory, this is a wonderful idea from the perspective of artisan enterprises, given the variation in the quality of finished products by most artisans this might not be workable in practice.

Changes in personal circumstances also account for the decline in rattan enterprise. For example, some artisans stated that as they get older, they begin to rely on other sources of income. Other artisans are somewhat peripatetic in their activities and revert to part- or full-time farming, particularly as commodities such as cocoa and coffee have increased in value in recent years. Without question, despite the fiscal benefits rattan brings, those artisans who are also involved in harvesting unanimously state that the unpleasant and risky nature of the harvesting process make alternative income generating activities far more attractive. Correspondingly, some artisans suggest that this is one of the main reasons for local scarcity. In this regard, they state that village-based harvesters, who were formerly supplying urban markets, are reverting to farming and other occupations for their livelihoods and are less inclined to

⁸ In contrast to the indigenous market, rattan is a favoured product for ex-patriots working in Cameroon and hence the increased profit margins in towns with high concentrations of resident, or visiting (for tourist areas), ex-patriots.

continue with these difficult harvesting activities, particularly as the harvest range increases. Hence, rattan harvesting may be described as a livelihood “safety-net” when other occupations are not economic. This situation has been also described by a number of previous studies (Ndoye, 1994; Defo, 1997; Defo, 1999; Sunderland, 1999a; 1999b).

In contrast to the general decline in the rattan sector, some artisans suggest that their own circumstances have improved in recent years and their share of the market in finished products is increasing. Although these are in the minority, it certainly seems that some artisanal enterprises are indeed expanding, particularly in the employment of additional employees. In general, these enterprises are based in Douala and Yaounde where they have permanent workshops along with access to innovative designs and a large expatriate market. The increased labour availability can also be considered a direct result of the economic crisis; with more unemployment, available labour has increased dramatically.

Rattan unions

Whilst the use of a formal artisan union to establish a pricing framework might be somewhat counter-productive, the sector could certainly benefit from some level of organisation and formalisation. The benefits that could be brought about by creating a formal union could possibly include the provision of credit facilities, increased efficiency through the adoption of appropriate technologies, opportunities for training and product development and the promotion of rattan products. In this regard, government intervention in the sector might bring about such benefits, although an NGO or development agency might also be an appropriate catalyst for such a network of organisations.

Conclusion

As these studies show, the trade in unprocessed rattan alone is extremely valuable and contributes significantly to the livelihoods of rural harvesters as well as artisans that rely on unprocessed rattan. However, very little of this income benefits the production side of the sector and for this reason, very little effort is being made to generate sustainable management regimes for the exploitation of rattan. This is additionally hindered by a lack of adequate resource tenure for a product that has traditionally regarded as an open-access resource.

Although there is considerable “informal” taxation of the rattan trade, as well as limited (formal) revenue collection, in the form of council dues, the formal forestry sector receives very little if any revenue from this extremely profitable industry. Part of the problem, as discussed, is the fact that revenues from forest products are traded in invisible markets. However, this need not be the case, and, it would not be prohibitively complicated to establish a system of harvesting licenses and quotas based on known and actual sustainable yields (once this baseline information becomes available). It is often argued that the monitoring of such a system is a particular problem given the limited resources of the forestry services. However, it could be argued that if forest officers are actively gathering informal taxes, how much more regulation would it take to collect taxes on an official basis?

Perhaps if some of the income generated from a high value NTFP such as rattan is formally realised by the forestry administration, this might provide the necessary means of supporting such initiatives. Revenues generated by such high value NTFPs, could be realised through collecting fees for permits and direct product taxation, based on volume (equivalent to “stumpage” for timber).

The realisation of the true value of such resources is critical in the pursuit of a holistic conservation management approach for a wide range of forest products rather than for timber resources alone. In this respect, moves towards formal forest management by communities throughout much of West and Central Africa provide the legislative framework for such an ideal.

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MORPHOLOGY OF THE AERIAL AXIS OF SOME RATTAN PALMS OF WEST AFRICA

Jean-Pierre Profizi

Summary

The analysis of the length and diameter of each internode of the culinary axis of some African rattan palms species (*Calamus deërratus*, *Eremospatha macrocarpa*, and *Laccosperma secundiflorum*) shows that their growth follows a rhythm. Different exogenous causes of this rhythm are discussed, especially the pedology and progression within the support vegetation at increasing energy. The latter seems to be the most satisfying at the present state of studies.

Introduction

West African climbing palms have been objects of very little studies despite their abundance in marshy or flooded vegetation. Recently, a new interest has been generated towards these plants. We shall find in other communications of this international seminar, the current state of research in Africa, on this climbing plant, which is of much importance to the livelihood of its rural and urban populations.

Four species are found in the Republic of Benin (Profizi, 1981), *Calamus deërratus*, *Eremospatha macrocarpa*, *Laccosperma secundiflorum*, and *Oncocalamus wrightianus*. The latter species shall not be studied here because it is rare and often found in the forests of Benin only at the juvenile stage of growth.

This work was initiated with the aim of understanding the growth relationship of the different vegetative organs and to analyse the morphology of stems (cane) of rattan palms of Benin. This presentation gives the results of measurements made on the aerial axis of three of the four liana palms species of South Benin marshlands. It should be pointed out that many species of Malaysia (Fisher, 1978) and Australia (Putz, 1990) had been studied for these characteristics which are particularly important for artisan studies.

Material and methods

Rattan palms (*Arecaceae*, sub-family of *Calamoideae* - Uhl & Dransfield, 1987) are usually very thorny palms, found within the Guinea type marsh vegetation (White, 1983) with a four season sub-equatorial climate type in Benin. They are usually harvested and processed by people in the same way as *Raphia hookeri*, and found in the same milieu.

All these species form linear tufts of orthotropic monopodial parts, with spiralled phyllotaxy, resulting from a grain or most often from an underground juvenile ramification. The axis therefore is part of a clone resulting from a single germination and which can have numerous aerial axes at different stages of growth. In all the cases observed, vegetative buds are positioned at 180° to the axil of the leaf corresponding to

the inter-node that gave birth to it (these are the "leaf opposed buds" of Fisher and Dransfield, 1979). They represent the entire Tomlinson model (Halle *et al.*, 1978; De Castro de Santos, 1981) and have either hapaxanthic flowering (terminal inflorescence of the aerial axis of a clone) for *Laccosperma secundiflorum* or pleonanthic flowering (multiple lateral inflorescence on each axis) for *Calamus deërratus* and *Eremospatha macrocarpa*. For further details on this topic see Sunderland (2000).

Eremospatha macrocarpa and *Laccosperma secundiflorum* form pachymorphic or clustered rhizomes (as well as *Oncocalamus wrightianus*, which is not studied here), whereas *Calamus deërratus* is leptomorphic. The axis of this species progresses and ramifies at some centimetres in the soil before redressing itself and forming an orthotrophic aerial axis in patches where light touches the ground.

The mode of anchor (see Dransfield, 1978) of these climbers within the surrounding vegetation for *Calamus* consists of a lateral flagellum (sterile inflorescence) armed with, curved verticillate thorns. The other three species develop long leaves of 1.5 to 2.5 m. Each of these leaves end with a cirrus made up of a distal extremity of the rachis on which sturdy pairs of hooks (transformed leaflets) that curve to the base insert themselves.

For this study, stems were obtained from Benin within the much degraded swampy forest of Tohoué (6° 25 N, 2° 40 E, Sémé-Podji District, Ouémé Province). The marsh is covered by raffia palms (dominated by *Raphia hookeri*), enriched by some tree-like dicotyledons (Profizi, 1983 and 1985). After removing their leaves and leaf sheaths, we measured the length and diameter (at 1/10th of a millimetre) of each inter-node, from the base of the axis (germination or base of ramification) to the end (terminal bud). For the calculation of inter-node volume, these are assumed to be perfect cylinders: The inclination of the insertion line of the leaf is compensated for by a measurement taken at mid levels. Numbering of inter-nodes is undertaken by order of position from the base of the axis to the terminal bud.

Results

Eremospatha macrocarpa (Figures 1 and 2)

The dimensions (diameter, length, volume: figure 1) of the first inter-nodes are small then progress rapidly until it becomes greater than the diameter of the future cane. This corresponds to the installation phase of the future rattan palm plant. The large diameter is due to the passing of roots in to the burrows of cortical tissue, which is produced at this level. Growth in height of the axis begins with an elongation of succeeding inter-nodes with a considerably constant diameter right to the proximity of the terminal meristem. On the contrary, the length of inter-nodes is very variable even if we consider only 90% of these (that is, excluding those that are close to the base and to the tip of the stem). This length varies from 15 cm to more than 25 cm (Figure 2), whereas the diameter/length ratio of inter-nodes classically show an independence of the diameter to the length as is the case with monocotyledons void of secondary meristems.

The volume of inter-nodes was calculated to better understand the production of plant matter, and consequently the metabolic activity of the plant throughout its growth. We thus noticed that this volume varies considerably. A rhythm comprising oscillating growth phases of twenty to thirty inter-nodes each is revealed. Each of these phases is comprised of a series of weak variations of volume increase from one inter-node to the next then a decrease which is sometimes significant, preceding a new phase. The first flowering (indicated by an arrow in Figure 1) occurs on individuals analysed after two to three growth phases and this equally corresponds to a high level in the canopy of the marshland. As has already been observed with other climbers, flowering occurs only at the plant's emergence above (or in the upper part of the foliage) the top of support trees.

In this manner, *Eremospatha macrocarpa* seems to show a rhythmic growth of four phases, which needs to be compared to the three tree strata of the surrounding vegetation.

Laccosperma secundiflorum (Figure 3)

Despite its different phenology, this species shows the same growth characteristics like *Eremospatha macrocarpa* (Figure 3a). Thus we equally observed two or three successive phases of significant importance. The appearance of inflorescence shown by arrows on the figure occurs in the hapaxanthic species only after inter-node volumes have attained their maximum. Similarly, the length/diameter ratio of inter-nodes (Figure 4 b) shows the same independence between these data like with *E. macrocarpa*.

Calamus deerratus (Figure 4)

Variations from one inter-node to the other are also significant for this species but growth phases are difficult to distinguish. Contrary to other species studied, the number of terminal bud inter-nodes is very significant, representing up to 30% of the total whereas, the first inflorescence were already present.

Comments

Two of the three climbing palms present in the swampy forests of the south of Benin therefore have a growth showing rhythmic variations of inter-node volume. The main growth characteristic is the presence of more or less accentuated oscillation phases, themselves comprising secondary variations of two to three inter-nodes.

This mode of growth could be endogenous and correspond to the variation of growth hormone production rhythm. To my knowledge, there is no available mention of this proposal in literature at least concerning climbing monocotyledons. We can therefore only state the hypothesis without being categorical about the reality.

An exogenous cause of this could be sought for: the observed rhythm may therefore result from environmental conditions, which vary throughout the growth of rattan palms in the marsh. Here two factors are considered: (i) The influence of water factor and (ii)

The impact of different energetic levels within the different strata of the marsh vegetation.

The milieu is characterised by permanent or periodic flooding of the soil. Because of its concave nature, suspended on a briny water sheet of ocean origin, the water supply of the marsh is ensured only by precipitation with no alternative source (Profizi, 1983). The level of the water table thus varies greatly during the year. The highest level corresponding to the end of the rainy season (May-July and September-October) and the lowest at the end of the long dry season (April). The distribution of *Eremospatha macrocarpa* and *Laccosperma secundiflorum* in the field shows that these two species are found in permanently flooded zones even at the end of the dry season. Whereas *Calamus deërratus* is found in the zone which is flooded only at the highest water table level.

The variation of inter-nodes growth at least the most important phases could be correlated with fluctuations of the water table or, for *C. deërratus*, by the alternation of flood and non-flood periods of the soil. But temporal growth information is not precisely known to conclude on this aspect. Elsewhere, studies have been undertaken on Asian rattan palms show that growth is slow especially for young plants growing on stable soil. Thus Generaldo (1981) gives duration of 10 to 15 years before canes can be exploited. During this seminar Nzoo et al., (this volume) state that the axis of *Laccosperma secundiflorum* attain maturity at the end of 4.64 ± 1.2 years of growth. It therefore becomes difficult to expect that water table fluctuations are a determining factor for variations observed with inter-node volumes.

In contrast, we can observe in the field that rattan palms have a non-linear growth course within the woody vegetation from the ground to the top of the canopy. We thus notice an alternation of orthotropic progression phases and phases of plagiotropic stabilisation. The existence of these plagiotropic phases can equally explain the rolling up on the ground of basal parts of rattan palms when the oldest leaves dry up. If was only orthotropic, these extra length of stems would have been absent.

The different trophic levels attained in this way as rattan palms progress within the surrounding vegetation can in their own way explain the measurements given here. The main growth phases (determined by long inter-nodes) should correspond to orthotropic behaviour, whereas the low volume phases (short inter-nodes) should participate in plagiotropic behaviour. Observations made for this study does not allow us to be clear-cut about the cause of this phenomenon. But it seems that explaining plant matter production by a progressive increase of trophic energy within the forest stratification is a very probable eventuality. Other measurements and experiments (locating each inter-node along the vertical transect of the forest structure, measuring of available energy at each level) are necessary to refine, ease or contradict this analysis.

Conclusion

The cause of inter-node volume variations of rattan palms constitutes an opportunity to better understand the natural growth of these climbers. But these results can also have

great importance for the choice of long inter-node rattan by rattan artisans. Especially in facilitating their task of curving rattan in the course of making furniture. In the case of rattan palms plantations which can be set up rapidly (see other communications of this workshop) these can equally be important in the choice of support trees. It is therefore necessary to carry out a thorough investigation of research subject within a short delay so that determination of the best cropping conditions precedes planting operations.

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REPORT ON THE INTERNATIONAL AFRICAN RATTAN WORKSHOP

Brendan JAFF

Introduction

Rattans are climbing palms found in the lowland tropical forests of the Old World. The flexible stems are used for the manufacture of baskets, furniture, and other woven products. The international rattan trade is currently worth some US\$6.5 million per annum. Although the majority of this trade is concentrated in SE Asia, the rattans of Africa are also an important forest resource and play an important role in indigenous subsistence strategies.

Until very recently, very little was known about the rattans of Africa. Despite this, and with the growing focus on such high value non-timber forest products, rattans have recently been identified by many governments and bilateral development agencies, as a high priority resource with the potential to contribute to the conservation of forests of west and Central Africa through sustainable development. However, this development has been constrained by the lack of basic knowledge on taxonomy, ecology and the utilisation of these species. Recent attempts by workers across Africa to address this basic shortfall in information has resulted in the initial background information surrounding the biological and social aspects of the rattan sector in Africa now being available.

The primary objectives of this international seminar were to:

- Bring together the current experts concerned with rattan research and development in Africa;
- Present and disseminate the current state of the knowledge of the rattan sector in key areas on the continent;
- Make recommendations and draw up an appropriate strategy by which rattans can meaningfully contribute to the sustainable development of the forests of West and Central Africa

The workshop, which was held at the Limbe Botanic Garden, Cameroon; from the 1st-3rd February 2000, brought together a total of 29 participants from throughout the forest regions of Africa, including representatives from Cameroon, Ghana, the Democratic Republic of Congo, Gabon and Zambia.

Presentations

Following the opening of the workshop a series of papers were presented. The papers were based on the following themes:

- Biology, Ecology and Cultivation

- Social, marketing and Management

Each presentation was for 20 minutes followed by a 10-minute discussion session. Key issues raised during the discussion were written on flip charts for consideration during the recommendation formulation stage of the workshop.

Formulation of Recommendations

At the end of paper presentations, participants in a plenary session formulated recommendations on African Rattan Research and Development taking into account crucial issues from the paper presentations and discussion, along with their own experience.

Each participant was given four cards to write his / her recommendations. These were then collected and clustered. A total of seven key Recommendations and accompanying elements were formulated.

Summary of recommendations on rattan research and development

Using the procedure described in 2.3 above, the following 7 key recommendations on African Rattan Research and Development were formulated.

- The African Rattan Research Programme with the collaboration of other research programmes, projects and institutions should create a formal African Rattan Network; in order to facilitate exchange of experiences, ensure meaningful collaborative research, avoid duplication of research; thereby contributing to the sustainable use of African Rattan.
- Review the legal aspects governing Non-Timber Forest Products including Rattans; key aspects include; resource tenure, ownership, harvesting licenses and quota's. The review should consider possibilities of involving NGOs and the local communities via its institutions in the implementation of the law.
- Disseminate existing information on African rattan via the production of various publications for the use of different target groups; including researchers, local communities and policy makers.
- Taking into account existing information, conduct complementary and collaborative research on the Biology, Ecology, Cultivation, Social, Marketing and Management of African rattan. Collaborative regional research programmes should be encouraged so as to generate rich and comparative information.
- Support the development / transfer of appropriate technology for the harvesting, processing and transformation of African rattans, aimed at increasing the quality of finished products, adding value and reducing the cost of production; this calls for meaningful collaboration between government, the private sector and researchers.

- Support the establishment of an appropriate funding mechanism aimed at encouraging rattan research and development related initiatives at community level; including the creation of nurseries, plantation establishment, harvesters union creation, marketing co-operatives amongst others.
- Improve the Marketing Strategy of African rattans with the involvement of all stakeholders based on existing information and taking into account the Asian experience

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The business of rattan production and trade is well established in Asia. It remains a vibrant business although one greatly affected by over-exploitation of the resource, resource scarcity and relative labour costs between countries. Far less is known about rattans in Africa, yet there is a potential to emulate the better aspects of Asian experience in order to alleviate rural poverty.

Rattan needs light overhead shade and a tree canopy to scramble up into. It is thus a unique crop in that it makes the farmer a colleague in arresting deforestation. The concept of participatory rattan farming in the forest margins deserves far greater attention than it has received from all those who wish to involve local people as allies in stabilising forest margins and arresting deforestation.

This workshop brought together many practitioners and experts from Africa. It concluded by summarising that, since there are so few researchers and practitioners, duplication of effort should be avoided.

There are policy and regulatory problems that needed to be overcome before rattan-based development can thrive. It concluded that greater effort was needed to disseminate information and technologies. Higher value products are also needed.