

NON-WOOD FOREST PRODUCTS OF CENTRAL AFRICA

# CURRENT RESEARCH ISSUES AND PROSPECTS FOR CONSERVATION AND DEVELOPMENT



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## **INTRODUCTION and WORKSHOP SUMMARY**

NON-WOOD FOREST PRODUCTS OF CENTRAL AFRICA

# **CURRENT RESEARCH ISSUES AND PROSPECTS FOR CONSERVATION AND DEVELOPMENT**

Edited by  
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Based on the outcome of the International Expert Meeting on  
Non-Wood Forest Products in Central Africa, held at  
The Limbe Botanic Garden, Cameroon,  
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CARPE, the Central African Regional Program for the Environment is a five-year, USAID-funded project that seeks to identify and establish conditions and practices required to reduce deforestation and biodiversity loss in the Congo Basin.

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## FOREWORD

With the accelerating loss of tropical rainforest around the world, non-wood forest products (NWFPs) are becoming ever more important as a means of mitigating deforestation, hence maintaining forest cover and realising income from it. NWFPs have been widely acclaimed as a panacea for the problem, but there are many constraints and frequently false hopes have been raised by the promulgation of the value of NWFPs. It is therefore excellent that an international workshop on NWFPs was recently held at Limbe Botanic Garden, Cameroon, to evaluate the situation and develop possible strategies to assess the potential that forest products, other than timber, can contribute to conservation and development initiatives.

Although this workshop was primarily geared towards Central Africa, it has a much wider relevance to the rainforests of the world. I have attended several recent meetings where NWFPs have been discussed and have been particularly struck by two things. Firstly, the commercial exploitation of many NWFPs is often undertaken in a non-sustainable manner, and secondly, we lack so much of the basic research that is essential before further exploitation of a particular NWFP is promoted, in terms of both biology and the socio-economic considerations. However, in spite of these reservations there is no doubt that NWFPs have an important role to play in the future of tropical forests and the conclusions and recommendations of the papers and discussion sessions from this workshop are a most welcome addition to the debate on how to use NWFPs more wisely.

Rainforest species generally occur in extremely low densities. In the majority of the inventory plots with which I have been involved the majority of species, some of which could yield non-wood products, occur with extremely low frequency. For example in a three hectare inventory in the Rio Xingu region of Brazil, 125 of the 265 species were represented by only one individual and another 54 by two. However, that same inventory included 79 individuals of the very useful babassu palm (*Orbignya phalerata*). In general, species with low densities are unlikely to become important commercial sources of NWFPs, as they are highly susceptible to the impacts of over-harvesting. Even many of the more common species that produce NWFPs are often over-exploited and many examples of this are given in this volume. The type of research reported on by Van Dijk is essential because it identifies the rare and the abundant resources of a rainforest area in Central Africa, whilst also taking into account the socio-economic aspects of exploitation.

As Charles Peters points out, other factors that need to be taken into account when a NWFP is exploited include the effect on pollinators and agents of seed dispersal and also on the removal of essential nutrients from the forest. So many rainforests are on poor soils and some of the essential nutrients are concentrated in the parts removed, especially in bark and fruits. In the exploitation of NWFPs it is essential that the regeneration of the species is not prevented by, for example, the removal of too many seeds or the damage to seedlings from trampling by the gatherer of a product.

As the majority of the harvesting of NWFPs is undertaken by forest dwellers, it is an essential requirement that the local community be involved in the management system. It is therefore good to see a paper by Ruth Malleson on the community management of forest resources and the importance of the social institutions that can influence the exploitation of NWFPs.

This volume reports on considerable research that has been carried out on NWFPs in Central Africa. However, a great deal more research is needed before we can be sure that any product is managed in a long-term sustainable manner. It is to be hoped that this volume will not only stimulate the use of NWFPs, but also much further research on the ethnobotany, ecology and socio-economic importance of any product that is to be promoted. It is only with this basic research that NWFPs will truly play a significant role in the conservation and the sustainable use of the tropical forests.

Sir Ghilleen Prance FRS  
Director  
Royal Botanic Gardens, Kew  
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## PREFACE

The USAID-funded Central African Regional Program for the Environment (CARPE) with support from the FAO Non-Wood Forest Products Programme, organised an international expert workshop on non-wood forest products in Central Africa during May 1998 at the Limbe Botanic Garden, Cameroon. This workshop set the stage for the creation of a regional network for information sharing and collaboration and has helped to identify short and medium-term activities that will clarify the potential role of the sector in the better management of the forests of Central Africa.

In addition, the workshop provided an invaluable forum for the NWFP community to share their work and experiences with others. It is our hope that this will encourage an increased unification of knowledge and activities in the NWFP sector in Central Africa and determine the present and potential contribution of NWFPs to conservation and development. The workshop also provided, for many, a rare opportunity to disseminate their research findings in an international setting.

These proceedings include the papers presented at the workshop as well as a number of extra papers submitted by participants after the workshop had ended that were thought to be of sufficient interest to merit inclusion. The papers included in this publication are a synthesis of the current state of the knowledge of NWFPs in general and related issues surrounding their exploitation, and provide a unique overview of the NWFP sector throughout Central Africa, rather than the usual country specific approach.

The workshop and these proceedings would not have been possible without the hard work of a number of individuals and institutions. Full acknowledgement should be given to the Limbe Botanic Garden, without whose marvelous facilities and considerable logistical support the workshop would not have run as smoothly as it did. Special mention must also be made to Brendan Jaff who facilitated the workshop in a highly professional manner. Dr. David Wilkie provided an invaluable synopsis of the discussion sessions at the workshop, a summary of which forms the introduction to these proceedings. The CARPE contact for Cameroon, Nicodeme Tchamou, also provided invaluable help, advice and support both prior to and during the workshop. Indeed it was Nicodeme who originally identified the need for this workshop and helped us think through various issues along the way.

Finally, the workshop would never have happened without the personal commitment, dedication, and many long hours of hard work from Laurie Clark and Terry Sunderland. Laurie took on the thankless administrative and logistical burden, and Terry was instrumental in helping us finalize our thematic approach, identify key participants and, after the workshop, pulled together these proceedings. Overall guidance and coordination for the preparation, review and publication of the final document was provided by Paul Vantomme. Thanks and appreciation to them, and to the others who participated in the process.

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## EDITORS' NOTES

As can be seen from a cursory glance through these proceedings, many of these papers are inter-connected and refer a great deal to each other. To facilitate ease of reading and presentation, we have avoided significant repetition that would occur if we were to include a definition of non-wood or non-timber forest products in each paper. Instead, we have opted for the use of the term Non-Wood Forest products and left David Wilkie in his introduction (and workshop summary) to provide the definition on NWFPs which applies to this volume, as indeed it did for the workshop itself.

A key to the acronyms used in the papers can be found in the Appendices, although efforts have been made to ensure that as many acronyms as possible are expanded upon in the individual papers. In many cases they have been avoided.

It should be noted that at the time of collation, the CFA franc / US\$ exchange rate was 600 CFA = \$1.

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# CARPE AND NON-WOOD FOREST PRODUCTS

David Wilkie

## 1. Background

The forests of the Congo Basin cover approximately 2.8 million km<sup>2</sup> – an area about one third the size of the United States, and constitute the second largest contiguous block of tropical forest after the Amazon (BSP, 1993). These forests contain a diversity of plants and animals unmatched in Africa, and continue to provide food, shelter and income to 25-30 million people (Bahuchet, 1995).

Contrary to popular belief, the forests of the Congo Basin have over millennia, expanded, contracted and changed in species composition in response to climatic variability and disturbance by humans (Oslisly, 1995; Oslisly, 1998). In the last 20 years, as a result of globalisation of market economies and growth in demand, the scale and rate of exploitation of non-wood forest products (NWFPs) has expanded faster than at any other time in history, and use of forest resources is approaching or exceeding sustainable thresholds in many locations across the Congo Basin. Over-exploitation and eventual disappearance of NWFPs are of both local and global concern, because when a plant or animal goes locally extinct it:

- can no longer contribute to the diet or economy of forest families and,
- risks the irreplaceable loss of species and genetic biodiversity that may contribute significantly to forest ecosystem production and resilience.

Between 10 and 15 May 1998 the United States Forest Service held an *International Expert Workshop on Non-Wood Forest Products in Central Africa* at the Limbe Botanic Garden in Cameroon, with support from the USAID Central African Regional Program for the Environment (CARPE) and the Food and Agriculture Organization of the United Nations (FAO).

The workshop brought together over 60 regional and international experts to:

- Share their experience and knowledge on the use and management of non-wood forest products;
- Provide a forum for applied scientists working in the region to meet new colleagues and develop informal networks;
- Help avoid duplication of effort by exposing participants to past and ongoing research and applied work on NWFPs in the region;
- Seek consensus on a prioritized set of short- to mid-term actions to promote the sustainable use of NWFPs within the Congo Basin for the benefit of local communities and the conservation of forest biodiversity.

## 2. A focus on non-wood forest products of plant origin

Given the number of products used by humans that originate from the forest (*wood products* - logs, sawn wood, poles, fuelwood, charcoal, and *non-wood products* - bark, roots, tubers, corms, leaves, flowers, seeds, fruits, sap, resins, honey, fungi, and animal products - that include everything from termites to elephants); the factors that influence their availability

over time; the enormous range of domestic and commercial uses for these products; and the complexity of the pathways along which forest products travel from producer to consumer, a single workshop to review the state-of-knowledge of the whole sector and identify priority next steps for sustainable management of all forest products would be untenable. To keep the size of the experts group to a workshop maximum of under 100 people, and to ensure that a set of priority actions could be identified in the available time, the organisers decided to focus on non-wood forest products, and excluded both wood products, and vertebrates from the discussion.

### **3. A call for action on wildlife use in the region**

Excluding bushmeat hunting, trophy hunting and the live animal trade is contentious as some would argue that in terms of value to local economies and immediate threat to biodiversity conservation, trade in animals is a key issue. Though the workshop organisers deny neither of these contentions they believed that their expertise, and thus their capacity to identify experts and to organize the workshop, lay more in the domain of non-wood forest products of plant origin. That wildlife use in the forests of the Congo Basin is a key issue is not debated; rather the organizers of this workshop challenge others with expertise in this domain to pull together, as soon as possible, the experts in this field to characterise the state-of-knowledge and identify priority actions to promote sustainable use of wildlife within the forest of the Congo Basin.

### **4. Structure of the workshop**

The two primary goals of the workshop were to bring together NWFP experts to:

- Share their experiences;
- Identify priority actions to promote sustainable use of NWFPs to benefit local communities, and conserve forest biodiversity.

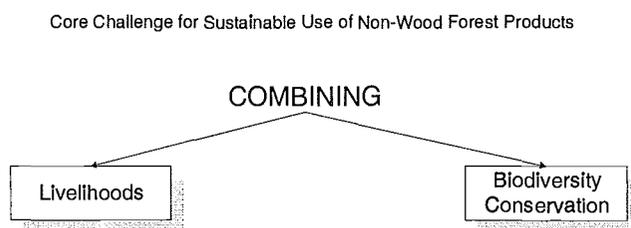
Given these two goals, the workshop was divided into two components:

- A series of 20 minutes presentations by workshop participants that were selected to characterise the state of the NWFP sector across the Congo Basin;
- A set of working groups designed to identify short- to mid-term actions that would build on past and ongoing activities to promote the sustainable use of NWFPs.

### **5. The challenge of discussing a complex issue**

Whenever humans use wild resources for domestic consumption or as a source of income the question of sustainability arises. If the resource is not used sustainably, its abundance will decrease progressively so that at some time in the future it no longer becomes available as a source of nutrition, construction materials, medicine, or income to local communities, and the species and its genetic makeup may be lost forever from the global patrimony. The issue of sustainability is key to any discussion of NWFPs. However sustainability is a complex issue and one whose components are all interconnected. This makes any discussion of NWFPs a challenge because the issues are too complex to address simultaneously. Yet the division of the issues into components is somewhat arbitrary, and most importantly, risks overlooking the inherent interconnections and interdependencies among the components within the NWFP sector.

The workshop was designed so that three major issues concerning the exploitation of NWFPs were addressed; ecological, socio-political and market-economic issues. These topics provided the theme under which papers were organised and presented. During the workshop an additional focus area, that of networking and information exchange, was also identified.



**Figure 1.** Reconciling development and conservation

Clearly, the boundaries around these components are fuzzy and interconnections and interdependencies abound. Yet they do provide the opportunity for focused discussion on the state-of-knowledge within each area, and a prioritisation of future actions. The thread binding together each of these focus areas is the common desire to – *promote the sustainable use of NWFPs to benefit local communities and conserve forest biodiversity*. This core message was voiced by all participants throughout the workshop and constituted a challenge to all involved to find ways to combine a concern for *people's livelihoods* with the need to *conserve biodiversity* when discussing the importance, values and management of NWFPs in the Congo Basin.

## 6. Presentations

Papers presented during the workshop were selected:

- To reflect the range of issues that must be addressed to manage NWFPs sustainably;
- To characterise different approaches to promoting sustainable NWFP use;
- To provide an overview of the present status of NWFP use and management across the Congo Basin.

The list of the names of all authors and the title of the papers presented during the workshop are presented in the list of contents of this volume.

## 7. Summary of the key issues arising from the presentations

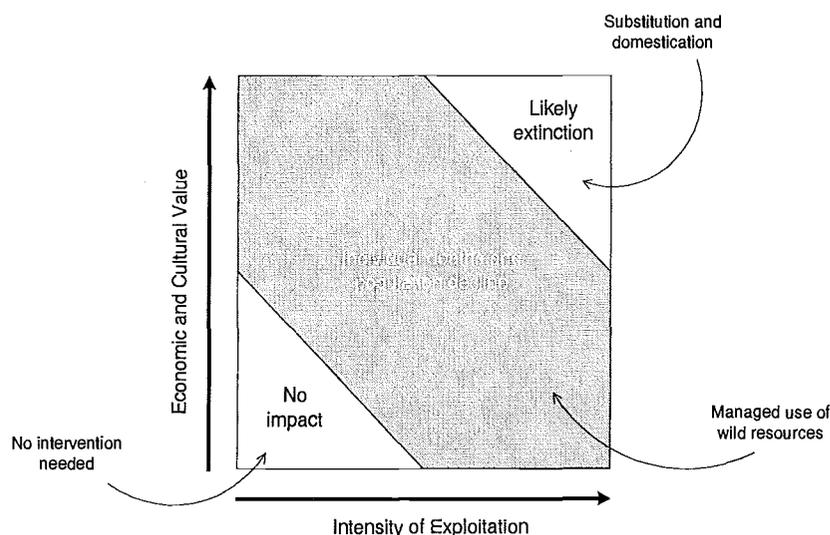
Summarising the extraordinary range and depth of the information and lessons learned presented in the papers listed above might seem like a Herculean task, were it not for the fact that the issues addressed in each of the papers tend to fit rather neatly into a remarkably simple model presented by Tony Cunningham and developed by Brad Bennett (1992).

This model argues that approaches to sustainable NWFP management are influenced largely by two factors:

- The cultural and economic value of a given NWFP;
- The intensity of exploitation of the NWFP (a function of the productivity of the resource relative to the scale of harvesting).

When the value of an NWFP and the intensity of exploitation are low, human impact on that NWFP are likely to be minimal and little if any formal management of the resource is

required. At the other end of the continuum, when the value of an NWFP and the intensity of its use are extremely high, it is highly likely that the resource is being overexploited and is threatened with local extinction. In this case, substitution or domestication may be the only way to conserve the wild resource without adversely affecting local livelihoods. Between these two extremes, human use of wild resources has a measurable impact on NWFP species abundance and productivity but can be sustainable if appropriate management systems are in place (i.e. there is control over resource access and harvest levels).



**Figure 2.** Model of NWFP sustainable use

Using this structure we can see that the papers presented during the workshop were all seeking to understand some component of this sustainable NWFP management model. For example, some papers considered how to assess human impacts on NWFPs or determine sustainable harvest levels, or characterise the value of NWFPs for local consumption and for markets, thus helping us to determine where along the management continuum of non-impact to likely extinction a particular community using a particular NWFP might lie. Other papers focused more on the management mechanisms that would need to be in place to monitor who uses a particular NWFP and how much they use. Still others were concerned with domestication and improvement (i.e. increased productivity, ease of harvesting, quality control and as a means of ensuring ownership) of species that were both valued by resources users and threatened with local extinction.

Given this structure what were some of the key lessons learned from the presentations? From the model two major options are available to manage NWFPs – the first, domestication and on-farm cultivation is appropriate when wild resources are being over-exploited; the second, putting in place systems to define who has access to wild NWFP resources in a given area, and to monitor (measure and control) harvest levels, is appropriate when wild resource use is still within sustainable levels. A third issue, maximising the per unit value obtained from marketing NWFPs, applies to both options as it is intended to increase the value of NWFPs without increasing the quantity exploited.

More specifically, the presentations identified a range of critical issues that must be considered when promoting sustainable NWFP use in the Congo Basin. The citations below refer to the papers included within these proceedings.

## 8. Ecological lessons learned

- Depending on the life history of the species involved and how the NWFP is harvested (whole plant, leaves, bark, fruits, resin, etc.) the impact of NWFP use on the population structure and long-term productivity of the resource may not be discernible in the short-term (van Dijk; Sunderland *et al.*; Cunningham). For example, the impact of seed harvesting on tree regeneration may not be detected for 60-100 years in long-living tree species (Peters).
- Some dense forest trees species in the Congo basin such as okoumé (*Aukoumea klaineana*) appear to regenerate only in relatively large disturbed areas (Laird).
- Variability in flowering and fruiting may result in wide fluctuations in NWFP availability from year to year (van Dijk).
- High diversity of tropical forests means that the density of NWFPs may be low or very patchy in distribution (Peters; van Dijk; Cunningham).
- Sustainable use requires a) inventories of standing stock, b) productivity estimates, c) monitoring of regeneration and d) assessment of present and future demand (Peters).
- Propagation and cultivation of many NWFPs are difficult or poorly understood (Okafor; Nkefor *et al.*; Tchoundjeu *et al.*).
- Reduced-impact harvesting is only likely if the harvester believes he or she will benefit from the effort (van Dijk; Cunningham).
- Results of ecological research have to be made available to local communities, other resource users and politicians if the full value of the forest is to be reflected in forest use decisions (Shanley).

## 9. Socio-political lessons learned

- Harvesters of NWFPs often modify the landscape to facilitate regeneration. For example, rattan harvesters ensure adequate light penetration to encourage regrowth (Sunderland).
- Local communities are more likely to have in place and enforce NWFP-use restrictions if the community is ethnically homogenous and stable in composition (Malleison; Shanley).
- Absentee elites often attempt to capture the value of community forests for their personal gain, and may actively attempt to diminish the effectiveness of community-based sustainable NWFP use systems (Malleison).
- Resource users know what NWFPs are important to them, what NWFPs they would like to see domesticated, and what characteristics of NWFPs they would like improved (Okafor; Nkefor *et al.*; Tchoundjeu; Ladipo).
- Raising household income can have perverse impacts on NWFP consumption (e.g. more income means higher demand for goods, and the ability to hire labour to intensify harvesting of NWFPs). Gabon is an example of a relatively wealthy nation that maintains a high per capita demand for NWFPs (Profizi; Yembi). There is also a high demand for NWFPs in Europe from prosperous African expatriates (Tabuna).
- Resource ownership is a key to individual investment in NWFPs. For example, women were keen to plant trees as sources of scarce fuelwood but men realized that trees might give women *de facto* ownership over “their” land (Burnley).
- The first step in any NWFP action is to determine what people use and its relative importance in the domestic and market economy (Ndoye *et al.*; Clark and Sunderland; Liengola; Yembi; Kimpouni; Sunderland and Obama).

## 10. Market-economic lessons learned

- Developing effective methods for preserving and storing NWFPs is critical to maximising the income that can be generated from each unit of a given NWFP (Ladipo; Tabuna).
- Without access to markets NWFPs contribute very little to household income, but may still contribute significantly to domestic consumption (van Dijk; Malleson).
- NWFP marketing is seldom a specialist activity, and is more often used to generate capital needed to start other economic activities such as tree-crop plantations, or to pay for seasonal (school fees) or unexpected costs (funerals, illness, etc.) (Sunderland; Defo).
- The legal framework for harvesting NWFPs is unclear and harvesters risk harassment while transporting their products to market (Sunderland *et al.*; Defo; Nkuinkeu).
- Recently urbanized populations and nationals living overseas can generate strong demand for NWFPs that are viewed as one of their few remaining links to a traditional village way of life (Tabuna).
- Small changes in the supply of NWFPs appear to result in large changes in the quantity marketed (i.e. markets for NWFPs are thin) resulting in supply uncertainty and irregular income from NWFP marketing (Liengola).
- Domestication and on-farm cultivation are the keys to ensuring reliable supplies of NWFPs (Okafor; Nkefor *et al.*; Tchoundjeu; Nkuinkeu; Sunderland).
- Logging revenues accrue at the national/treasury level, whereas NWFP revenues accrue at the local community/household level – national governments and local communities may therefore be in conflict over perceptions of the most economically rational use of the forest (Malleson; Shanley).

## 11. Working groups

The working groups were given the task of identifying a priority set of short- to mid-term actions that would build on past and ongoing work to promote the sustainable use of NWFPs in the Congo Basin. Discussions during working group sessions touched on a wide range of topics and concerns. Yet, it is still possible to distil from each group a key message that, hopefully, captures the essence of the experts' efforts to set priorities for future action. A key message from each working group might be the following:

Working group	Key Message
Ecological	Methods for baseline data collecting and monitoring of NWFPs must be developed, and individuals responsible for management of NWFPs trained in their use if NWFPs are to be managed sustainably in the wild.
Socio-Political	Ensuring the existence of social institutions capable of regulating access to and harvest levels of NWFPs is critical to sustainable use of NWFPs.
Market-Economic	Seeking ways to smooth the supply of NWFPs and enhance their per unit value is central to providing economic incentives (i.e. livelihood benefits) for sustainable NWFP use.
Networking and Information Exchange	Making available to Central Africans the information on NWFPs that already is being published regularly by other organizations and networks is a key to “building on the knowledge base - and avoiding reinventing the wheel”

Building on the foundation of these key messages the working groups proposed the following set of priority actions:

## 12. Ecological priority actions

The ecological working group felt strongly that an important first step to prioritising actions to promote sustainable NWFP use in the Congo Basin was to identify a short-list of key NWFP species. Two primary criteria were used to select key NWFP species. The first and most important is that the NWFP must be highly valued for domestic consumption or as a product for the market. The second criterion was that demand for a “high value” NWFP was exceeding supply. Simply stated, the criteria for selection are those that place specific NWFPs toward the top-right corner of the sustainable use model shown in Figure 2. The diversity of NWFP experts present at the Limbe workshop provided a unique opportunity to develop a short-list of NWFPs to be the focus of short- to mid-term sustainable use actions. Tables 1 and 2 show the results of this two step selection process. Step one identifies NWFPs with high value, step two subsets those that are intensively harvested.

**Table 1:** Short-list of key NWFPs

Species	<i>In-situ</i> conservation priority status	Livelihood Value	Domestication Priority	New Markets Potential
<i>Baillonella toxisperma</i>	***	***		
<i>Gnetum africanum</i> & <i>G. buchholzianum</i>	***	***	***	***
Rattan ( <i>Laccosperma secundiflorum</i> & <i>Eremospatha macrocarpa</i> )	**	***	***	***
<i>Cola acuminata</i> & <i>C. nitida</i>	*	***	*	
<i>Irvingia gabonensis</i> & <i>I. wombolu</i>	*	***	***	***
<i>Dacryodes edulis</i>		***	*	
<i>Piper guineensis</i>		***		***
<i>Garcinia lucida</i> , <i>G. mannii</i> & <i>G. kola</i>	***	**	***	
<i>Marantaceae</i>	**	**		
<i>Ricinodendron heudelottii</i>		**		
<i>Prunus africana</i>	***	*	***	**
<i>Pausinystalia johimbe</i>	***	*	***	*
<i>Tabernanthe iboga</i>	**	*	***	

Results of this preliminary prioritisation process suggest that efforts, at least in short- to mid-term, should be focused on *Gnetum*, *Baillonella*, and rattans (*Laccosperma secundiflorum* and *Eremospatha macrocarpa* in particular). *Prunus africana* and yohimbe (*Pausinystalia johimbe*) may also be considered of importance given the size of the international market and the potential for domestication. *Cola*, *Irvingia* and *Dacryodes* are of lower priority because they have already been incorporated into agro-production systems to some extent.

**Table 2 Characteristics of key NWFPs**

Species	Volume Used	Household Use	Market	Intntl Market	Harvest Impact	Plant Part Used	Uses	Domestication Status	Distribution	Habitat
<i>Baillonella toxisperma</i>	high	high	high	high	high	timber, fruit	medicine, timber, food	wild	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	primary forest, plantation
<i>Cola acuminata, nitida</i>	high	high	high	medium	low	fruit, seed	medicine, dye, food	wild, cultivated	Cameroon, Gabon	plantation, farms
<i>Dacryodes edulis</i>	high	high	high	low	low	fruit	fruit, fodder, shade, medicine	cultivated	Cameroon, Nigeria, Gabon, Eq. Guinea, Congo-Brazza, CAR, Congo-Kinshasa	farms, secondary forest
<i>Dioscorea</i>	high	high	high	medium	high	tubers	food, medicine	wild, cultivated	Cameroon, Nigeria, Gabon, Eq. Guinea, Congo-Brazza, CAR, Congo-Kinshasa	
<i>Fungi</i>	low	low	low	low	low	all	food	wild	All areas	
<i>Garcinia lucida, mannii, &amp; kola</i>	medium	high	medium	low	high	roots, bark, timber	medicine, cosmetic, spice	wild, cultivated	Cameroon, Gabon	secondary forest, primary forest, tree crops
<i>Gnetum africanum</i> <i>G. buchholzianum</i>	high	high	high	medium	high	leaf	food, medicine	wild, tolerated, cultivated	Cameroon, Nigeria, Cent. Afr. Rep. Congo-Kinshasa, Congo-Brazza, Eq. Guinea, Gabon	primary forest, secondary forest, fallow
<i>Irvingia gabonensis &amp; wombolu</i>	high	high	high	medium	low	seed, fruit	medicine, food, cosmetic, spice, fuelwood, timber	wild, tolerated	Cameroon, Nigeria, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	primary forest, secondary forest, farms
<i>Marantaceae (wrapping leaves)</i>	high	high	high	low	high	leaf, fruit	wrappers, crafts	wild	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	secondary forest
<i>Pausinystalia johimbe</i>	high	low		high	high	bark	medicine	wild, cultivated	Cameroon, Gabon, Eq. Guinea, Nigeria, Congo-Brazza	primary forest
<i>Phytostigma venenosum</i>	medium	low	low	low	low	seed	medicine, cultural	wild, cultivated	Cameroon, Nigeria, Congo-Kinshasa	secondary forest
<i>Picralima nitida</i>	low	low	low		medium	seed, bark	medicine	wild	Cameroon, Gabon, Congo-Brazza, Congo-Kinshasa, Eq. Guinea	primary forest

Species	Volume Used	Household Use	Market	Intntl Market	Harvest Impact	Plant Part Used	Uses	Domestication Status	Distribution	Habitat
<i>Piper guineensis</i>	high	high	high	low	low	seed, leaf	spice	wild, cultivated	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	secondary forest
<i>Prunus africana</i>	high	low	high	high	high	bark	medicine, timber	wild, cultivated	Eq. Guinea, Congo-Kinshasa, Cameroon	primary forest, farms
Rattan ( <i>Laccosperma secundiflorum</i> <i>Eremospatha macrocarpa</i> )	medium	high	medium	low	medium	stem	crafts, food, medicine	wild	Cameroon, Nigeria, Cent. Afr. Rep. Congo-Kinshasa, Congo-Brazza, Eq. Guinea, Gabon	primary forest, secondary forest
<i>Ricinodendron heudelottii</i>	medium	medium	medium	low	low	fruit, seed	food	wild, tolerated	Cameroon, Gabon, Congo-Brazza, Congo-Kinshasa, Eq. Guinea	secondary forest, plantation, farms
<i>Strophanthus gratus</i>	low	low	low	low	low	seed	medicine	wild, cultivated	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	secondary forest
<i>Tabernanthe iboga</i>	low	low	low	low	high	resin	medicine, cultural	wild, cultivated	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	secondary forest
<i>Voacanga africana</i>	medium	low	medium	medium	low	seed, bark, resin, latex	medicine	wild, cultivated	Cameroon, Gabon, Eq. Guinea, Congo-Brazza, Congo-Kinshasa	secondary forest

Furthermore, the ecological working group suggested that it is critical to:

- build on past and ongoing work on key NWFPs;
- develop appropriate methods (i.e. cheap, culturally acceptable, economically viable, feasible) for baseline data collection and monitoring of key NWFPs in the wild; and
- establish farmer research activities to better understand the process of domestic production of key NWFPs, and the benefits, constraints, and impacts of domestic production.

By combining the short-list of key NWFPs with the above three items, the ecological working group generated a set of short- to mid-term actions to promote the sustainable use of key NWFPs in the Congo Basin.

### **12.1. Recommended short- to mid-term actions**

**Step 1:** Prepare and disseminate state-of-knowledge reports on *Gnetum*, *Baillonella*, *P. johimbe* and rattan. These reports should: a) detail who has and is doing what in regard to the sustainable use of each NWFP, b) identify gaps in our knowledge, and c) characterise opportunities and constraints to promoting sustainable use of these NWFPs.

**Step 2:** Support a set of applied research projects (see paper by Patricia Shanley as an example) to develop and share appropriate (i.e. cheap, culturally acceptable, economically viable, feasible) methods for baseline data collection and monitoring of *Gnetum*, *Baillonella*, *P. johimbe* and rattan in the wild.

**Step 3:** Support establishment of farmer-based research activities to better understand the process, benefits, constraints, and impacts of domestic production of *Gnetum*, *Baillonella*, *P. johimbe* and rattan, and to promote adoption of domestic NWFP production.

### **13. Socio-political priority actions**

The socio-political working group focused their discussions primarily on issues related to the social institutions that exist or need to be in place to monitor and regulate access to, and harvest levels of, NWFPs. Across the sustainable use spectrum (Figure 2) the range of actors involved in the use and misuse of NWFPs is as broad as the types of regulatory systems that control who has access to forest resources, determine what constitutes appropriate use, and impose sanctions on those who break resource use rules. A key question that arose from the workshop discussions was – *why do traditional systems of forest resource management breakdown, can they be revitalised or what can replace them?*

As one moves along the sustainable use continuum (from lower-left to upper-right in Figure 2) resource management systems often shift from common property ownership to individual ownership of wild or on-farm resources. In between these two extremes is where resource management institutions tend to break down or become ineffective. During the transition from public to private ownership, community based institutions that primarily were responsible for determining who has access, rather than how much was harvested, are often overpowered by outsiders or absentee elites, resulting in the rapid depletion of the resources and the impoverishment of the local community.

The use of *Garcinia* chewsticks in Cameroon and Nigeria was presented as an interesting example of the dynamic between outsiders seeking access to resources and community capacity to regulate the access and to benefit from such regulation. In Cameroon, Nigerian

chewstick harvesters pay for access to community stocks of *Garcinia* but are allowed to harvest unlimited quantities. Across the border, Nigerian communities charge not only for access but also for the quantity of *Garcinia* harvested. In the Nigerian case, harvesting is less intensive and the community gains more from providing access to their forest resources. The opposite is true for the Cameroon case, in that the resource is being heavily exploited and the community benefits little from the depletion of their natural capital. The questions posed by this example are: a) why do two communities from the same ethnic group have different systems for regulating access to their forest resources, and b) how can the Cameroonian community learn from their Nigerian neighbours?

To better understand the role that social institutions play in regulating access to and harvest levels of NWFPs, and to help establish social systems that can promote the sustainable use of NWFPs, the socio-political working group recommended the following actions:

### **13.1. Recommended short- to mid-term actions**

**Step 1:** Support a set of case studies to characterise the social institutions (local and extra-local) responsible for regulating access to, and harvest levels of, NWFPs, evaluate the factors associated with their management strengths and weakness, and identify opportunities for reinforcing local resource management capacity. The case studies should be stratified across the continuum from low or no-impact NWFP use to high intensity use where the resource is threatened with local extinction, and, if possible, should build on existing studies or projects. The case studies should also focus on critical NWFPs as identified by the Ecological Working Group (i.e. *Gnetum*, *Baillonella*, *P. johimbe* and rattan).

**Step 2:** Share the results of the case studies with local communities, and national forest management authorities (see example by Shanley) to help reinforce local capacity to regulate use of their forest resources and thus enhance the benefits that they gain from the forest.

### **14. Market-economic priority actions**

In remarkable congruence with both the Ecological and Socio-political Working Groups, the Market-economic Working Group felt that a critical first step to prioritising future actions was to identify key NWFPs based on: a) their economic value to producers and consumers, and b) their conservation status.

The Market-economic Working Group was concerned about identifying gaps in our knowledge of a) local, national and international markets in key NWFPs, b) approaches to adding value to key NWFPs that enter the market, and c) legislation and policies that promote or militate against sustainable use of NWFPs.

To address these concerns this working group recommended the following actions:

#### **14.1. Recommended short- to mid-term actions**

**Step 1:** Support an analytical review of NWFP market surveys completed at the local, national and international level to assess: a) the value of NWFPs being traded, b) seasonal fluctuations in NWFP supplies and prices, c) profit margins for traders at different locations along the market chain from producer to consumer, d) opportunities and constraints to adding value to NWFPs, and e) gaps in our knowledge.

**Step 2:** Support development of viable storage and processing methods to help add value to key NWFPs such as *Gnetum*, *Baillonella*, *Cola*, *Garcinia*, *Irvingia* and rattan.

**Step 3:** Support a regional study of legislation and policies that promote or militate against sustainable use of NWFPs, and identify opportunities and constraints to harmonisation of enabling legislation and policies across the Congo Basin.

## **15. Networking and information exchange priority actions**

This working group, as a result of scheduling constraints, was only able to convene for one hour during the workshop. Yet, participants were able to articulate a vision of what they would like to see put in place in the next 18 - 24 months to promote networking and information exchange.

The working group first identified the following list of critical information that they wanted to see made available or shared more regularly:

- a compendium of ongoing research that includes the topic of research, geographic location of the research, and the address of the key contact person or organisation responsible for directing the research;
- a *who's-who* in the NWFP sector in Central Africa that includes individuals working in the sector, as well as NWFP concerned networks;
- a regularly updated and disseminated calendar of NWFP events (e.g. workshops, meetings etc.);
- information on NWFP markets and new market opportunities;
- methods for conducting ecological, socio-political and market-economic research on NWFPs;
- results of NWFP research.

The working group voiced the need for NWFPs practitioners to come together periodically as a group to share their ongoing experiences, to develop stronger collaboration, and to reduce duplication of effort. They also felt that, at least at this early stage when the demand for information is uncertain (or at least unquantified), that all networking and information exchange actions should make use of already established networks, newsletters, journals, meetings, etc. rather than attempting to create new structures that are costly to maintain.

To ease the flow and exchange of information on NWFPs to and from stakeholders in the Congo Basin, the working group recommended the following actions:

### **15.1. Recommended short- to mid-term actions**

**Step 1:** Identify NWFP focal-points in each country of the Congo Basin who would be willing to disseminate NWFP information flowing into the country, and assemble information to generate within the country to be made available to others in the Congo Basin NWFP network. Focal points will also be responsible for ensuring that all interested stakeholders complete *who's-who* information sheets and then sending them to FAO for incorporation into their NWFPs experts database.

**Step 2:** To compile information on NWFPs assembled by focal-points in the Congo Basin, and to disseminate this information in the region, FAO has offered the editing, printing and distribution capacity of the FAO annual publication *Non-Wood News*. The working group envisioned that focal-points would send to FAO relevant

information gleaned from their NWFP contacts in the country. FAO would incorporate this information into Non-Wood News and send copies of the publication to the focal-points for dissemination to NWFP stakeholders throughout the region.

**Step 3:** To make available to Central Africans information on NWFPs made available free of charge on the Internet, the USDA/Forest Service will conduct quarterly surveys of the NWFP newsletters and other literature available on the Internet, and compile this information into hardcopy booklets to be distributed to focal-points for dissemination in the region.

**Step 4:** To generate an archive of key literature on NWFPs in the Congo Basin, the USDA/Forest Service will generate a CD-ROM containing state-of-knowledge reports and background literature on key NWFPs such as *Gnetum*, *Baillonella*, *Cola*, *Garcinia Irvingia* and rattan.

## **16. The potential role of NWFPs in forest conservation**

Relative to agriculture and logging, the NWFP sector is the least well understood in regard to:

- a) its contribution to forest resource degradation and biodiversity loss, and;
- b) its potential role in encouraging the conservation of forests and reducing incentives to convert forest to non-forested land-uses.

The following applied research papers, that were presented during the Limbe workshop, capture the diversity of people involved in the NWFP sector, the range of ecological, socio-political, and economic issues that must be addressed if the role of NWFPs in forest conservation and community development is to be understood, and equally important, the gaps that remain in our knowledge. These research papers constitute a solid foundation upon which to build a coherent applied research programme. However, to evaluate the potential role of NWFPs in forest conservation it is critical that continued support is provided to applied research activities targeted at filling the gaps in our knowledge so that we can answer the following questions:

- What is the likely scale of NWFP impact on forest resources across the Congo Basin?
- Where across the Congo Basin is wild harvesting still likely to be tenable?
- Where across the Congo Basin is wild harvesting untenable and domestication a likely option?
- Under what conditions is wild harvesting sufficiently valued by producers that revenues exceed: a) the management costs to control harvest levels and b) opportunity costs of other, forest degrading, land-uses?
- Does the cultivation of domesticated NWFPs result in a reduction of wild NWFP harvesting, or does NWFP cultivation result in a decline in the value of wild NWFP harvesting such that the value of the intact forest no longer exceeds the opportunity costs of other, forest degrading, land-uses (i.e. does domestication lower the value of intact forest, thus promote conversion to other land-uses including the cultivation of domesticated NWFPs)?
- What tools or approaches help promote sustainable wild harvesting?
- What tools or approaches help promote domestic production of NWFPs?

## References

- Bahuchet, S. 1995. *State of indigenous populations living in rainforest areas*. Brussels, European Commission DG XI Environment.
- Bennett, B.C. 1992. Plants and people of the Amazonian rainforests: The role of ethnobotany in sustainable development. *Bioscience* 42, 599-607.
- BSP. 1993. Central Africa global climate change and development - technical report, Washington, DC, Biodiversity Support Program.
- Oslisly, R. 1995. The middle Ogooué valley, Gabon: cultural changes and palaeoclimatic implications of the last four millenia. *Azania*. 39-40: 324-331.
- Oslisly, R. 1998. The history of human settlement in the middle Ogooué valley (Gabon): implications for the environment. In W. Weber, A. Veder, H. Simons Morland, L.J.T. White & T. Hart, eds. *African rain forest ecology and conservation*. New Haven, Yale University Press.

## **ECOLOGICAL ISSUES**

# ECOLOGICAL RESEARCH FOR SUSTAINABLE NON-WOOD FOREST PRODUCT EXPLOITATION: AN OVERVIEW<sup>1</sup>

Charles M. Peters

## Abstract

Tropical trees and forests exhibit several ecological characteristics that make the sustainable exploitation of non-wood forest products (NWFPs) a more difficult proposition than it might first appear. The most important of these are the high diversity and low density of conspecific individuals, the strong reliance on animals for pollination and seed dispersal, the high mortality and low establishment rate during the seedling stage, and the sensitivity of population structure to changes in the level of natural regeneration. Ignoring these ecological constraints can lead to over-exploitation, resource degradation, and the gradual elimination of a species from the forest.

At a very basic level, designing systems for the sustainable exploitation of NWFPs requires two pieces of ecological information. We need to know the density and size-class structure of the plant populations that produce the NWFP (i.e. the resource stock), and we need to know how much of the desired resource these populations produce in a given period of time (i.e. the yield). The first data set is collected by means of a systematic forest inventory. The second data set requires periodic observations of the growth and productivity of a subsample of marked individuals of varying size. The relationship between resource stock and yield can be used to estimate a sustainable harvest level for many NWFPs. To ensure that this intensity of exploitation can be maintained over time, seedling and sapling numbers should be carefully monitored and harvest levels adjusted as necessary to provide a continual flow of new seedlings into the population. Data collection and monitoring activities are most effective when conducted by local communities that have been specifically trained for this purpose.

**Key words:** Ecological impacts, forest management, non-wood forest products, sustainability

## 1. Introduction

This paper presents the observations of a plant ecologist who has spent almost twenty years studying the ecology, use, and management of non-wood forest products (NWFPs) in the tropics. In fact, when I first started studying these plant resources they were called “minor” forest products and nobody really paid much attention to them. This situation has changed drastically in recent years. NWFPs are big business now, and numerous efforts are currently underway to promote the exploitation of these valuable and highly-publicised resources. Much attention has often focused on the economic side of things, e.g. developing markets for different products, implementing local processing and value-added strategies, and ensuring the equitable distribution of income generated. Social issues such as securing land tenure or usufruct rights for collector groups have also played a prominent role. It is somewhat surprising, however, that the ecological factors associated with the exploitation of NWFPs

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<sup>1</sup> A similar version of this paper appears in: *Current Issues in Non-timber Forest Products Research*, M. Ruiz-Perez and J.E.M. Arnold (eds). 1996. Center for International Forestry Research, Bogor, Indonesia.

have only rarely been addressed. Maintaining a reliable income flow over time from a tract of forest requires that the forest resources upon which this flow is based be maintained as well. If these resources are depleted through over-exploitation, destructive harvesting, or poor management, no new market, cottage industry or land-tenure system will make very much difference. In the long term, ecology is arguably the bottom line for sustainability.

The purpose of this paper is threefold:

- to challenge the common assumption that the commercial harvesting of NWFPs has minimal impact on a tropical forest;
- to propose some simple data collection procedures for monitoring the ecological sustainability of forest exploitation, and
- to highlight several problems that might hinder the implementation of these monitoring activities.

Given the author's previous experience and interests, the discussion focuses primarily on techniques for the participatory management of NWFPs by local communities. Within the context of this paper, a sustainable system for exploiting NWFPs is defined as one in which fruits, nuts, latex, and other non-wood resources can be harvested indefinitely from a limited area of forest with negligible impact on the structure and dynamics of the plant populations being exploited.

## **2. Ecological impacts of forest use: The myth**

Human cultures have developed a variety of different ways to use forest vegetation. Each form of land-use carries with it a particular suite of ecological costs. Perhaps the most intensive and costly way to use a forest is to cut it down, burn it, and plant something else (e.g. timber trees, agricultural crops, pasture grasses) on the site. The ecological impacts of forest conversion are immediate, highly visible, and, in most cases, highly severe. Current research in tropical forests suggests that the most important of these impacts include:

- the loss of biomass and species diversity
- the release of CO<sub>2</sub> and other greenhouse gases
- disruption of nutrient and hydrological cycles
- soil loss through erosion
- increased local temperatures and decreased local rainfall

To put some of these consequences in perspective, a one hectare tract of primary forest in the Brazilian Amazon may contain more than 200 tree species (>10cm dbh) and present an above ground living biomass of about 300 tons/hectare (Brown *et al.*, 1995). Cutting and burning this forest would eliminate most of the biodiversity and release approximately 150 tons of carbon/hectare in the form of carbon dioxide and other greenhouse gases (Keller *et al.*, 1991). The removal of the vegetation cover would increase water movement, soil erosion, and nutrient loss, decrease evapo-transpiration and total ecosystem productivity (Jordan, 1987), and potentially modify local climatic regimes because of the increased reflectance of solar radiation (Shukla *et al.*, 1990). The site would be characterised by stumps, blackened tree trunks and, depending on the topography, a growing network of eroding gullies. It is obvious to the most casual observer that a major ecological disturbance has occurred here.

Another common use of forests is to selectively cut and remove the desirable timber trees. Although certainly less damaging than total forest conversion, selective logging is also known to produce a number of ecological repercussions. The most conspicuous of these are:

- Loss of some plant and animal species
- Damage to residual trees
- Soil loss through erosion
- Loss of nutrients through stem removal
- Change in forest structure and increase in light levels

A major problem with selective logging in tropical forests is that the crowns of many large canopy trees are lashed to those of their neighbours by a profusion of vines, lianas and climbers. When selected timber trees are felled, other canopy species are pulled down and the whole woody mass crashes through the lower canopy, snapping tree boles, breaking branches, and flattening a considerable proportion of the forest understory. Harvesting even a small number of stems can destroy up to 55% of the residual stand and seriously damage an additional 3% to 6% of the standing trees (Burgess, 1971; Johns, 1988). Associated impacts include soil compaction, decreased infiltration of water, increased rate of soil loss from erosion, disruption of local animal populations, increased susceptibility to fire (Uhl *et al.*, 1988), and nutrient loss from the removal of sawlogs. Commercial tree felling produces a notable impact on a forest ecosystem, and the physical evidence of this disturbance is immediately apparent and persists in the form of logging roads, skid trails, and scattered stumps for many years.

A final form of forest use that has attracted a lot of attention recently involves the selective harvest of fruits, nuts, latex and other non-wood resources. Although relatively benign when compared with forest clearing and selective logging, this activity also produces a number of ecological impacts including:

- gradual reduction in the vigour of harvest plants
- decrease in rate of seedling establishment of harvest species
- potential disruption of local animal populations
- nutrient loss from harvested material

At first glance, these impacts seem insignificant. The harvest of non-wood forest products does not necessarily kill the plant, compact the soil, increase erosion, or cause a notable change in the structure and function of the forest. A forest exploited for non-wood resources, unlike a logged-over forest, maintains the appearance of being undisturbed. It is easy to overlook the subtle impacts of NWFP harvest and to assume *a priori* that this activity is something that can be done repeatedly, year after year, on a sustainable basis. This ubiquitous idea, or some variant of it, has appeared in books, scientific papers, conference proceedings, grant proposals, magazine articles, newspaper stories, on television and radio shows, in the annual reports of private companies, and even on the back of cereal boxes and ice cream cartons. Unfortunately, in the great majority of cases, this assumption is patently incorrect.

### **3. Some facts about tropical trees and forests**

Tropical forests exhibit several ecological characteristics that make the sustainable exploitation of non-wood resources a more difficult proposition than it might first appear. One of the most fundamental and well-known features of these forests is their great species richness, or large number of plant species per unit area. To illustrate this point specifically for trees, floristic data collected from small tracts of tropical forests around the world are shown in Table 1. Although there is much variability from site to site, the results from these surveys show that tropical forests are extremely diverse and may contain from 100 to over 300 species of trees per hectare.

**Table 1.** Number of tree species (>10cm in diameter) recorded in small tracts of tropical forest.

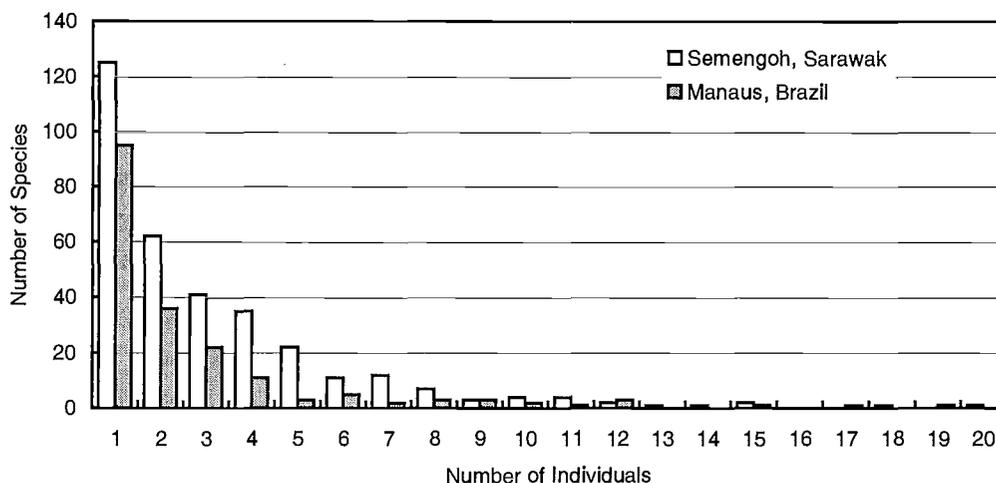
Location	Sample area (hectares)	Number of species >10cm in diameter	Source
Cuyabeno, Ecuador	1.0	307	Valencia <i>et al.</i> , 1994
Mishana, Peru	1.0	289	Gentry, 1988
Lambir, Sarawak	1.6	289	Ashton, 1984
Bajo Calima, Colombia	1.0	252	Faber-Lagendoen & Gentry, 1991
Sungei Menyala, Malaysia	2.0	240	Manokaran & Kochummen, 1987
Wanariset, East Kalimantan	1.6	239	Kartawinata <i>et al.</i> , 1981
Gunung Mulu, Sarawak	1.0	225	Proctor <i>et al.</i> , 1984
Campo, Cameroon	1.0	189	Sunderland <i>et al.</i> , 1997
Rio Xingu, Brazil	1.0	162	Campbell <i>et al.</i> , 1986
Barro Colorado, Panama	1.5	142	Lang & Knight, 1983
Oveng, Gabon	1.0	123	Reitsma, 1988

From a commercial standpoint, the high diversity of tropical forests is a mixed blessing. On the one hand, forests containing a large number of different species usually contain an equally diverse assortment of useful plant species, i.e. species richness and resource richness are usually correlated. The great interest in tropical forests as an undiscovered source of new foods, materials, and medicines is largely in response to the magnitude of the species pool in these ecosystems. Unfortunately, an additional correlate to high species diversity is that the individuals of a given species usually occur at very low densities. There is a limit to the total number of trees than can be packed into a hectare of tropical forest. If you have a large number of species, each species can only be represented by a few individuals.

This tendency of high species diversity coupled with low species density is illustrated in Figure 1 using inventory data collected from small tracts of forest in Brazil and Sarawak. As shown in the histogram, the great majority of the species at each site are represented by only one or two trees; less than ten percent of the species exhibited densities greater than four trees/hectare. Although there may be an abundance of resources in tropical forests, most of them are scattered throughout the forest at extremely low densities. Low density resources are difficult for collectors to locate, they require lengthy travel times, produce a low-yield per unit area, and they are extremely susceptible to over-exploitation. Clearly, none of these are desirable characteristics in a forest resource.

A second characteristic of tropical trees that represents a stumbling block to sustainability concerns the way that they move their pollen and disperse their seeds. The low density and scattered distribution of individuals in many tropical tree populations greatly complicates the process of pollination. Given that the distance between conspecific individuals may be greater than 100 meters in some cases, moving pollen from the flowers of one tree to another can be a difficult proposition. Many tropical trees have overcome this problem by co-evolving relationships with a variety of animals, ranging from tiny thrips and midges to bees and large bats, that act as long-distance pollen vectors. These relationships can be quite specific, with one type of insect being solely responsible for pollinating the flowers of a

particular species, or even genus, of forest trees (e.g. Wiebes, 1979). The use of biotic vectors to transfer pollen is apparently the norm in tropical forests, and recent studies in Costa Rica (Bawa *et al.*, 1985) suggest that over 96% of the local tree species are pollinated exclusively by animals.



**Figure 1.** Densities of different tree species within small tracts of tropical forest. Inventory data from Semengoh, Sarawak based on a 4.0 hectare sample plot (Ashton, 1984); Manaus based on a 1.0 hectare sample plot (from Prance).

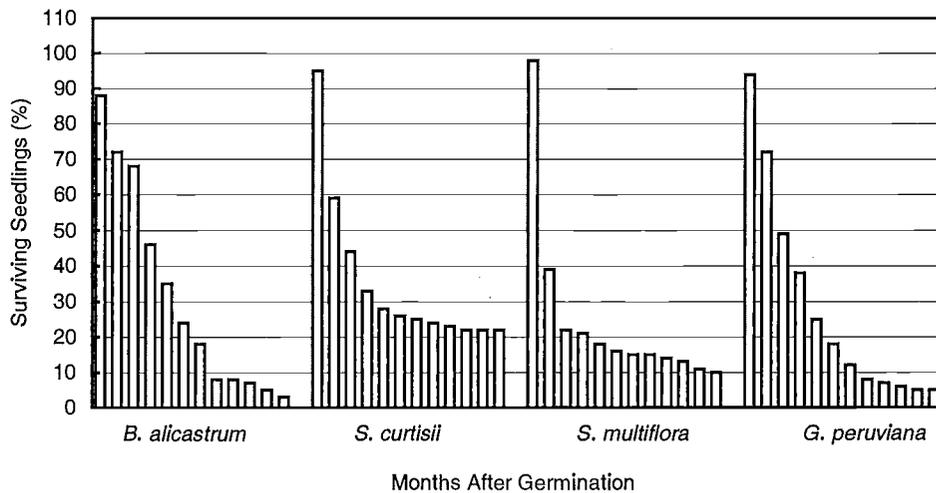
Animals also play a very important role in dispersing the seeds produced by tropical trees. Studies conducted in Rio Palenque, Ecuador (Gentry, 1982), for example, have shown that 93% of the canopy trees produce fruit adapted for consumption by birds and mammals, while Croat (1978) estimates that 78% of the canopy trees and 87% of the subcanopy trees at Barro Colorado Island in Panama have animal dispersed fruits. These animals may either remove fruit and seeds directly from the tree (primary dispersers), or they may forage on fruits that have already fallen to the ground and split open (secondary dispersers).

The important lesson to be gained from these findings is that the production of fruits, seeds, and seedlings in tropical forests necessarily involves the collaboration of animals. Although it is very easy to overlook this fact, or to view forest animals solely as pests that damage or consume large quantities of fruit, sustainable resource use in tropical forests ultimately depends on the continual availability of pollinators and seed dispersers. In simple terms, no pollination means no fruits, no fruits and/or no dispersers mean no established seedlings, and no established seedlings means no next generation, no products, no profits and, importantly, no sustainability.

A final characteristic of many tropical tree species is that they have a very difficult time recruiting new seedlings into their populations. Even given abundant pollination, fruit set, and dispersal, there is still a very, very small probability that a seedling will become successfully established in the forest. The seed must avoid being eaten, it must encounter the appropriate light, soil moisture and nutrient conditions for germination, and it must be able to germinate and grow faster than the seeds of all other species that are competing to establish themselves on that microsite. The young seedling must then stay free of pathogens, be able to recuperate from the damage caused by herbivores, avoid falling branches and other hazards, and continue to photosynthesise and push its way upward into the forest canopy.

Not surprisingly, mortality during the early stages of the life cycle of a tropical plant is extremely high.

A graphic example of the seedling mortality experienced by tropical trees is provided by the four survivorship curves shown in Figure 2. *Brosimum alicastrum* is a widely distributed canopy tree from the Neotropics (Peters, 1990a), *Shorea curtisii* and *Shorea multiflora* are dominant tree species in Southeast Asia (Turner, 1990), and *Grias peruviana* is an abundant lower canopy tree in western Amazonia (Peters, 1990b).



**Figure 2.** Seedling survivorship curves for *Brosimum alicastrum*, *Shorea curtisii*, *Shorea multiflora*, and *Grias peruviana*. Histograms show the percentage of seedlings surviving during the first year following germination. Data for *B. alicastrum* were collected in Veracruz, Mexico (Peters, 1990a), *S. curtisii* and *S. multiflora* were studied in Peninsula Malaysia (Turner, 1990), and *G. peruviana* data were collected in Peruvian Amazonia (Peters, 1990b).

As is illustrated in these histograms, seedling survival by these four species during the first twelve months following seedfall ranges from a high of 22% for *S. curtisii* to a low of 3% for *B. alicastrum*. Half-lives, or the time required to kill off 50 percent of the initial cohort, vary from two to five months. Taking into account seed predation and germination failure, less than 0.1% of the seeds produced by *B. alicastrum* become established seedlings (Peters, 1989). Only a very small fraction of these (approximately 1 in 1.5 million) will ever make it to the canopy and start producing fruit. Data such as these, which are by no means atypical for tropical trees, provide perhaps the most convincing demonstration of how difficult it is for a species to maintain itself in the forest, even in the absence of any type of resource harvest.

#### 4. The reality of NWFP harvest

Given the low density of tropical forest species, their reliance on animals for reproduction, and the difficulty experienced in establishing their seedlings, the harvest of any type of plant tissue will necessarily have an effect on the species involved. The delicate ecological balance maintained in a tropical forest is easily disrupted by human intervention, and extractive activities that at first glance appear very benign can later have a severe impact on the structure and dynamics of forest tree populations. This impact may not be immediately visible to the untrained eye, but it is definitely occurring.

In general, the ecological impact of NWFP utilisation depends on the nature and intensity of harvesting and the particular species and type of resource under exploitation. Sporadic

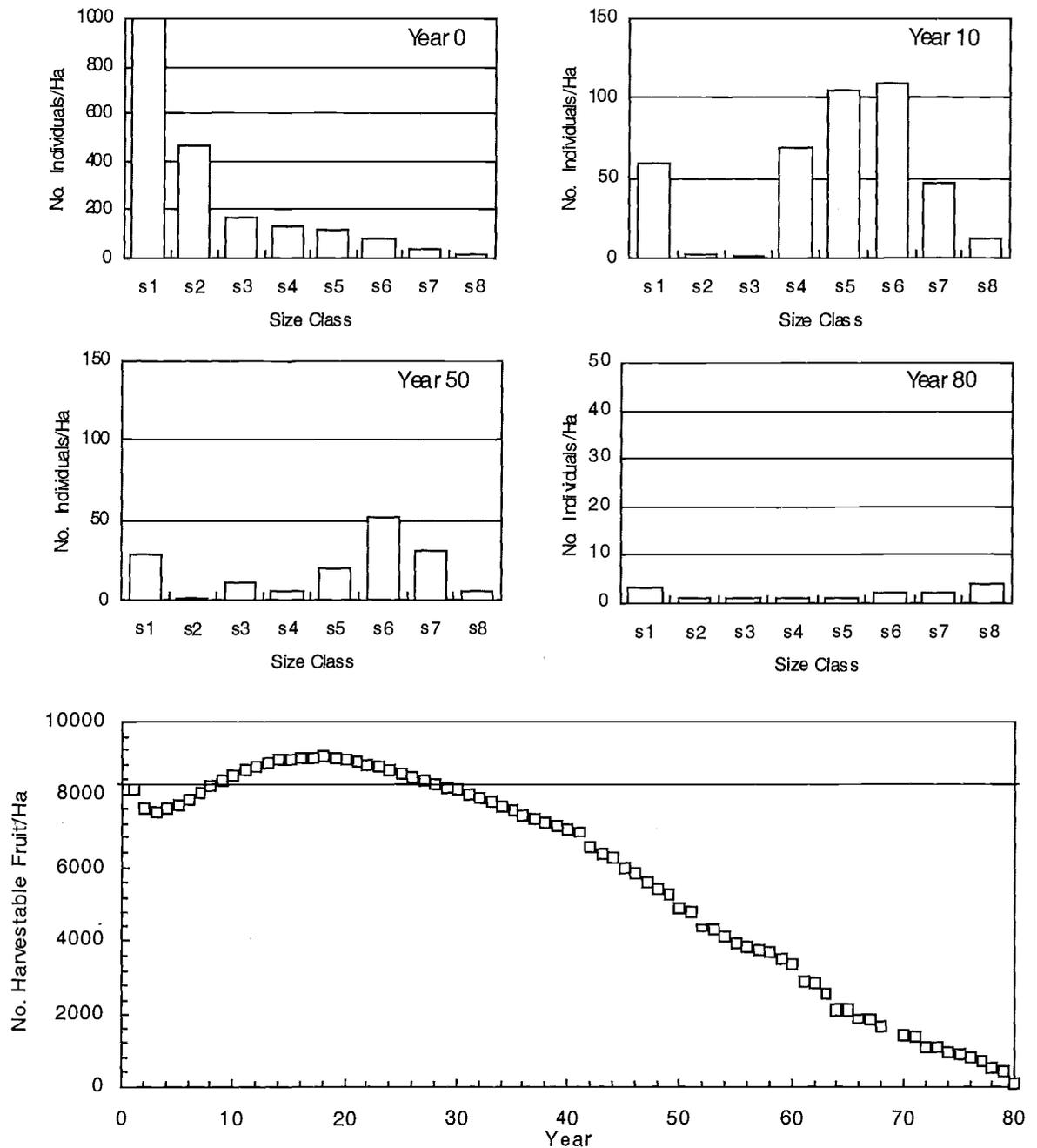
collection of a few fruits or the periodic harvesting of leaves for cordage may have little impact on the long-term stability of a tree population. Intensive, annual harvesting of a valuable market fruit or oil seed, on the other hand, can gradually eliminate a species from the forest. The felling of large adult trees can produce a similar ecological result in a much shorter time period.

Although the fact is seldom mentioned in much of the literature on the subject, a large number of non-wood forest resources are actually harvested destructively. Uncontrolled felling for fruit collection has virtually eliminated the valuable aguaje palm (*Mauritia flexuosa*) from many parts of Peruvian lowlands (Vazquez and Gentry, 1989). Destructive harvesting has also seriously reduced the local abundance of the ungurahui palm (*Jessenia bataua*), the babassu palm (*Orbignya phalerata*), and a wide variety of other important Amazonian fruit trees such as *Parahancornia peruviana*, *Couma macrocarpa*, and *Genipa americana* (Peters *et al.*, 1989). Gharu trees (*Aquilaria malaccensis*) in Southeast Asia are routinely cut to harvest the resinous heartwood (Jessup and Peluso, 1986), and the collection of damar from *Dipterocarpus* trees in Peninsula Malaysia involves hacking a large box in the trunk of the harvest tree and then building a fire inside this cavity to stimulate the flow of oleo-resin (Gianno, 1990). *Prunus africana* trees in Cameroon are felled or completely stripped and girdled to harvest the bark tissue (Cunningham and Mbenkum, 1993). There are numerous other examples of forest species that are killed or fatally wounded by the harvest of non-wood products.

Even in the absence of destructive harvesting, the collection of commercial quantities of fruit and seeds can still have a significant ecological impact. In terms of simple demographics, if a tree population produces 1,000 seeds and 95% of the new seedlings produced from these seeds die during the first year, the population has still recruited 50 new individuals. If, on the other hand, commercial harvesting removes all but 100 of these seeds from the site prior to germination, the maximum number of seedlings that can be recruited into the population is reduced to only five. This ten-fold shortfall in recruitment can cause a notable change in the structure of the population.

In reality, this example is probably overly optimistic. First, it is assumed that all of the seeds left in the forest are positioned in precisely the right spot for germination and early growth. Second, there is always the possibility that the fruits and seeds left in the forest will experience a rate of mortality that is higher than 95%. Commercial collectors, in effect, are competitors with forest frugivores, and their activities reduce the total supply of food resources available. In response to the reduced abundance of fruits and seeds, frugivores might be forced to increase their foraging to obtain sufficient food. The net result would be an increase in the total percentage of seeds destroyed.

All of these factors interact in a synergistic fashion to inhibit the recruitment of new individuals into a plant population. Over time, this lack of recruitment will alter the size-class distribution of the population being harvested. If commercial collection continues uncontrolled, the harvest species can be gradually eliminated from the forest. This process of gradual population disintegration is illustrated in Figure 3 using demographic data for *Grias peruviana* and the stepwise results from computer simulations using a transition matrix model (Peters, 1990b). Size classes 1 to 3 are based on height measurements of seedlings, saplings, and juveniles, while classes 4 through 8 reflect a 5.0 cm diameter (dbh) interval for adults. For the purpose of the simulation, the intensity of harvest was set at 85% of the total annual fruit production. Note the change of scale at years 10, 50, and 80 to compensate for the gradual decrease in population size. The scatterplot in the lower half of the figure shows the total number of fruits harvested from the *Grias* population during each year of the simulation.



**Figure 3.** Simulated change in the population structure of *Grias peruviana* in response to excessive fruit collection. Results based on stepwise analyses using a transition matrix model and demographic data reported in Peters (1990b). Harvest intensity set at 85% of the total annual fruit production. Note change in scale in the latter three time periods to account for progressive decrease in population size.

As is shown at Year 0, the *G. peruviana* population initially displays an inverse J-shaped, or negative exponential, size-class distribution of a shade tolerant canopy tree with abundant reproduction. After ten years of fruit collection, however, the structure of the population has been notably changed. The infrequency of seedling establishment has caused a reduction in the smaller size classes; the greater number of stems in the intermediate size classes reflects

the growth of saplings that were established prior to exploitation. By Year 50, the population has been even further degraded by the chronic lack of regeneration. Some of the intermediate size classes contain less than ten individuals, and the existing level of seedlings and saplings appears insufficient to re-stock the adult classes. The size-class histogram at Year 80 represents the culmination of a long process of over-exploitation. The population consists primarily of large, old adult trees, none of which are regenerating. In the absence of remedial action, it is only a matter of time before *G. peruviana* becomes locally extinct.

The important message to be gained from this simulation is that at no point during the process of over-exploitation is there any dramatic visual evidence (e.g. dead or dying trees) that something is going wrong. Fruit production and harvest levels don't even begin to drop below baseline until year 30, and commercial quantities of fruit continue to be available for several decades after this (see scatterplot in Figure 3). Even during the latter stages, the forest still contains a considerable number of adult *G. peruviana* trees that are producing fruit. Harvesting would undoubtedly continue unabated until these trees began to senesce, at which point collectors would be forced to move into a new area of forest in search of the *Grias* fruits.

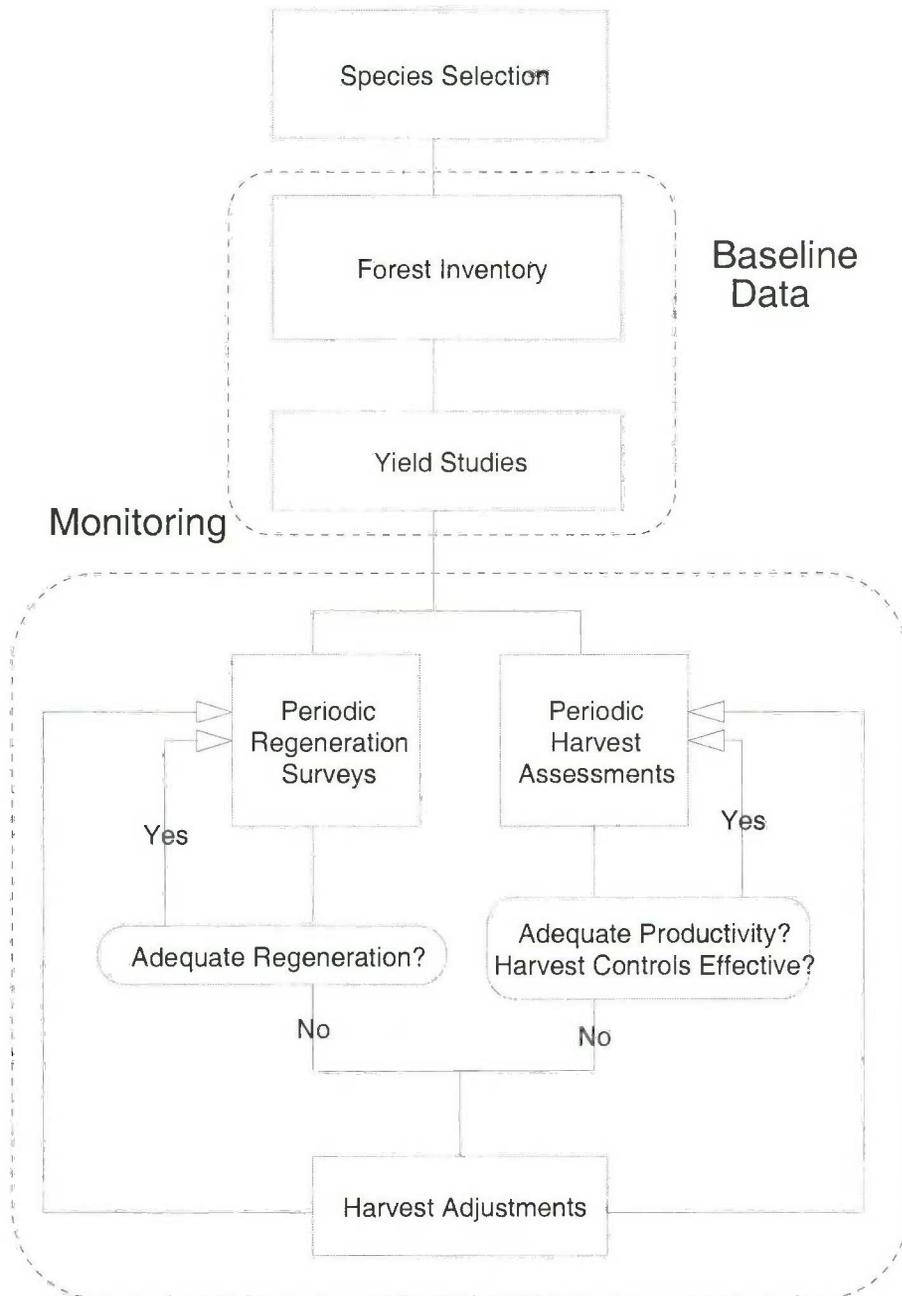
The example shown in Figure 3 represents an extreme case of uncontrolled over-exploitation, and does not necessarily imply that every level of NWFP harvest leads directly to species extinction. The simulation is very useful, however, because it shows that even though the ecological impacts of this type of resource use are relatively subtle, very gradual, and essentially invisible, in the long run they can be as devastating as logging in causing the disruption of local populations and species extinction.

Finally, in addition to its impact on seedling establishment and population structure, the collection of non-wood forest products can also affect the genetic composition of the plant population being exploited (Peters, 1990c). A population of forest fruit trees, for example, will usually contain several individuals that produce large succulent fruits, a great number of individuals that produce fruits of intermediate size or quality, and a few individuals that produce fruits that, from a commercial standpoint, are inferior because of small size, bitter taste, or poor appearance. If this population is subjected to intensive fruit collection, the "inferior" trees will be the ones whose fruits and seeds are left in the forest to regenerate. Over time, the selective removal of only the best fruit types will result in a population dominated by trees of marginal economic value. This process, although more subtle and occurring over a longer period of time, is identical to the "high-grading" or "creaming" of the best tropical timbers that occurs in many logging operations.

## **5. Baseline data and monitoring to minimise ecological impact**

Given the "boom and bust" cycles that have historically characterised the exploitation of non-wood forest products, it seems unlikely that the unfettered interaction of markets, commercial collectors, and tropical forest species will automatically produce a sustainable form of resource use. Achieving this objective will require more than blind faith in the productive capacity of tropical trees, an unwavering trust in a free market system, and the unquestioned assumption that local collector groups instinctually hold the goals of forest conservation above any desire for personal economic gain. Sustainable exploitation of NWFPs will require a concerted management effort by all of the parties involved. It will require careful selection of species, resource, and sites. It will require controlled harvesting and periodic monitoring of the regeneration and growth of the species being exploited. More than anything, however, it will require a greater appreciation of the fact that ecology and management are the cornerstones of sustainable resource use.

From an ecological standpoint, one of the most essential ingredients required to achieve a sustainable level of resource use is information. By this we mean information about the density and distribution of resources within the forest, information about the population structure and productivity of these resources, and information about the ecological impact of differing harvest levels. An overall strategy for collecting this information, and for applying it in such a way as to guarantee that the plant populations being exploited will maintain themselves in the forest over time, is presented as a flow chart in Figure 4. The overall concept and sequence of operations outlined is adapted from Peters (1994). The different procedures are sufficiently general that they can be applied to any class of NWFP procedures, at any scale, and in forests that have already been heavily exploited as well as in more pristine, undisturbed environments.



**Figure 4.** Flow chart of basic strategy for exploiting non-timber tropical forest plant resources on a sustained-yield basis. The complete process is composed of six steps: (1) Species Selection, (2) Forest Inventory, (3) Yield Studies, (4) Regeneration Surveys, (5) Harvest Adjustments, and (6) Serial Harvest Adjustments. See text for explanation of each management operation.

As is shown in Figure 4, the complete process is composed of six basic steps: (1) Species Selection, (2) Forest Inventory, (3) Yield Studies, (4) Regeneration Surveys, (5) Harvest Assessments, and (6) Harvest Adjustments. Taken together, these operations accomplish three fundamental management tasks. The species or resource to be exploited are first selected. Baseline data about the current density and productivity of these resources are then collected. Finally, the impact of harvesting is monitored and harvest levels are adjusted as necessary to minimise this impact.

The basic concept here is to provide a constant flow of diagnostic information about the ecological response of the species to varying degrees of exploitation. Sustainability is achieved through a continual process of reciprocal feedback, i.e. the demographic reaction of the target species must result in a corresponding adjustment in harvest levels. The exact nature of this “fine-tuning” process will depend on the site, the judgement of the resource manager, the precision of the diagnostic data collected, the effectiveness of harvest controls, and perhaps most importantly, the ecological behaviour of the plant population selected for management.

### **5.1. Species selection**

The decision on which plant resources to harvest will be based largely on economic concerns. Those resources possessing the highest current market price and the greatest potential for future market expansion will usually be chosen first. Social factors can also come into play. Some forest resources may have a long history of extraction or traditional use in the region, and local people may have a strong cultural preference towards continuing to exploit these resources. Other resources (e.g. medicinal plants or other plants of ceremonial importance) may be subject to certain taboos that prohibit commercial exploitation.

In addition to economic and social factors, a third set of criteria that should also be considered is the overall potential of the resource to be managed on a sustained-yield basis. Although the fact is frequently overlooked, some species are inherently better able to withstand the continual perturbations caused by resource extraction than others. Important ecological factors to consider include the life cycle characteristics of the species (e.g. phenology of flowering and fruiting, pollination, and seed dispersal), the type of resource produced (e.g. fruits, stems, bark, etc.), the abundance of the species in the forest, and the size-class distribution of natural populations. The basic idea here is quite simple. Given a group of resources with similar economic profiles, why not select those that are the easiest to manage and have the highest potential for sustainable exploitation?

### **5.2. Forest inventory**

Density and size-class structure data are the most fundamental pieces of information required for management. Just as foresters need to know how many cubic meters of timber occur in a particular forest, the management of non-timber resources also relies on estimates of the distribution and abundance of different species. These estimates can only be obtained through a quantitative forest inventory. Inventories also provide the baseline data necessary to monitor the impact of harvesting. Without some knowledge of initial density and size-class structure, the population could slowly go extinct with each successive harvest and never be noticed.

Forest inventories are time-consuming, somewhat costly, and extremely tedious to conduct. It is strongly recommended, therefore, that a professional forester or inventory specialist be involved in the planning of this fieldwork. In general, the inventory should be designed to provide the following types of information:

The inventory should provide a reasonably precise estimate of the total number of harvestable trees per hectare (i.e. the resource density) in different forest types. For fruit and oil seed species, this means the total number of adult trees. For latex-producing species, medicinal plants and other plants such as rattan, some juveniles may also need to be included.

The inventory should provide data on the current population structure or size-class distribution of adult trees. Collecting these data requires that the diameter (DBH) of all stems be measured. Height measurements can be substituted in the case of herbaceous plants, small understory palms or woody shrubs and in the case of rattan, stem length is the most important measurement.

The inventory should provide a preliminary assessment of the regeneration status of the species. Does the species appear to be maintaining itself in the forest? Are there a sufficient number of juveniles to replace the inevitable death of adult individuals? To begin answering these questions, smaller, non-productive individuals must also be counted and measured in the inventory.

### **5.3. Yield studies**

Given an understanding of the density and size-class distribution of a forest species, the next question that needs to be addressed is “How much of the desired resource is produced by natural populations of the species?”. Suppose 250 kilograms of fruit are harvested from the forest. Is this level of harvest sustainable? Well, that depends. How many fruits does the population produce? Is this only 10% of the total population seed production, or were 95% of all fruits removed? Clearly, it makes a difference. Just as foresters (theoretically) use growth data to avoid cutting timber faster than it is produced in the forest, the sustained-yield management of non-timber resources also requires information about the productive capacity of the species being exploited. This information is obtained through yield studies.

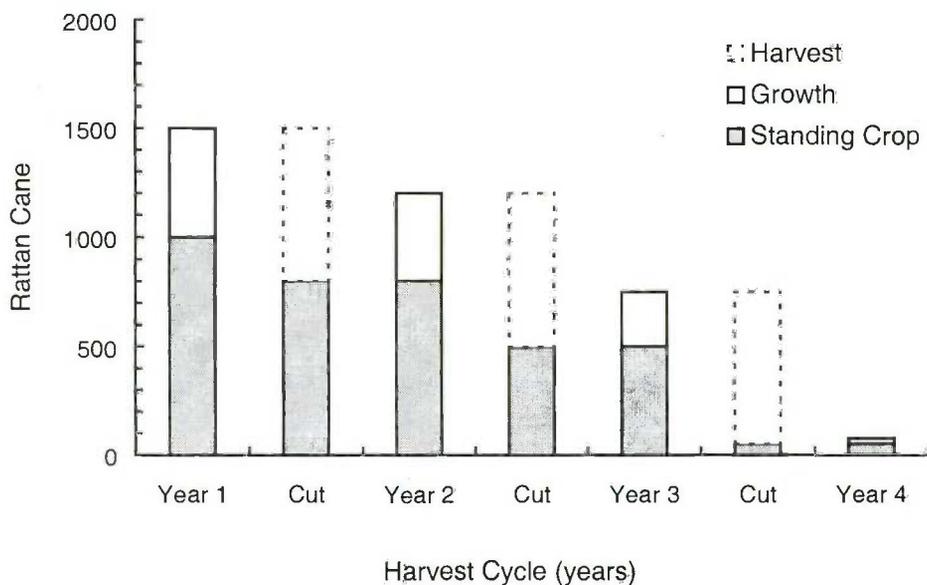
The basic objective here is to obtain a reasonable estimate of the total quantity of resource produced by a species in different habitats or forest types. In view of the fact that larger plants are invariably more productive than smaller plants, of particular interest is the relationship between plant size and productivity. Probably the easiest way to obtain these data is to train local collectors to weigh, count, or measure the quantity of resource produced by different sample trees during their normal harvest operations. These studies should be repeated every few years using the same group of sample plants to monitor the variation in yield over time.

### **5.4 Insights from inventory and yield data**

For resources which involve the harvest of vegetative tissues (e.g. thatch from *Raphia* palms, rattan cane, bamboo), the baseline data from the forest inventory and yield studies can be used to provide a useful preliminary assessment of sustainability. The analysis is based on the general relationship between the current stock, or standing crop, of a resource and its annual production. In general, abundant species with a large stock produce the largest amount of growth in a year, while sparse, low density species exhibit an annual production rate that is much smaller. Ten rattan canes growing 50 centimetres/year will produce 5 meters of cane; one thousand rattan canes growing 50 centimetres/year will produce 500 meters of cane.

Given this relationship, if we want to exploit the same forest resource year after year, it is important that we harvest no more than its annual growth each time. If we harvest more than the growth, we diminish the current stock of the resource and, over time, the species can be

eliminated from the forest. A graphic, albeit hypothetical, example of the effect of over-harvesting is shown in Figure 5. The solid bars in the histogram represent the current stock of rattan cane at the start of each year; the open bars shown at the top of each solid bar represent the total growth by the end of the year. The dotted bars show the amount of rattan cane that is harvested each year.



**Figure 5.** Hypothetical example of over-exploitation of rattan illustrating the relationship between resource stock and annual productivity. See text for explanation of stock, growth, and harvest parameters.

As illustrated in Figure 5, the current stock of rattan in the forest at the start of Year 1 is 1000 canes. This stock produces 500 new canes during the year. At the end of Year 1, 700 rattan canes are harvested, i.e. 200 more than were produced during the year, leaving a stock of 800 canes. These plants are left to grow for a year and they produce 400 new canes. The next year, 700 canes, i.e. 300 more than were produced, are harvested again. The remaining rattan plants produce 250 new canes yielding a total stock of only 750 canes. A final harvest of 700 canes at the end of Year 3 reduces the total stock to only 50. At this point, commercial rattan harvesting is no longer possible and the annual growth of the resource has been reduced to only 25 canes/year. If nothing is done to remedy the situation, rattan will probably disappear from the forest as it has in many parts of Southeast Asia (Dransfield and Manokaran, 1994).

Based on what we know about the density and yield of the rattan population in this example, a more sustainable level of offtake can be prescribed. The initial stock of rattan produces 500 new canes each year. By harvesting only this amount and leaving the basic stock untouched, rattan cane could be exploited for a long, long time on the site. The key is to only cut as much rattan as the basic stock produces in one year. Sounds simple, but only because there are inventory and yield data available to define the key parameters.

### **5.5. Regeneration surveys**

Periodic monitoring activities are essential for defining and maintaining the sustainability of NWFP exploitation. For most species and resources, the effects of over-harvesting are most clearly visible in the seedling and small sapling stage. Harvesting may kill a large number of adult plants, may lower individual tree vigour to the point that flower and fruit production is affected, or may remove an excessive number of seeds from the forest. From a population standpoint, the net results of these activities are the same--all reduce the rate at which new seedlings are established in the population. This impact can be detected, and hopefully avoided, by periodically monitoring the density of seedlings and saplings in the populations being exploited. In essence, the seedling and sapling densities in each population are a demographic "yardstick" with which to measure the actual long-term impact of harvesting. To use a medical analogy, these data are the vital signs by which to assess the health or infirmity of the population.

### **5.6. Harvest assessments**

Harvest assessments are an additional type of monitoring activity used to gauge the ecological impact of resource harvest. These are primarily visual appraisals of the behaviour and condition of adult trees that are conducted concurrently with harvest operations. In many cases, these quick assessments can detect a problem with reproduction or growth before it becomes serious enough to actually reduce the rate of seedling establishment. The sample plants selected and marked for the yield studies are perfect subjects for these observations. Examples of the type of information to be recorded during these assessments include: overall vigour of the plant, wounding caused by harvesting, trampling of seedlings by collectors, evidence of insect pests or fungal pathogens, and abundance of fallen flowers and immature fruits under the crown.

### **5.7. Harvest adjustments**

The monitoring operations are used to appraise the sustainability of current harvest levels (see Figure 4). The seedling and sapling densities recorded in the original regeneration survey represent the threshold values by which sustainability is measured. As long as densities remain above this threshold value, and no major problems are detected in the harvest assessments, there is a high probability that the current level of exploitation can be sustained. If, however, seedling and sapling densities are found to drop below this value, immediate steps should be taken to reduce the intensity of harvest. The effectiveness of this harvest reduction will be verified during the next regeneration survey. Further reductions in harvest levels may be warranted if seedling and sapling densities fail to stabilise, or drop even lower during subsequent surveys.

In actual practice, achieving a sustainable yield in this manner will invariably involve a considerable number of harvest adjustments. There is frequently a time lag in a population's response to disturbance, and after several cycles of apparently stable results from the regeneration surveys, the population may exhibit a drastic fluctuation in seedling and sapling densities. The important thing is that these fluctuations do not go unnoticed. By gradually lowering, or even raising in some cases, the intensity of resource extraction, the level of seedling establishment should eventually approximate the threshold value established for the population.

## **6. Some hard questions about sustainability**

In a perfect world, baseline data about the size-class structure and yield characteristic of different NWFPs would be collected, regeneration surveys would be conducted as a matter of routine, and harvest levels would be adjusted periodically as necessary to ensure the long-term sustainability of resource exploitation. The relatively sordid history of forest exploitation in the tropics, however, suggests that this has rarely, if ever, been the case. From a technical standpoint, there is absolutely no reason that non-wood forest resources cannot be managed on a sustained-yield basis. Why then, given all of the recent interest in the conservation, social, and financial benefits of non-timber forest products, has so little attention been focused on actually monitoring the sustainability of the resource base from which all of these benefits accrue? In closing, I would like to pose three questions, the answers to which will probably go a long way in explaining the total lack of sustainability which currently characterises the modern world of NWFPs.

### **6.1. Who is responsible for doing the monitoring?**

It seems to me that this question has never been clearly defined. If local communities are to be given the responsibility of stewarding their own forests (an alternative that I decidedly favour), why haven't I witnessed a surge of collaborative programmes designed to train forest collectors to inventory, monitor, and manage their resource base under commercial levels of exploitation? There are literally hundreds of projects currently underway throughout the tropics that are focused on the development, marketing, and sustainable exploitation of non-timber forest products. Many of these involve the creation of a management plan. Most of these plans are being developed by expatriate development workers, university foresters and extension agents. I wonder how many of these plans are actually being developed with the enthusiastic participation of local community groups. I also wonder whether equal emphasis is being placed on the economic, social, and ecological aspects of the enterprise. Will the monitoring and management activities be continued after the outside technical assistance has been withdrawn?

### **6.2. Who is paying for it?**

Forest inventories, yield studies, and the periodic survey of regeneration plots are expensive activities. Even given the local expertise to collect these data, where will the money come from to continue this fieldwork once the development project or research programme has finished? If we are really interested in maintaining the long-term sustainability of forest exploitation, these activities must be viewed as a fixed cost. Are any provisions being made to ensure that these costs will continually be covered from the profits generated by the sale of forest products?

### **6.3. How do you stop it if it's not sustainable?**

Much of the current interest in NWFPs stems from the potential conservation benefits afforded by this type of land use. The forest can be used and conserved at the same time, ecosystem structure and function is preserved essentially intact, and local population experience a welcome improvement in their monetary situation and standard of living. At least that is how it is supposed to work. As an ecologist, however, I am always bothered by a disturbing variation on this scenario. Let's assume for the moment that everything works. New markets are created for a certain NWFP, all the baseline data has been collected and the monitoring systems are in place, a local cottage industry has been set up, and sales are increasing every year. The revenues from the enterprise make a significant contribution to the well-being of the community. During the third survey of the regeneration plots it

becomes obvious that the current rates of harvest are not sustainable and that the resource is being progressively over-exploited. The management prescription is that harvest levels should be reduced by 20% which will cause an immediate and notable drop in the profits from the enterprise. Where does the incentive come from to follow the path towards sustainability?

## References

- Ashton, P.H. 1984. Biosystematics of tropical woody plants: A problem of rare species. pp. 497-518 in W.F. Grant (ed.), *Plant Biosystematics*. New York, Academic Press.
- Bawa, K.S., S.H. Bullock, D.R. Perry, R.E. Coville & M.H. Grayum. 1985. Reproductive biology of tropical lowland rain forest trees. II. Pollination systems. *American Journal of Botany* 72:346-356.
- Brown, F.I., L.A. Martinelli, W.W. Thomas, M.Z. Moreira, C.A. Cid Ferreira & R.A. Victoria. 1995. Uncertainty in the biomass of Amazonian forests: An example from Rondonia, Brazil. *Forest Ecology and Management* 75: 175-189.
- Burgess, P.F. 1971. Effect of logging on hill Dipterocarp forest. *Malaysian Nature Journal* 24:231-237.
- Campbell, D.G., D.C. Daly, G.T. Prance & U.N. Maciel. 1986. Quantitative ecological inventory of *terra firme* and *varzea* tropical forests on the Rio Xingu, Brazilian Amazon. *Brittonia* 38:369-393.
- Croat, T.B. 1978. *Flora of Barro Colorado Island*. La Jolla, Stanford University Press.
- Cunningham, A.B. & F.T. Mbenkum. 1993. *Sustainability of harvesting Prunus africana bark in Cameroon: A medicinal plant in international trade*. People and Plants Working Papers No. 2. UNESCO.
- Dransfield, J. & N. Manokaran. 1994. *Rattans: Plant resources of South-East Asia No.6*. PROSEA, Bogor.
- Faber-Langendoen, D. & A.H. Gentry. 1991. The structure and diversity of rainforests at Bajo Calima, Chocó Region, western Colombia. *Biotropica* 23:2-11.
- Gentry, A.H. 1982. Patterns of neotropical plant species diversity. *Evolutionary Biology* 15:1-84.
- Gentry, A.H. 1988. *Tree species richness of upper Amazonian forests*. Proceedings of the National Academy of Sciences 85:156-159.
- Gianno, R. 1990. *Semelai culture and resin technology*. Connecticut Academy of Arts and Sciences.
- Jessup, T.C. & N.L. Peluso. 1986. *Minor forest products as common property resources in East Kalimantan, Indonesia*. *Common Property Resource Management*, National Academy Press.
- Johns, A.D. 1988. Effect of "selective" timber extraction on rain forest structure and composition and some consequences for frugivores and folivores. *Biotropica* 20:31-37.
- Jordan, C.F. 1987. *Amazonian rain forests: Disturbance and recovery*, New York, Springer-Verlag.
- Kartawinata, K., R. Abdulhadi & T. Partomihardjo. 1981. Composition and structure of lowland Dipterocarp forest at Wanariset, East Kalimantan. *Malayan Forester* 44:397.
- Keller, M., D.J. Jacob, S.C. Wofsy & R.C. Hariss. 1991. Effects of tropical deforestation on global and regional atmospheric chemistry. *Climatic Change* 19:139-158.
- Lang, G.E. & D.H. Knight. 1983. Tree growth, mortality, recruitment, and canopy gap formation during a 10-year period in a tropical moist forest. *Ecology* 64:1075-1080.

- Manokaran, N. & K.M. Kochummen. 1987. Recruitment, growth, and mortality of tree species in a lowland dipterocarp forest in Peninsula Malaysia. *Journal of Tropical Ecology* 3:315-330.
- Peters, C.M. 1989. *Reproduction, growth, and the population dynamics of Brosimum alicastrum Sw. in a moist tropical forest of central Veracruz, Mexico*. Ph.D. dissertation, Yale University, New Haven.
- Peters, C.M. 1990a. Plant demography and the management of tropical forest resources: A case study of *Brosimum alicastrum* in Mexico, pp. 265-272 In: A. Gomez-Pompa, T.C. Whitmore, and M. Hadley (eds.), *Rain Forest Regeneration and Management*, Cambridge University Press.
- Peters, C.M. 1990b. Population ecology and management of forest fruit trees in Peruvian Amazonia, pp. 86-98. In A.B. Anderson (ed.), *Alternatives to deforestation: Steps toward sustainable use of the Amazon rain forest*, Columbia University Press.
- Peters, C.M. 1990c. Plenty of fruit but no free lunch. *Garden* 14:8-13.
- Peters, C.M. 1994. *Sustainable harvest of non-timber plant resources in tropical moist forest: An ecological primer*. Washington, Biodiversity Support Program.
- Peters, C.M., M.J. Balick, F. Kahn & A.B. Anderson. 1989. Oligarchic forests of economic plants in Amazonia: Utilisation and conservation of an important tropical resource. *Conservation Biology* 3:341-349.
- Procter, J., J.M. Anderson, P. Chai & H.W. Vallack. 1983. Ecological studies in four contrasting lowland rain forests in Gunung Mulu National Park, Sarawak. *Journal of Ecology* 71:237-260.
- Reitsma, J.M. 1988. *Végétation forestière du Gabon*. Tropenbos Tech. Series 1:1-142.
- Shukla, J., C.A. Nobre & P. Sellers. 1990. Amazon deforestation and climate change. *Science* 247:1322-1325.
- Sunderland, T.C.H., C.J. Ros, J.A. Comiskey & A. Njiamnshi. 1997. *The vegetation of the Campo Faunal Reserve and the Ejagham Forest Reserve, Cameroon*. International Cooperative Biodiversity Group / Smithsonian Institution - Man and the Biosphere Program.
- Turner, I.M. 1990. The seedling survivorship and growth of three *Shorea* species in a Malaysian tropical rain forest. *Journal of Tropical Ecology* 6:469-478.
- Uhl, C., J.B. Kauffman & D.L. Cummings. 1988. Fire in the Venezuelan Amazon. 2: Environmental conditions necessary for forest fires in the evergreen rainforest of Venezuela. *Oikos* 53:176-184.
- Valencia, R., H. Balslev & G. Paz y Mino C. 1994. High tree alpha-diversity in Amazonian Ecuador. *Biodiversity and Conservation* 3:21-28.
- Vazquez, R. & A.H. Gentry. 1989. Use and mis-use of forest-harvested fruits in the Iquitos area. *Conservation Biology* 3:350-361.
- Wiebes, J.T. 1979. Coevolution of figs and their insect pollinators. *Annual Review of Ecology and Systematics* 10:1-12.

# AN ASSESSMENT OF NON-WOOD FOREST PRODUCT RESOURCES FOR THE DEVELOPMENT OF SUSTAINABLE COMMERCIAL EXTRACTION

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## Abstract

The development of commercial NWFP extraction is often seen as an option to increase the income of forest dwellers and to conserve the overall forest resource. For the development and promotion of NWFP exploitation, the most promising resources are those that can be exploited in a sustainable way and which have a high yielding resource base. Within the framework of the Tropenbos Cameroon Programme (TCP) socio-economic and ecological surveys on NWFPs are being carried out in the Bipindi-Akom II region in the South Province of Cameroon. In this region the extraction of NWFP for markets is not particularly well developed; income from NWFPs is very important, but it is mainly generated by selling products such as bush meat and palm wine for which the trade is restricted to the village level only.

A survey of NWFP resources was recently carried out in order to gain an insight into the abundance and distribution of NWFP species and to obtain indications of the impact of exploitation on the available resources. From the surveys, it appears that even in the relatively small study area of 200 000 ha, the variation in abundance and distribution of NWFPs is high. Several frequently used species are restricted to specific localities within the area. In addition, an important number of the (potentially) commercial NWFP species find their maximum density in secondary forest types, e.g. the condiments njansang from *Ricinodendron heudelotii* and mbongo, the fruits of the rhizomatous herb *Aframomum citratum*. Many of the species providing products with a high commercial value, such as a number of oleaginous seed producing trees as *Baillonella toxisperma*, *Panda oleosa* and *Poga oleosa*, appear to be rare while other important NWFP species, like the well known bush mango, *Irvingia gabonensis*, have a moderate density.

An additional survey has concentrated on a high value NWFP species that is exploited commercially. *Garcinia lucida*, the bark and seeds of which are used for palm wine production as well as for medicinal purposes, is a small understorey tree that grows on steep slopes in high density stands over areas of 2 to 3 km<sup>2</sup> in high altitude forest. However, in areas where the bark is stripped for commercial purposes, the mortality is very high and these populations are becoming seriously threatened.

**Key words:** NWFPs, Cameroon, resource inventory, commercial extraction.

## 1. Introduction

At present it is generally recognized that NWFPs play an important role for subsistence and cash income for local people. The awareness is growing that effective conservation and management of NWFP resources should be included in natural forest management in order to meet the present and future needs of local populations. Moreover, the development of

commercial extraction of NWFPs is often seen as a way to ensure forest conservation whilst improving rural peoples' living standards (Ros-Tonen, Dijkman & Lammerts van Bueren, 1995, de Beer and McDermott, 1989). Undoubtedly, some NWFPs can be extracted sustainably from forest ecosystems (Peters, this volume) and the attainment of this forms the basis of many conservation and development research programmes, including that of Tropenbos.

In general, spatial and quantitative data on the availability of NWFP resources and their use are lacking. Only recently have researchers begun to develop methods to assess the potential sustainability of NWFP resources. Within the Tropenbos Cameroon Programme (TCP) a broadly-oriented NWFP project is currently being undertaken. The project consists of a NWFP identification and utilization survey, a resource inventory, a harvesting impact study and socio-economic surveys. This paper will mainly review the results of the ecological inventory which can be best described as a reconnaissance survey.

During this survey, the abundance and distribution of NWFP species were assessed and the data were used to derive indications of the impact of different types of exploitation on the availability of a wide range of resources. This paper will focus on those plant NWFPs which are commonly traded in the south of Cameroon.

## **2. The setting**

### **2.1. The study site**

The TCP study site covers an area of 200 000 ha in the South Province of Cameroon and is located between 50 km and 100 km from the coast. The study site corresponds with past and present timber concession areas of a Dutch logging company and because of this the majority of the study area has been logged-over several times. However, this timber exploitation has been carried out selectively and is therefore undertaken at a low intensity; it is estimated that about 0.7 trees/ha are harvested with around 14% of the forest surface being affected (Van Leersum, pers. comm.).

The study area is geomorphologically diverse. In the western area, plains dominate whereas the eastern area is fairly mountainous. Because of this varied topography, the altitude ranges from 40m above sea level (asl) in the western area to more than 1 000m asl in the eastern area. Annual rainfall varies from 1 800 mm to 2 500 mm with two distinct rainy seasons and two drier seasons. The vegetation changes gradually from Low Altitude Evergreen Forest of *Lophira alata* to Mid Altitude Evergreen Forest rich in *Caesalpinaceae* (Letouzey, 1985).

The population density is rather low, ranging from 5-10 inhabitants per km<sup>2</sup> with 90% of the population being of Bantu origin. These people are generally referred to as "villagers" or "farmers". They practice shifting cultivation, cocoa cash crop farming and hunting and gathering. The majority of the Bantu people belong to the Bulu tribe. Other Bantu groups in the area are the closely-related Fang, the Bassa and the Ngumba. The remaining 10% of the population consists of Bagyeli (Pygmy) people. They are mainly hunter-gatherers, although they have adopted farming and, to a lesser extent, cocoa growing.

In terms of logistics, road conditions and public transport access within the area are very poor, particularly as the logging company which used to maintain the road network has now departed from the majority of the area.

## 2.2. NWFP extraction in the study area

An enormous variety of NWFPs are commonly used or are known to be useful. About 200 animal species and 500 plant species were identified, the latter accounting for 1 200 different uses (Van Dijk, in press). Many of these species have a commercial value and are traded widely throughout the region. Appendix I presents an overview of commercial NWFP species of plant origin which occur in the study site.

Income from the sale of NWFPs is generally of importance but it is mainly generated by the sale of products such as bush meat and palm wine and its derivatives, for which the trade is restricted to the village level. The extraction and sale of NWFPs for markets outside the village range area is not particularly well developed. Table 1 shows the relative contribution from selling NWFPs and agricultural produce to household incomes. The figures are based on preliminary data only from an ongoing survey among eleven Bagyeli and nineteen Bantu families, and does not include adjustment for the costs on inputs such as wire for snares, bullets, etc. These data reflect the results over a period of four months at the end of 1997 which correspond to the peak period of cocoa harvest and sale. It appears that even in this period the income from the sale of bush meat is often equal to the cash obtained by selling cocoa. Bush meat represents 75% of the contribution of NWFPs to income.

**Table 1.** Household income from the sale of NWFPs and agricultural produce in the period September 1997-January 1998.

	% of income	# of families involved (N=30)
Bush meat/Chops	31.2	23
Fish	0.4	4
Honey	0.7	9
Basketry	1.3	5
Forest foods	3.3	15
Palm wine/liquor	6.0	12
Pharmaceutical inputs	1.0	2
Total NTFPs	43.9	
Cash crops	42.9	14
Food crops	12.6	19
Fruits/nuts	0.6	18
Animal husbandry	0.0	1
Total agriculture	56.1	

Table 2 gives an impression of the actual degree of commercialization of a number of marketable NWFPs, which, in general, is not very high. Out of the 23 products which are said to be sold to retailers or assemblers, 18 were harvested during the four months' period. From these 18 products, only 10 were effectively sold. Bush mango, *Irvingia gabonensis*, is one of the most frequently harvested and by far the most frequently sold product. However, most of the harvest is allocated for household consumption and only 20% of the total quantity collected is sold. Surprisingly, less than half of the total number of families and none of the Bagyeli families are involved in selling. Njansang, a condiment derived from the oily seeds of *Ricinodendron heudelotii*, is another NWFP which is marketed in significant quantities in the South of Cameroon (Ndoye *et al.*, 1997).

In the TCP study area, however, only two out of the thirty participating families appear to be involved in the trade of this product. In light of the data presented in Table 2, one might state

that there exists a potential in the study area to develop the commercial extraction of NWFPs. A resource inventory can contribute to examine the opportunities for such a development.

**Table 2.** The degree of commercialization of marketable NWFP products among family households in the period September 1997-January 1998.

Species name	# of families involved in extraction	# of families involved in trade	% of harvest sold	Total revenue in CFA (4 months)
<i>Coula edulis</i>	28	3	5	15 000
<i>Cola acuminata/nitida</i>	8	3	30	2 500
<i>Cola lepidota</i>	14	3	30	3 850
<i>Dacryodes edulis</i>	22	6	10	11 000
<i>Dacryodes macrophylla</i>	12	3	10	2 000
<i>Elaeis guineensis</i> (fruit)	30	2	< 1	2 800
<i>Garcinia lucida</i>	10	1	10	400
<i>Irvingia gabonensis</i>	28	11	20	79 000
<i>Ricinodendron heudelotii</i>	2	1	100	5 800
<i>Strophanthus gratus</i>	2	2	100	32 500

### 3. Data collection and analysis

The objectives of the ecological survey were to gain insight into the relative abundance and distribution of NWFP species and to obtain some indications of the impact of agriculture, logging and NWFP harvesting on the availability of these resources. The methodology was based on the sample design as developed by Hall and Bawa (1993). One-hectare plots in the form of 1 km long and 10 m wide transects were enumerated for all individuals >10 cm dbh. In each transect, 10 plots of 10 x 10 m were laid out at regular distances in which all individuals with a minimum height of 1 m and a maximum dbh of 10 cm were enumerated. The smallest individuals of less than 1m in height were counted in 2 x 2 m subplots.

Twenty NWFP species were selected for which the dbh was accurately measured using a tape. For other NWFP species encountered along the transects, the dbh was estimated using global size classes of 10 cm. Land characteristics in terms of topography and vegetation structure were recorded. Identification of each species was undertaken by local field assistants, using vernacular names. In order to determine the scientific names, a number of the transects were inventoried simultaneously by botanists and the local assistants. Moreover, herbarium vouchers collected during the field work were later examined in the TCP herbarium and the National Herbarium of Cameroon in Yaoundé.

The location of the transects was selected on the basis of an aerial photo-interpretation developed for an overall land inventory in which the planation level along with shifting cultivation were distinguished as the main differentiating factors for soils and vegetation (Touber, 1993). The selection included the inventory of fields, fallow lands and cocoa plantations. A total of 32 hectares were inventoried.

Two of the 20 selected NWFP species were initially not found during the inventory; *Aframomum citratum* and *Garcinia lucida*. For these species separate surveys were carried out in several alternative sites that were indicated by local harvesters.

The data analysis was undertaken by post-stratification in order to examine the factors influencing the variation in abundance and distribution of the NWFP species. This analysis resulted in the determination of the following habitat types:

- undisturbed lowland forest (<350m asl)
- mid-elevation or intermediate forest (350-500m asl)
- high altitude forest (>500m asl)
- swamp forest
- secondary forest
- fields and young fallow lands
- cocoa plantations

#### 4. NWFP resources

##### 4.1. Abundance and distribution of marketable NWFP species

With respect to the development of commercial extraction, the most suitable NWFP resources are those which can be extracted sustainably and which have a high potential yield per unit of land, defined by the number of individuals and the potential productivity. In Table 3, an overview is presented of the abundance and distribution of actual and potential commercial NWFP species which occur in the TCP study site.

In general, the average densities of marketable NWFP species may be considered low with the large majority of these species not achieving densities of more than 5 stems/ha with a dbh of more than 10 cm in any part of the area. Some species, for example the high-value oleaginous seed bearing trees *Baillonella toxisperma*, and *Poga oleosa*, can be classified as being rare, with less than 1 tree/ha greater than 10cm dbh. In addition, the fact that many of these species are medium to large trees which reach their reproductive stage only at larger size classes, for example *Baillonella toxisperma* which starts flowering at an average dbh of 70 cm (Debroux, 1996), enables one to conclude that the productivity per unit of area is low for many NWFP species.

The difference between the average and maximum densities of the listed species is an indication of the absence or presence of specific (distinct) habitat requirements. Most of the recorded NWFP species are more or less evenly distributed in the area. Nevertheless, there are some species which are far more abundant in specific forest or habitat types and in some cases they are completely absent in large parts of the area. The distribution patterns of these species indicate that the variation in availability of NWFP resources even in a small area such as the TCP study site is very important.

It is obvious that it is not only undisturbed forests that contain NWFP resources. An important number of species find their maximum densities in secondary vegetation types. A number of typical pioneer species provide important NWFPs such as the oil palm *Elaeis guineensis*, *Ricinodendron heudelotii* (njansang) and *Aframomum citratum*. The latter species, in particular occurs most commonly along logging roads and skid trails.

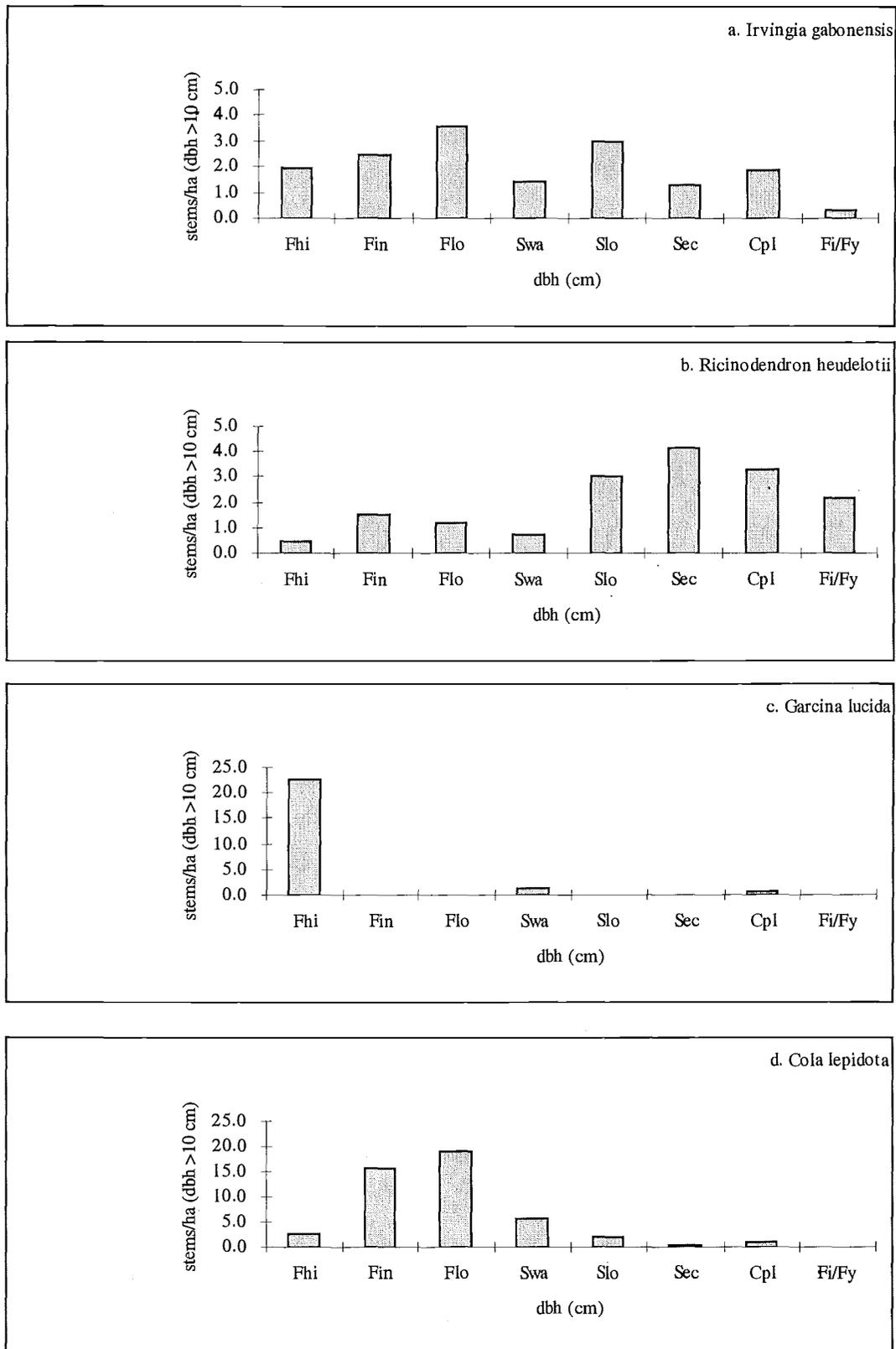
However, the fact that some species show the highest abundance in cocoa plantations (e.g. *Dacryodes macrophylla*, *Hexalobus crispiflorus*, *Strophanthus gratus* and *Alstonia boonei*) is undoubtedly the result of effective conservation, enrichment planting or other type of human intervention.

Figure 1 presents some examples of the abundance and distribution of NWFP species with regard to the various habitat types. The bush mango tree, *Irvingia gabonensis*, is an example of a species which is more or less evenly distributed in the area (Figure 1a). The tree occurs in every habitat type and the abundance varies from 0.4-3.0 and 2.0-3.6 stems/ha with a dbh > 10 cm in secondary and undisturbed forest types respectively (see Figure 1a).

**Table 3.** Abundance and distribution of NWFP species with a known market value

Name of the species	Aver. density	Preferred habitat	
		Forest type/ altitude class	Max. density (stems/ha except where indicated)
Commercial condiments, barks, nuts and spices			
<i>Baillonella toxisperma</i>	0,2	undist. forest/high	0,3
<i>Cola nitida/C. acuminata</i>	2,4	undist. forest/high	4,3
<i>Coula edulis</i>	4,7	undist. forest/high	10,1
<i>Dacryodes edulis</i>	0,4	cocoa plantations	3,8
<i>Elaeis guineensis</i>	4,6	cocoa plantations	21,8
<i>Garcinia lucida</i>	5,4	undist. forest/high	22,7
<i>Garcinia kola</i>	0,4	logged-over forest	1,1
<i>Irvingia gabonensis</i>	2,1	undist. forest/low	3,6
<i>Panda oleosa</i>	0,7	undist. forest/low	2,0
<i>Poga oleosa</i>	0,3	undist. forest/interm.	0,9
<i>Raphia montbuttorum</i>	0,9	swamp forest	16,5
<i>Ricinodendron heudelotii</i>	2,1	sec. forest	4,1
<i>Scorodophloeus zenkeri</i>	6,6	undist. forest/high	29,9
<i>Aframomum citratum</i> (herb)	5 sites/ village	fallow lands/logging roads	200 clumps/ site
Condiments and vegetables, actually not commercially exploited			
<i>Monodora</i> spp.	1,3	undist./interm.	2,4
<i>Tetrapleura tetraptera</i>	0,5	sec. forest + fallow	1,8
<i>Xylopia aethiopica</i>	3,0	sec. forest	5,7
Commercialized fresh fruits			
<i>Antrocaryon klaineianum</i>	1,8	cocoa pl./sec. forest	3,3
<i>Cola riciniifolia</i>	0,7	undist. forest/low	3,2
<i>Cola lepidota</i>	4,7	undist. forest/interm.	18,9
<i>Dacryodes macrophylla</i>	0,3	cocoa pl./swamp for.	2,7
<i>Hexalobus crispiflorus</i>	0,3	cocoa plantations	1,1
<i>Trichoscypha acuminata</i>	1,4	undist. forest/high	3,2
<i>Trichoscypha arborea</i>	0,5	undist. forest/low	1,6
(Former) industrial inputs			
<i>Alstonia boonei</i>	2,2	cocoa plantations	5,2
<i>Annickia chloranta</i>	2,4	logged-over forest	4,9
<i>Strophanthus gratus</i>	0,2	cocoa plantations	1,4
<i>Rauvolfia vomitoria</i>	1,0	sec. forest	3,3

**Figure 1.** Abundance and distribution of four important NWFP species. Fhi: Forest high > 500 m asl; Fin: forest 350-500 m asl; Flo: forest < 350 m asl; Swa: swamp forest; Slo: logged-over forest; Sec: secondary forest; Cpl: cocoa plantation; Fi/Fy: fields and young fallow lands.



*Ricinodendron heudelotii* (Figure 1b) is also represented in the entire area. As stated above, this species is a typical pioneer which explains its higher abundance in all the secondary forest types.

*Garcinia lucida* (Figure 1c), is completely absent in the western area of the study i.e. the low altitude zone (<500 m asl) and the species occurs at altitudes of >500 m above sea level and uniquely on very steep slopes. The high average density of more than 70 adult stems/ha is undoubtedly due to the fact that the species grows in high density stands in restricted areas of an average of 2 to 3 km<sup>2</sup> within these rather specific ecological conditions. A comparable although inverse distribution pattern is shown by the fruit bearing tree *Cola lepidota* (Figure 1d). This species is also restricted to steep slopes. However, it occurs mainly within the lower altitude zone of <500 m asl (2.2 versus 15-19 stems/ha with a dbh >10 cm).

The four examples presented also demonstrate the importance of cocoa plantations as a source of NWFPs. The presence of *Garcinia lucida* in cocoa plantations results from enrichment planting by farmers. However, the majority of these plantings have not been successful due to prolonged insect attacks and damage.

#### **4.2. The sustainability of NWFP harvesting: The case of *Garcinia lucida***

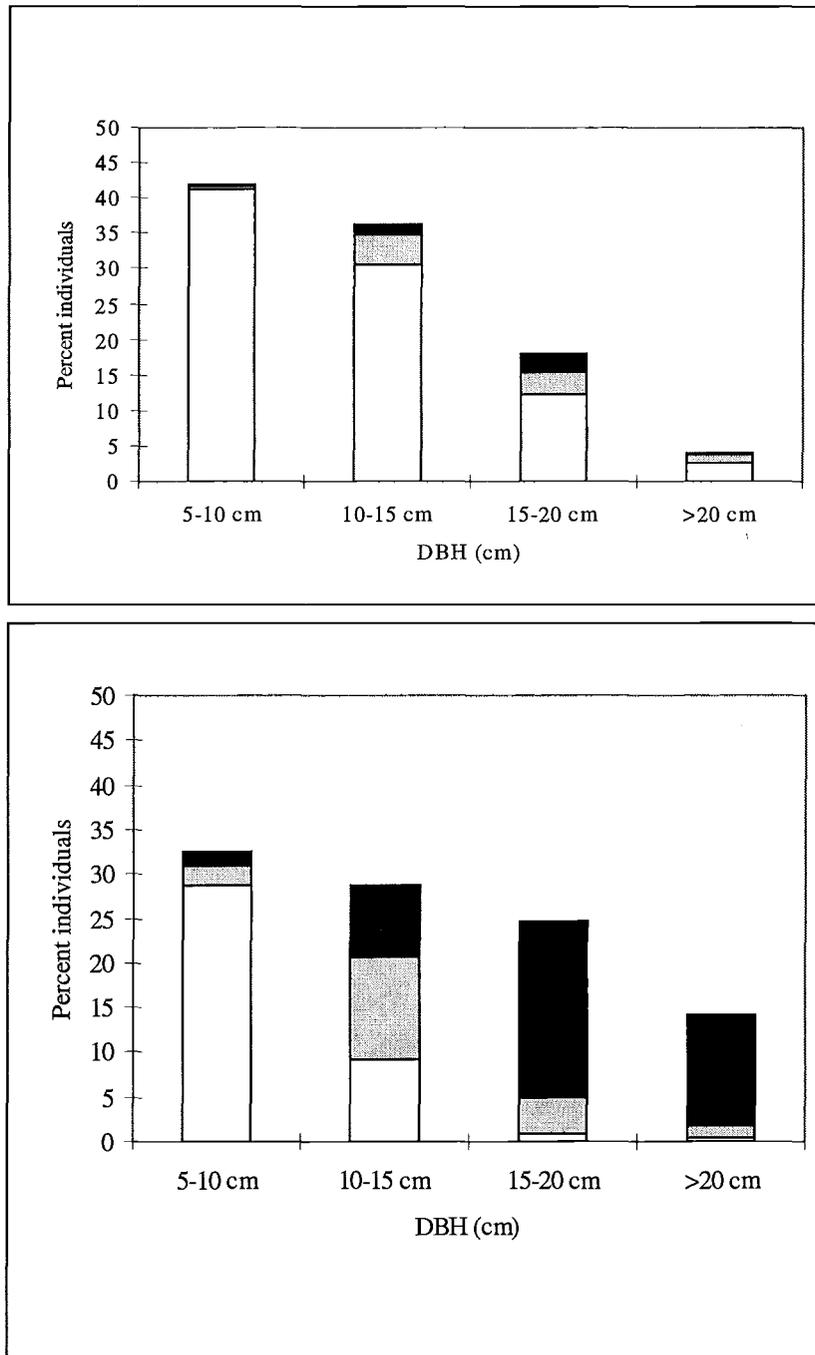
In general, it is not easy to evaluate the impact of NWFP harvesting on plant populations. The most appropriate way to get a first indication on the impact of harvesting is to analyze the size-class distribution of the population (Peters, 1996; Peters, this volume; Hall and Bawa, 1993), preferably with regard to differences in exploitation intensity. However, even with a rather exhaustive inventory as described above, the low densities and the high variation in abundance and distribution of the species puts serious restrictions on this type of analysis. The number of individuals is not sufficient to get reliable results.

However, the data collected on *Garcinia lucida* during the supplementary survey undertaken for this species (Guedje, 1996) do permit the plotting of a reliable size-class distribution. In total, 494 reproductive individuals (dbh >5 cm) were enumerated in four different sites over an area of 8.4 ha.

As stated above, this small understorey tree grows in restricted areas. The distance between the villages and these stands is rather important as the species is considered open-access resource. The extraction of the bark for commercial purposes is undertaken by stripping the bark from the entire bole, essentially ring-barking the stem and resulting in the immediate death of the individual. The mortality in the various sample locations ranged from 5 to 35% (with an average of 19%). Figure 2. presents the size class distribution after post stratification of the data in two sets by regrouping the transects in which the mortality was very high (more than 30%) and those in which the mortality was relatively low (less than 10%). This artificial grouping reflects the impacts of high and low exploitation.

The size-class distributions show clearly that it is preferable that the largest trees are exploited. In the dbh class of 5-10 cm hardly any tree is de-barked and, as expected, in the dbh class of >15 cm very few of the trees remain unaffected by bark exploitation. It can be confidently assumed that the elimination of the largest, and therefore most productive, trees has serious consequences for the regeneration capacity of the populations. However, at present, both exploitation regimes show an inverse J-shaped size-class distribution, indicative for an adequate recruitment. An ongoing monitoring programme on the population dynamics of *Garcinia lucida* will provide more information on the long term effects of the actual exploitation system. Moreover, future work will attempt to determine the sustainable harvesting levels by an experimental approach. A number of selected trees were subjected to

various exploitation techniques and harvesting levels. Parameters on growth, health, reproduction and regeneration are being monitored.



**Figure 2.** The size class-distribution of *Garcinia lucida* including healthy trees (blank), de-barked trees (hatched) and dead trees (solid): a. lightly exploited sites; b. heavily exploited sites.

## 5. Conclusions and discussion

### 5.1. Methodological aspects

The adopted methodology of selecting sample locations on the basis of an aerial photo-interpretation is very appropriate for quickly gaining insight into the abundance and distribution of NWFP species in a heterogeneous area such as the TCP study site. Working mainly with vernacular names and "local taxonomists" provides generally sufficient detail, although some problems occurred. In some cases, several species are regrouped under the same vernacular name. This is for example the case for rattan species for which the generic term nlong is used. The same name is given to a particular rattan species, *Eremospatha macrocarpa*. The fact that this coincidence only became apparent in the course of the inventory, made it impossible to make a proper distinction whether nlong had been used to indicate this particular species or small-diameter canes as a whole. A second problem concerns those species which are hardly used but which could be of economic interest. They were not always recognized by the local assistants. This occurred with *Gnetum* spp. (providing the vegetable ocok or eru), which is very frequently consumed and heavily exploited elsewhere in Cameroon.

The attempt to combine the determination of variation in the abundance and distribution of NWFP species and obtaining indications on the impact of exploitation on the availability of resources was less successful. Due to the low densities of many important species the number of individuals is not sufficient for reliable size-class distribution analysis. Other methods should be applied to obtain indications of the impact of harvesting.

### 5.2. NWFP resources and their utilization: consequences for the development of extraction

In view of the results obtained from the various executed and/or ongoing ecological and socio-economic surveys undertaken in the study area of the Tropenbos Cameroon Programme, a number of preliminary conclusions can be drawn:

- The sale of NWFPs is almost as important to the income of households as the sale of agricultural products. However, the sale of NWFPs is mainly restricted to the village level and the income derived is dominated by the sale of bush meat (up to 75%);
- The products of an estimated 23 NWFP species are said to be of commercial value. Yet, despite the fact during a four month observation period many of these were seen to be exploited, only four of these species contributed effectively to the income of the households surveyed. These were *Irvingia gabonensis*, *Strophantus gratus*, *Coula edulis* and *Dacryodes macrophylla*;
- Even for a relatively small study area of 200 000 hectares, a large variation in abundance and distribution is observed, which implies that not every household has the same access to the same resources, making generalisations and extrapolations impossible;
- The densities of the majority of NWFP species with a commercial value may be regarded as low to moderate. Several species have less than one productive individual per hectare, which sets important constraints on the availability of resources and to the development of efficient extraction in natural forest;

- Those species which have a higher average density, and hence a higher potential yield, for the whole study area are mostly restricted to specific habitat types. Except for those occurring in secondary forests, they are often absent in large parts of the area and therefore not available to every household;
- Secondary forests and cocoa plantations are very important areas for NWFP extraction. The impact of active management of NWFP resources in, for example, cocoa plantations is reflected in the results of the ecological survey. Although the scale of active management is rather limited at present, it might indicate opportunities for further development of the availability of NWFP resources in such anthropogenic areas;
- The example of the impact of harvesting on *Garcinia lucida* populations demonstrates that high density stands of commercial NWFP trees considered as open-access resources are very vulnerable to over-harvesting. This phenomena is illustrated by the recorded high mortality rate. However, the fact that individuals in the smaller size distribution classes are reproductive, and that it is mainly the bigger trees that are de-barked, the impact might be less serious than expected. Further research to determine the sustainability of the exploitation of this species is continuing.

### 5.3. Which strategies to follow for a sustainable development of NWFP extraction?

The surveys demonstrated that there are quite a number of NWFP species with an economic value which can be extracted in a sustainable way. However, from the results obtained so far, it seems that the local people are not very interested in the extraction of NWFPs which have no subsistence value, like *Ricinodendron heudelotii* and *Strophantus gratus* and are only valuable on a commercial basis. Less than 10% of the families interviewed are involved in the exploitation of these species and harvesting and sale seems to be restricted to specialists.

In contrast, almost all families are involved in the harvesting of NWFPs with an important subsistence value, such as *Coula edulis* and *Irvingia gabonensis* with additional families generating income from the sale of these products. In other words, people seem to prefer to trade essentially the surplus of the quantity needed for auto-consumption. The still relatively low level of commercialization of these products is likely to be caused by restrictions on the harvesting capacity (for example time constraints, accessibility, property rights, subsistence needs) and on the marketing opportunities. The development of the extraction of these products seems to offer the most promising perspective for the improvement of income and sustainable resources use.

However, it is doubtful whether adequate resources can be found for a sustainable and efficient increase of existing extraction levels. In this respect, the compatibility of raising household incomes from NWFP extraction from natural stands whilst ensuring conservation of the forest as a whole might need to be reviewed. This is not only due to the risks of oft-practiced destructive harvesting practices, but also because of the low densities of many NWFP species in natural forest. Therefore, the intensification of the NWFP management on anthropogenic land types and the promotion of the domestication of appropriate NWFP species might be the most promising options for increasing household incomes whilst removing harvest pressure on the wild resource.

## References

- De Beer, J.H. & M.J. McDermott. 1989. *The economic value of non-timber forest products in Southeast Asia*. Amsterdam, IUCN.
- Debroux L. 1996. *La régénération naturelle et la gestion de populations d'arbres: L'étude du Moabi (Baillonella toxisperma) dans la forêt du Dja, Cameroun*. Synthèse à mi-parcours des travaux de doctorat, Gembloux, Faculté Universitaire des Sciences Agronomique de Gembloux.
- Guedje, N. 1996. *Evaluation de quelques aspects écologiques de Garcinia lucida, Aframomum citratum et A. melegueta dans la région de Bipindi-Akom II du Sud Cameroun*. Yaoundé/Kribi, Rapport d'étudiant, Université de Yaoundé I/Programme Tropenbos Cameroun.
- Hall, P. & K. Bawa, 1993. Methods to assess the impact of extraction of non-timber tropical forest products on plant populations. *Economic Botany* 47(3): 234-247.
- Letouzey, R. 1985. Notice de la carte phytogéographique du Cameroun. Toulouse, France, Institut de la Carte Internationale de la Végétation.
- Ndoye, O., M. Ruiz Pérez & A. Eyebe, 1997. *The markets of non-timber forest products in the humid forest zone of Cameroon*. ODI-Network Paper 22c.
- Peters, C.M., 1996. *The ecology and management of non-timber forest resources*. World Bank Technical Paper 322, The World Bank, Washington DC.
- Ros-Tonen, M., W. Dijkman & E. Lammerts van Bueren, 1995. *Commercial and sustainable extraction of non-timber forest products. Towards a policy and management oriented research strategy*. Wageningen, Tropenbos Foundation.
- Touber, L., 1993. *Report on a mission in support of the Land Inventory Project in the Tropenbos Cameroon Programme*. Wageningen, International Activities Report 32, SC-DLO.
- Van Dijk, J.F.W. [in press]. *Non-timber forest products resources in the Bipindi-Akom II area, South Cameroon. An economic and ecological assessment*. Kribi, Tropenbos Cameroon Documents X.

APPENDIX 1: Commercialised and commercialisable NWFP species occurring in the TCP study site

Species (* domesticated)	Habit	Commercialised/ Commercialisable (*) product		Other uses:	
		Part	Product	Part	Product
<i>Aframomum citratum</i>	herb	fr	condiment		
<i>Aframomum melegueta*</i>	herb	fr	aphrodisiac, medicines		
<i>Alstonia boonei</i>	l-sized tree	ba, ex	medicines	ba	additive palm wine
<i>Antrocaryon klaineianum</i>	m/l-sized tree	fr	fresh fruit	ba, se	medicines, condiment
<i>Baillonella toxisperma</i>	l-sized tree	se	cooking oil, condiment	ba, fr, wo	fresh fruit, medicines, carpentry
<i>Cola acuminata/C. nitida*</i>	m-sized trees	se	snack/aphrodisiac	ba	medicines
<i>Cola lepidota</i>	s-sized tree	fr	fresh fruit	fr	fresh fruit
<i>Cola ricinifolia</i>	s-sized tree	fr	fresh fruit		
<i>Coula edulis</i>	m-sized tree	se	snack, condiment	wo	poles for construction
<i>Dacryodes edulis*</i>	m-sized tree	fr	vegetable	ba	medicines
<i>Dacryodes macrophylla</i>	m-sized tree	fr	fresh fruit		
<i>Elaeis guineensis</i>	m-sized tree	ex, fr, se	palm wine, condiment, cooking oil, medicinal oil	le	medicines, equipment
<i>Enantia chlorantha</i>	s/m-sized tree	ba	pharmaceutical input	wo, le	medicines, furniture, equipment
<i>Garcinia kola</i>	m-sized tree	se, ba	snack/aphrodisiac	se, ba	additive palm wine, medicines
<i>Garcinia lucida</i>	s/m-sized tree	ba, se	additive palm wine, snack/aphrodisiac	ba, se	medicines
<i>Gnetum sp.</i>	vine	le	vegetable*		
<i>Halopegia azurea</i>	herb	le	food wrapping	ro, st, ex	medicines, basketry
<i>Haumania danckelmaniana</i>	liana	st	shrimp traps	ex, le, st	medicines, wrapping, basketry
<i>Hexalobus crispiflorus</i>	m-sized tree	fr	fresh fruit, condiment	fr, wo	lure, equipment
<i>Irvingia gabonensis</i>	l-sized tree	se, fr	condiment, fresh fruit	ba	medicines
<i>Megaphrynium macrostachyum</i>	herb	le	food wrapping	le, st	basketry, equipment
<i>Monodora myristica</i>	m-sized tree	se	condiment*		
<i>Panda oleosa</i>	m-sized tree	se	condiment	ba	medicines
<i>Piper guineense</i>	liana	fr	spice	ba, le	additive palm wine, vegetable, medici
<i>Poga oleosa</i>	m-sized tree	se	condiment, cooking oil, snack		
<i>Raphia montbuttorum</i>	palm	ex, le	palm wine, furniture, equipment	le, ex, fr	construction, snack
Rattan species	liana	st	basketry	st	construction, equipment, medicines
<i>Rauvolfia vomitoria</i>	s-sized tree	ba	pharmaceutical input*	fr, ro, ba, le	medicines
<i>Ricinodendron heudelotii</i>	m/l-sized tree	se	condiment	ba	medicines
<i>Sarcophrynium priogonum</i>	herb	le, fr	food wrapping	fr	fresh fruit
<i>Scorodophloeus zenkeri</i>	m-sized tree	ba, se	spice		
<i>Strophantus gratus</i>	liana	se	pharmaceutical input	se	hunting/fishing poison
<i>Strychnos asterantha</i>	liana	wo, ex	equipment	ex	drinking water
<i>Tetrapleura tetraptera</i>	m-sized tree	fr	condiment*	fr	medicines
<i>Treculia africana</i>	m-sized tree	wo	hafts of tools	se	condiment, medicines
<i>Trichoscypha acuminata/T. abut</i>	s/m sized tree	fr	fresh fruit	ba	medicines
<i>Trichoscypha arborea</i>	m-sized tree	fr	fresh fruit	ba, wo	medicines, pestles
<i>Xylopia aethiopica</i>	s-sized tree	fr	condiment*	wo, ba	construction, furniture, medicines

# THE MANAGEMENT OF FORESTS FOR TIMBER AND NON-WOOD FOREST PRODUCTS IN CENTRAL AFRICA

Sarah A. Laird

## 1. Introduction

Logging is the main economic activity in the forests of Central Africa, and increasing portions of the forest area are allocated to timber concessions. Given the large and growing role of timber production in the economy of Central African forests, it is important that an examination of the value of NWFPs in local economies, and their potential incorporation into conservation and development projects, include the relationship between the harvest of NWFPs and timber.

Timber and NWFPs are inter-related in a range of ways. In some cases, timber species have important non-timber uses, and logging will reduce availability of these species as locally or regionally consumed NWFPs. Destructive logging operations can also cause direct damage to species in residual stands and those that make up the understorey and ground cover of forests, many of which are important NWFPs. Subsequent silvicultural treatments, when they are applied, can reduce species diversity by promoting an increased proportion of commercial species, and removing competing “undesirables”, many of which might be NWFPs. On the other hand, logging can open up habitats for the many NWFPs that prefer disturbed sites and secondary forest.

By reducing the structural and species diversity of a forest, logging and silvicultural treatments can also produce a number of largely as yet unknown ecological repercussions. These may include reductions in numbers of pollinators, seed dispersers, alterations in plant-herbivore relationships and the possibility that timber exploitation may ultimately produce conditions in which it is difficult for many forest species to regenerate (Peters, 1996). Since a wide range of NWFPs are generally harvested from a given forest area, reductions in species diversity over the long-term can directly affect the consumption and trade patterns of local people dependent upon NWFPs for their livelihoods.

On the positive side, however, the integration of timber and NWFPs into multi-purpose systems of natural forest management can both minimize the negative impacts of timber extraction and capitalize on the many benefits provided by a range of forest products. Calls for management plans for Central African forests on the part of governments and international development agencies, and recent developments in forest product certification and conservation project approaches in the region, argue for a closer examination of the relationship between timber, the primary cash earner, and NWFPs of central importance to local economies, health, and cultures.

This paper will briefly address some of the components of the timber-NWFP relationship in Central Africa, including:

- Species that yield both NWFPs and timber;
- The impacts of logging operations on NWFPs; and
- The incorporation of the NWFP-timber relationship into management plans for sustainable forest management.

## 1.1. Scale of activity

Timber and NWFPs are often artificially separated in examinations of forest management, since local people will manage the forest for both types of products. Some researchers have suggested that discussions should not be organized around a timber/NWFP dichotomy, but should instead address forest management at the level and scale of inputs and outputs in relation to small holder livelihoods (Padoch and Pinedo-Vasquez, 1996). The distinction should be made, therefore, between:

- Commercial and industrial exploitation; and
- Small-holder, small-scale exploitation.

Commercial, industrial scale timber exploitation represents the bulk of logging volume in Central Africa. NWFPs, on the other hand, with the exception of a dozen or so medicinal species harvested for phytomedical or pharmaceutical export markets such as *Pausinystalia johimbe* and *Prunus africana*, tend to be harvested for small holder subsistence consumption or for sale in local markets (Cunningham *et al.*, 1997; Cunningham and Mbenkum, 1993; Sunderland *et al.*, 1997).

Well-established regional markets for forest spices, medicine, chewsticks, kola nuts, and forest foods, are also significant, and form what might be thought of as an intermediate band of resource exploitation. For example, a large number of the NWFPs sold in markets in Bata, Equatorial Guinea, such as *Afrostryrax spp.*, *Ricinodendron heudelottii*, *Aframomum spp.*, *Tetrapleura tetraptera*, and *Garcinia kola*, are imported across sometimes great distances from Cameroon (Sunderland, 1998).

## 1.2. Timber production in Central Africa

In recent years, log exports from Central Africa have increased dramatically. For example, between 1996 and 1997, log exports from Cameroon increased by 47% (SGS Cameroun, S.A. 1997). Demand from Asia accounted for the bulk of this increase in the 1990s, as supplies of domestic timber declined in that region. By 1997, Asian countries took 85% of log exports from Equatorial Guinea, and half of log exports from Cameroon. Log exports to Asian countries - including China, Japan, The Philippines, India, Taiwan, and Hong Kong - increased from 23.5% of total exports from Cameroon in 1996 to 49.5% of the total in 1997 (SGS Cameroun, S.A. 1997; Projet CUREF, 1997). Although greater emphasis has recently been placed on the domestic transformation of wood products by governments, the bulk of exports continue to be in the form of unprocessed logs.

Recently the economic crisis in Asia has dampened demand from this region for Central African timber. Japanese imports of Gabonese hardwoods, for example, had already declined by 68% from 1996 to 1997, and Thailand's imports declined by 39% (SEPBG, 1997). At the same time, however, significant increases in log exports from Cameroon to a number of European countries were also reported, including to Italy (the largest importer of Cameroon logs), France, Spain, and Germany (SGS Cameroun, S.A. 1997). Although a decline in demand from Asia might significantly affect exports of Central African timber in the short-term, it is likely that overall global demand for industrial wood will continue to rise.

## 2. Timber and NWFP species

The most direct connection between timber and NWFPs is when a single species has both timber and non-timber value. In many cases, this results in diminished availability of species for non-timber uses, although in some cases the impact is minimal, or harvests of NWFPs and

timber are complimentary. For example, *Aucoumea klaineana* (okoumé), the primary timber species exported from Equatorial Guinea (85% in 1997) and Gabon (70% in 1997), yields a resin which is tapped prior to felling for timber and collected to make torches (which are then wrapped in the bark of *Xylopiya aethiopica*, an NWFP with a range of uses).

**Table 1.** Cameroon Log Exports by Species: January-September 1997 (SGS Cameroun, S.A., 1997)

Species (scientific name)	Trade name	Volume (m <sup>3</sup> )
<i>Triplochiton scleroxylon</i>	ayous	412 186
<i>Entandophragma cylindricum</i>	sapelli	136 564
<i>Terminalia superba</i>	fraké	112 145
<i>Erythrophloeum ivorense</i>	tali	102 287
<i>Tetraberlinea bifoliata</i>	ekop	66 540
<i>Lophira alata</i>	azobé	63 503
<i>Milicia excelsa</i>	iroko	55 456
<i>Distemonanthus benthamianus</i>	movingui	39 690
<i>Canarium schweinfurthii</i>	aiele	29 788
<i>Baillonella toxisperma</i>	moabi	27 944
<i>Nauclea diderrichii</i>	bilinga	26 219
<i>Entandophragma utile</i>	sipo	25 773
<i>Eribroma oblonga</i>	eyong	23 947
<i>Pterocarpus soyauxii</i>	padouk	19 987
<i>Pericopsis elata</i>	afromosia	18 433
<i>Ceiba pentandra</i>	ceiba	18 387
<i>Lovoa trichiliodes</i>	bibolo	12 475
<i>Guibourtia tessmannii</i>	bubinga	11 454
<i>Daniella ogea</i>	faro	10 966
<i>Guarea cedrata</i>	bosse	10 207
<i>Cylicodiscus gabunensis</i>	okan	10 091
<i>Terminalia ivorensis</i>	framire	9 762
<i>Khaya ivorensis</i>	mahogany	9 343
Other		72 830
<b>TOTAL =</b>		<b>1 372 445</b>

Of the top 25 timber species exported from Cameroon in 1997 (see Table 1), most have non-wood values. However, for each species the relationship between timber and NWFP values varies due to factors such as variations in species density and distribution, timber value and the level of local demand for NWFPs. For example, species such as *Baillonella toxisperma* (moabi), *Pterocarpus soyauxii* (padouk), and *Milicia excelsa* (iroko) which have high timber values and are found unevenly distributed in low densities, are usually heavily depleted in areas where logging takes place. Meanwhile, their local NWFP values are high, and there are no ready substitutes for some of the more valuable products they yield. As a result, there is a significant conflict between NWFP and timber values.

*Baillonella toxisperma* is one of the more valuable timber species in the region, used in furniture and cabinet making, flooring and for veneer. In 1997, it was the tenth most important commercial timber species exported from Cameroon by volume (SGS, Cameroun, S.A., 1997). This, despite being found in notoriously low densities of less than 1 tree/hectare. The seed of *B. toxisperma* also produces a cooking oil so prized, and today so scarce, it is rarely sold in markets since local communities prefer to keep what they can collect for their own use. The seed oil is also used medicinally, including for skin problems and rheumatism.

*Pterocarpus soyauxii* (padouk, or camwood) is used to make furniture and in cabinet-making. Locally, it is a preferred wood in some areas for carving canoes, stools, musical instruments and agricultural implements, and the ground stem is also an important cultural and medicinal species associated with childbirth and marriages, used mainly by women. Due to selective logging pressure, it has become scarce in many forest areas. *Milicia excelsa* is one of the most sacred tree species in Central and West Africa, and is used medicinally. It is heavily depleted due to selective logging pressures, and in some countries, such as the Congo, is endangered (WCMC, 1994; Laird *et al.*, 1997).

Other valuable timber species with important non-timber uses include: *Nauclea diderrichii* (bilinga), a very strong timber, resistant to borers and used for harbour work, mortars and general construction. The bark, root, and wood are all used to make a yellow dye, and the bark is also used to treat fevers and stomach problems (Brown, 1978; Mabberley, 1989; Abbiw, 1990; Laird *et al.*, 1997). *Canarium schweinfurthii* (aiele) has a range of uses as timber, and also yields popular fruits sold in local markets and a resin which is burned as incense and to start fires (thus the name “bush candle”). *Lophira alata* (azobé or ironwood) was the sixth most important timber species by volume exported from Cameroon in 1997, and is also used locally as a medicine for back and toothache.

In a study in southern Cameroon, it was found that of the 31 timber species exploited by the Dutch logging company, GWZ, 19 (representing 86% of volume) are also used by local communities. *Baillonella toxisperma* was cited by 60% of local people as a NWFP seriously affected by logging, followed by *Guibourtia tessmannii* (bubinga), used locally for cultural and medicinal purposes, and *Entandophragma cylindricum* (sapelli), used locally for construction. Other NWFP species cited as directly affected by demand for a species’ timber value include *Terminalia superba* (fraké), *Milicia excelsa* (iroko), *Lophira alata* (azobé) and *Lovoa trichiliodes* (bibolo) (van Dijk, 1997).



**Figure 1.** A pile of *Pausinystalia johimbe* bark in a logging concession. Harvesting of the bark of this species usually follows timber logging operations (Photo: T. Sunderland).

**Table 2. Medicinal values of selected timber species in Cameroon**

Selected results from the Limbe region, SW Province, Cameroon (Laird *et al*, 1996)

SPECIES	Common/ pilot name	Top timber species (Cameroon and Limbe) <sup>2</sup>	Med. Use (Y/N)	Plant parts used in medicine (roughly in order of importance)	Status in Limbe region
<i>Aningeria robusta</i>	aniegre	Cameroon/Limbe	N	no common medicinal uses	* +
<i>Azelia bipindensis</i>	doussie	Cameroon/Limbe	N	no common medicinal uses	**
<i>Albizia zygia</i>	lantanza	Limbe	Y	bark, stem, fruit, leaves	*
<i>Alstonia boonei</i>	stoolwood	Limbe	Y	bark, latex, leaves	**
<i>Autranella congolensis</i>	mukulungu	Cameroon	N	no common medicinal uses	
<i>Baillonella toxisperma</i>	moabi	Cameroon	Y	bark, seed oil, rootbark	
<i>Canarium schweinfurthii</i>	aiele	Cameroon/Limbe	Y	resin, bark, fruit	*
<i>Chrysophyllum africana</i>	abam	Limbe	Y	fruit, bark	*
<i>Ceiba pentandra</i>	ceiba, boma	Cameroon	Y	bark, leaves, fruit, roots	
<i>Coelocaryon preussii</i>	ekoume	Limbe	Y (minor)	bark	**
<i>Distemonanhus benthamianus</i>	movingui	Cameroon	Y	bark, leaves	
<i>Entandrophragma cylindricum</i>	sapelli	Cameroon/Limbe	N	no common medicinal uses	* +
<i>Entandrophragma utile</i>	sipo	Cameroon	Y	bark	
<i>Entandrophragma angolensis</i>	tiama, timbi	Limbe	N	no common medicinal uses	** +
<i>Enantia chlorantha</i>	enantia, moambe jaune	Limbe	Y	bark	*
<i>Eribroma oblonga</i>	eyong	Cameroon	N	no common medicinal uses	
<i>Erythrophleum ivorense</i>	tali	Cameroon	N	no common medicinal uses	
<i>Gossweilerodendron balsamiferum</i>	tola	Cameroon	Y	stem exudate	
<i>Guibourtia tessmannii</i>	bubinga	Cameroon	Y	bark, leaves	
<i>Khaya ivorensis</i>	acajou, African mahogany	Cameroon	Y	bark, roots, seed	
<i>Lophira alata</i>	ironwood, azobe	Cameroon/Limbe	Y	bark, leaves	*
<i>Lovoa trichilioides</i>	dibetou	Cameroon	N	no common medicinal uses	
<i>Milicia excelsa</i>	iroko	Cameroon/Limbe	Y	barks, leaves, stem exudate	** +
<i>Mansonia altissinia</i>	mansonia, bete	Cameroon	Y (minor)	bark, root	
<i>Microberlinia bisulcata</i>	zingana, zebra wood	Limbe	N		** (west coast)
<i>Nesogordonia papaverifera</i>	kotibe	Cameroon	N	no common medicinal uses	
<i>Naucllea diderrichii</i>	bilinga	Cameroon/Limbe	Y	bark, leaves, root	**
<i>Pericopsis elata</i>	assemela, afromosia	Cameroon	N	no common medicinal uses - <i>P. laxiflora</i> commonly used	
<i>Piptadeniastrum africanum</i>	dabema, atui	Limbe	Y	fruit, leaves	**
<i>Poga oleosa</i>	poga	Limbe	Y	seed oil, seed	**
<i>Pterocarpus soyauxii</i>	padouk, camwood	Cameroon/Limbe	Y	stem, bark, leaves	** +
<i>Pycnanthus angolensis</i>	ilomba	Cameroon/Limbe	Y	bark, leaves, seed	**
<i>Staudtia stipitata</i>	niove	Limbe	N	no common medicinal uses	**
<i>Sterculia oblonga</i>	eyoung	Limbe	N	no common medicinal uses	* +
<i>Sterculia rhinopetala</i>	nkanang	Limbe	Y (minor)	bark	**
<i>Terminalia superba</i>	frake, limba	Cameroon/Limbe	Y	bark, leaves, fruit	**
<i>Triplochiton scleroxylon</i>	obeche, samba	Cameroon	N	no common medicinal uses	
<i>Tiegemella hechelii-africana</i>	douka	Cameroon	Y (minor)	bark	

Status of species exploited in the forest west-southwest-south of Mount Cameroon, encompassing Mount Etinde, and stretching along the coast from Idenau, through Limbe, to Mabeta-Moliwe, according to Akogo *et al* (1994):

+ = valuable timber species limited in distribution due to past selective exploitation;

\*(\*) = species (most) commonly exploited for timber in forest area (1988-94)

<sup>2</sup>The most exploited timbers in Cameroon according to FMRP (1993) and SGS (1997); 22 most exploited timbers in Limbe region according to Akogo *et al*. (1994).

In the Mount Cameroon region, more than half of the most valuable timber species exploited between 1988 and 1994 were also shown to have significant medicinal and other non-timber values (See Table 2). These include: *Alstonia boonei*, *Milicia excelsa*, *Canarium schweinfurthii*, *Nauclea diderichii*, *Poga oleosa*, *Pterocarpus soyauxii* and *Terminalia superba*. Most of the widely marketed NWFPs in Central Africa, however, including *Irvingia gabonensis*, *Afrostryax spp.*, *Tetrapleura tetraptera*, *Ricinodendron heudelottii*, *Garcinia kola*, *Gnetum africanum*, and *Monodora myristica* are not important timber species (Laird *et al.*, 1996; Ndoye *et al.*, 1997; van Dijk, 1997; Sunderland, 1998).

### 3. The impact of logging operations on NWFPs

Logging operations directly affect both present and future harvests of timber and NWFPs. They can lead to declines in species and forest structural diversity, and to unfavourable rates of basal area growth of species through destruction of seedlings, adolescent trees, soil surface and drainage patterns (John 1992; Dykstra and Heinrich 1992; Whitmore 1991). Studies in the eastern Amazon, for example, found that to extract 52 m<sup>3</sup>/ha, or eight trees, logging operators destroyed 26% of those trees remaining. Canopy cover, a summation of road area, felled tree area, and log storage area, might be reduced by half following logging (Johns, 1988; Uhl and Vieira, 1989). Logging damage to the soil surface, including the removal of topsoil, disturbance and soil compaction, can retard the growth of both NWFP and timber species.

Logging roads cause direct damage, and in poorly planned operations might occupy anywhere from 6-20% of the forest area (Uhl and Vieira 1989; Johns 1992; Jonson and Lindgren 1990). Perhaps the largest impact of logging roads on NWFPs, however, is through the access they provide to once inaccessible populations of wildlife and other NWFPs, as well as to markets. This helps people to capitalize on the market potential for previously inaccessible NWFPs, but can lead to over-exploitation of species (Wilkie *et al.*, 1992; Dahaban, Nordin and Bennett 1992; Caldecott 1989).

Damage in selective harvesting systems is usually patchy, due to varying population densities of commercial species. NWFP species with limited geographical ranges, poor dispersal ability and few seedlings in the understorey are generally less equipped to deal with logging pressures. Rare and specialized species will generally suffer most from the random damage of logging operations and the shift in species composition to generalists that often follows immediately upon logging (John, 1992; Cunningham, 1992; Peters, 1994; Laird, 1995; Peters, 1996).

It is clear, however, that logging can positively affect a suite of NWFP species that prefer disturbed forest areas and roadsides. In Central Africa, these include rattan species, as well as many condiment and medicinal species such as *Aframomum spp.* (used to spice stews, treat coughs and as important magnifying agents in medicinal mixtures), *Piper guineensis* (used as a spice in stews, to treat hangovers, stomach problems and to build strength), and *Piper umbellatum* (used as a wrapping for cooking).

Commonly used medicinal herbs found along logging roads and in disturbed forest patches also include: *Costus afer* (the stem is chewed to relieve coughs and sore throats, and the juice is used to treat eye infections); *Emilia coccinea* (used as an anti-poison, for jaundice and snakebite); and *Eremomastax speciosa* (used to purify and strengthen the blood). In southern Cameroon, logging appeared to cause abundant regeneration of the condiment species *Ricinodendron heudelottii*, and to have limited impact on the size class distribution of *Irvingia gabonensis* (van Dijk, 1997).



**Figure 2.** Fruits of *Aframomum* spp. (Photo: S. Laird)

A number of other important NWFP species - such as the medicinals *Senna (Cassia) alata* (a pan-tropical species the leaves of which are used as a treatment for ringworm and other skin ailments) and *Spilanthes filicaulis* (flowers chewed for toothache) - are found on the peripheries of villages and in gardens. Others - such as *Kigelia africana* (used for stomach problems, to treat snakebite and eye infections, and for a range of cultural and protection purposes) and *Alstonia boonei* (bark and latex used to treat fever and promote lactation), *Dacryodes edulis* (the fruits are a popular food) - have been brought from the forest and are planted in villages. For this range of NWFP species, logging will obviously have little immediate impact.

NWFPs are sourced from a range of habitat types, and traditional systems of management for forest resources make use of a continuum of vegetation types including recently cleared land, farm fallows, secondary forest, and forests which have not been cleared for hundreds of years. While most commonly-used medicinal plants are sourced from secondary forest, the edges of paths, farms, village peripheries and informal gardens kept by specialist healers, species used for more severe illnesses, and many of those species considered most powerful, are sourced from high or secondary forest (Thomas *et al.*, 1989; Falconer 1990, 1994; Laird *et al.*, 1996). Logging will directly affect only a portion of the range of NWFP species used by local communities, but the importance of this range and diversity in products, and the limits to substitution, should be recognized.

#### **4. The NWFP-timber interface: Contributing to sustainable natural forest management**

The harvest of timber and non-timber forest products can be incorporated into multi-purpose systems of natural forest management that both minimize the negative impacts of timber extraction and capitalise on the many benefits provided by a range of forest products. The vast majority of timber production in tropical countries comes from unmanaged forests. Rotations, regeneration periods, felling cycles, harvestable girth limits, etc. tend not to be based on the growth rates and regeneration requirements of the species, but on the demand for wood, so forests are usually harvested in excess of the allowable cut, and logging damage can be severe (Poore, 1989; Nair, 1991; Wadsworth, 1987). However, in managed forest areas timber and NWFPs can be harvested in a complimentary manner (Salick, 1992; Malhorta *et al.*, 1991).

Timber harvest plans can be based on inventories and the collection of information necessary to ensure sustainability and to plan transportation within the forest in a way that minimizes damage to residual stands and the total area disturbed by roads, landings and skid trails. Timing of logging operations can take into consideration rainy seasons, seedfalls and the reproductive cycles of animals and species of non-wood value. Complimentary harvests of NWFPs prior to and post logging can be planned, including the harvest of rattans, collection of oil-producing seeds and medicinal barks, and tapping essential oils and resins from valuable timber species. The harvest of NWFPs in conjunction with logging operations is often done now on an ad hoc basis, but these activities could be built into management plans, such as those called for in Cameroon as part of Community Forests, an innovation of the January 1994 Law No. 94/01 concerning Forests, Wildlife and Fisheries (GoC, 1994; GoC, 1997; Laird and Lisinge, 1998).

Management plans, and attention to multiple use, are also incorporated into international efforts to provide economic incentives for sustainable forest management. Recently, the Forest Stewardship Council - the main accreditation body for timber from natural and plantation forests - has begun exploring the role of NWFPs in timber production through an NTFP Working Group. A draft Principle governing NWFPs is under discussion. In addition to highlighting the need for sustainable management plans for NWFPs, the draft Principle requires that: "11.3 Management plans that prioritize timber production should include specific provisions to describe and minimize short and long-term impacts on NTFPS;" and "11.6 The monitoring of timber harvesting should evaluate impacts on non-timber resources and the forest ecosystem. Monitoring should also include the impacts of non-timber forest products on timber resources" (FSC NTFP Working Group, 1997).

Unfortunately, quantitative data on the relationship between timber and non-timber uses and management is difficult to come by, although some studies do exist which attempt to evaluate changes in community ecology variables with logging, damage, regeneration, and silvicultural treatments both for useful plant species and for the plant community as a whole (Salick *et al.*, 1992; Salick *et al.*, 1995; Peters 1996; van Dijk, 1997; Shanley *et al.*, 1998). Ecological, socioeconomic, legal, policy and cultural aspects of timber and NWFP harvesting and use must then be brought together in order to examine the relationship between timber and NWFPs, and the conservation of tropical forests and the resources contained within them.

## References

- Abbiw, D.K. 1990. *Useful plants of Ghana: West African uses of wild and cultivated plants*. Intermediate Technology Publications and the Royal Botanic Gardens, Kew. UK.
- Akogo, M.G., J.M. Mbani, C. Tako, A. Batoum, G. Nemoh, & Z. Nchimfor. 1994. *Illegal timber exploitation hot spots in Mabeta-Moliwe and Etinde Proposed Forest Reserves*. Limbe Botanic Garden/Mount Cameroon Project. Limbe.
- Brown, W.H. 1978. *Timbers of the world - Africa*. Timber Research and Development Association, High Wycombe, UK.
- Caldecott, J. 1988. *Hunting and wildlife management in Sarawak*. The IUCN Tropical Forest Programme, Cambridge, UK.
- Cunningham, M., A.B. Cunningham, & U. Schippmann. 1997. *Trade in Prunus africana and the Implementation of CITES*. Bonn, German Federal Agency for Nature Conservation.
- Cunningham, A.B. & F.T. Mbenkum. 1993. *Medicinal bark in international trade: A case study of the afro-montane tree Prunus africana*. Report to WWF-International, Gland.

- Cunningham, A.B. 1992. People, park, and plant use: research and recommendations for multiple-use zones and development alternatives around Bwindi-Impenetrable National Park, Uganda. CARE-International, Kampala, Uganda.
- Dahaban, Z., M. Nordin & E.L. Bennett. 1992. Immediate effects on wildlife of selective logging in a hill dipterocarp forest in Sarawak: mammals. Wildlife Conservation Society, Malaysia.
- Dykstra, D.P. & R. Heinrich. 1992. Sustaining tropical forests through environmentally sound harvesting practices. *Unasylva* 43 (169): 9-15.
- Falconer, J. 1994. *Non-timber forest products in Southern Ghana*. ODA, Republic of Ghana Forestry Department, and NRI, London.
- Falconer, J. 1990. *The major significance of "minor" forest products: the local use and value of forests in the West African humid forest zone*. FAO, Rome.
- Forest Management and Regeneration Project (FMRP). 1993. Identification guide of the 26 most exploited timbers in Cameroon. ONADEF/ODA, Yaounde.
- Forest Stewardship Council. Draft Principle #11: Non-Timber Forest Products. FSC NTFP Working Group, Vermont, USA.
- Gomez-Pompa, A. T.C. Whitmore & M. Hadley (eds.). 1991. *Rainforest regeneration and management*. Paris, UNESCO and The Parthenon Publishing Group Ltd.
- Government of Cameroon. 1997. *Draft manual of the procedures and norms for attribution and management of community forests*. MINEF, Yaounde.
- Government of Cameroon. 1994. Law No. 94/01 of 20 January 1994 concerning Forests, Wildlife and Fisheries.
- John, A.D. 1992. Species conservation in managed tropical forests. In T.C. Whitmore and J.A. Sayer (eds.) *Tropical deforestation and species extinction*. London, Chapman and Hall.
- John, A.D. 1988. Effects of selective timber extraction on rainforest structure and composition and some consequences for frugivores and foliovores. *Biotropica* 20(1): 31-37.
- Jonson, T. & P. Lindgren. 1990. *Logging technology for tropical forests, for or against?* Report from the ITTO pre-project Improvement of harvesting systems for the sustainable management of tropical rain forests. The Forest Operations Institute, Sweden.
- Laird, S.A. & E. Lisinge. 1998. *Benefit-Sharing Case Studies from Cameroon*. A UNEP contribution to the fourth meeting of the Conference of the Parties to the Convention on Biological Diversity. Nairobi.
- Laird, S.A. with M. Betafor, M. Enanga, C. Fominyam, M. Itoe, E. Litonga, J. Mafani, J. Menyoli, J. Meseke, W. Mukete, M. Motia, P. Ndumbe, J. Nkefor, J. Nning, N. Ndam, T. Sunderland, P. Tchouto, and M. Wana. 1997. *Medicinal Plants of the Limbe Botanic Garden*. Limbe Botanic Garden, Cameroon.
- Laird, S. 1995. *The Natural Management of Tropical Forests for Timber and Non-Timber Products*. Oxford Forestry Institute, Oxford.
- Malhorta, K.C., M. Poffenberger, A. Bhattacharya & D. Dev. 1991. Rapid appraisal methodology trials in Southwest Bengal: assessing natural forest regeneration patterns and non-wood forest product harvesting practices. *Forest, Trees and People Newsletter* No. 15/16.
- Mergen, F. & J.R. Vincent (eds.). 1987. *Natural management of tropical moist forests: silvicultural and management prospects of sustained utilization*. Yale University School of Forestry and Environmental Studies, New Haven, CT.
- Nair, C.T.S. 1991. A comparative account of silviculture in the tropical wet evergreen forests of Kerala, Andaman Islands and Assam. In Gomez-Pompa, A. T.C. Whitmore and M. Hadley (eds.). 1991. *Rainforest regeneration and management*. UNESCO and The Parthenon Publishing Group Ltd, Paris.
- Ndoye, O., M. Ruiz Perez, & A. Eyebe. 1997. *The markets of non-timber forest products in the humid forest zone of Cameroon*. ODI paper 22c. London.

- Padoch, C. & M. Pinedo-Vasquez. 1996. Smallholder forest management: Looking beyond non-timber forest products. In: M. Arnold and M. Ruiz Perez. *Non-Timber Forest Products*. CIFOR, Bogor.
- Peters, C.M. 1996. *The ecology and management of non-timber forest resources*. World Bank Technical Paper no. 322. Washington, DC.
- Peters, C.M. 1994. *Ecology and exploitation of non-timber forest resources: a primer on sustainability*. Biodiversity Support Program, Washington, DC.
- Poore, D., P. Burgess, J. Palmer, S. Rietbergen & Tim Synnott. 1989. *No timber without trees: sustainability in the tropical forest*. London, Earthscan Publications Ltd.
- Projet CUREF. 1997. Exportations par Destination et Exportations par Essence, Guinee Equatoriale, January to September 1996-97. *ATIBT Newsletter* No. 4/97. Paris.
- Redford, K.H. & C. Padoch (eds.). 1992. *Conservation of neotropical forests: working from traditional resource use*. New York, Columbia University Press.
- Salick, J., A. Mejia, & T. Anderson. 1995. NTFPs integrated with natural forest management, Rio San Juan, Nicaragua. *Ecological Associations* 5(4):878-895.
- Salick, J. 1992. Amuesha forest use and management: an integration of indigenous use and natural forest management. In K.H. Redford and C. Padoch (eds.). *Conservation of neotropical forests: working from traditional resource use*. New York, Columbia University Press.
- SEPBG. 1997. Grumes par Destination et Statistiques Comparatives par Essence & Ports de Chargement, Gabon, January to September, 1996-97. *ATIBT Newsletter* No. 4/97. Paris.
- SGS Cameroun, S.A. 1997. Log Exports, Cameroun, January to September 1996-97. *ATIBT Newsletter* No. 4/97. Paris.
- Shanley, Patricia, M. Cymerys, & J. Galvao. 1997. *Fruitiferas da mata na vida Amazonica*. Belem, Brazil.
- Sunderland, T.C.H. 1998. Preliminary Market Survey of the Non-Wood Forest Products (NWFPs) of Rio Muni, Equatorial Guinea. CARPE (Washington DC) and CUREF (Equatorial Guinea).
- Sunderland, T.C.H., A. Njiamnshi, A. Koufani, M.Ngo-Mpeck, & C. Obama. 1997. The ethnobotany, ecology, and natural distribution of Yohimbe (*Pausinystalia johimbe*) - an evaluation of the sustainability of current bark harvesting practices, and recommendations for domestication and management. ICRAF, Nairobi.
- Thomas, D.W., J.M. Thomas, W.A. Bromley, & F.T. Mbenkum. 1989. *Korup ethnobotany survey*. WWF, Godalming, U.K.
- Uhl, C. & I.C.G. Vieira. 1989. Ecological impacts of selective logging in the Brazilian Amazon: a case study from the Paragominas region of the state of Para. *Biotropica* 21(2): 98-106.
- Van Dijk. 1997. *Non-timber forest products in the Bipindi-Akom II region, Cameroon: an economic and ecological assessment*. Tropenbos Cameroon Documents. Kribi.
- Wadsworth, F.H. 1987. Applicability of Asian and African silviculture systems to naturally regenerated forests of the Neotropics. In F. Mergen and J.R. Vincent (eds.). *Natural management of tropical moist forests: silvicultural and management prospects of sustained utilization*. New Haven, CT, Yale University School of Forestry and Environmental Studies.
- Whitmore, T.C. & J.A. Sayer (eds.). 1992. *Tropical deforestation and species extinction*. Chapman and Hall, London.
- Whitmore, T.C. 1991. Tropical rainforest dynamics and its implications for management. In A. Gomez-Pompa, T.C. Whitmore and M. Hadley (eds.). 1991. *Rainforest regeneration and management*. UNESCO and The Parthenon Publishing Group Ltd, Paris.
- Wilkie, D.S., J.G. Sidle, & G.C. Boundzanga. 1992. Mechanized logging, market hunting, and a bank loan in Congo. *Conservation Biology* 6(4): 570-580.
- World Conservation Monitoring Centre (WCMC). 1994. *Cameroon: Conservation Status Listing of Plants*. Compiled from WCMC Plants Database, Cambridge, UK.

# THE SUSTAINABILITY OF ERU (*GNETUM AFRICANUM* AND *GNETUM BUCHHOLZIANUM*): OVER-EXPLOITED NON-WOOD FOREST PRODUCT FROM THE FORESTS OF CENTRAL AFRICA

Patrick Nde Shiembo

## Abstract

The leaves of *Gnetum africanum* and *G. buchholzianum* are highly valued as nutritious green vegetables across Central Africa and are the subject of considerable cross-border trade. This trade has increased dramatically in recent years and the resource base has been seriously threatened by unsustainable harvesting methods and the gradual disappearance of the forests in which they thrive. In order to ensure and enhance the sustainability of these two *Gnetum* species, research is being carried out on their selection, genetic improvement, vegetative propagation and *ex-situ* management.

To date, the two species have been successfully propagated and subsequently planted out mostly in on-station trial blocks. They respond well to cultivation and many of the plants have produced large amounts of biomass and have produced flowers and fruit. Germplasm of over eighty-five provenances has been established for future selection and genetic improvement for the mass production of broad-based planting materials. On-farm trials are now being established and appropriate harvesting methods are being introduced to allow for quick sprouting of vines. These efforts are aimed to ensure, not only the future availability of *Gnetum*, but that the cultivated sources are also genetically superior.

**Key words:** *Gnetum africanum*, *Gnetum buchholzianum*, domestication, field trials, sustainability

## 1. Introduction

*Gnetum* is the lone genus in the family Gnetaceae. There are about thirty species in the genus, which occurs throughout the tropics in Asia, South America (Mialoundama and Paulet, 1986) and in Central Africa (Watt and Breyer-Brandwijk, 1962). The majority of the species of *Gnetum* are lianas. The plants are dioecious, with the male plants producing catkins of stamens and the females catkins of ovules barely protected by an envelope (Letouzey, 1986).

There are two species of *Gnetum* in Africa, *G. africanum* and *G. buchholzianum* and they are distributed in the humid tropical forests from Nigeria through Cameroon, Central African Republic, Gabon, DR of Congo to Angola (Mialoundama, 1993). Both species are understory lianas, although in some cases some individuals have been found to scramble into the crowns of emergent trees (author, pers. obs.). These two species are very similar and can only be distinguished by the shape of the leaves and characters of the male reproductive parts (Lowe, 1984).

## 2. The importance and value of *Gnetum* spp.

Both *Gnetum* species have significant value to many forest-based communities and have a number of vernacular and trade names. In the Central African Republic, Gabon, Congo, DR of Congo and Angola, the two species are locally called koko. (Bahuchet, 1990). In Anglophone Cameroon, they are known as eru, while in Francophone Cameroon the name

okok is applied. In Nigeria, the two *Gnetum* species are called ukasi by the Igbo tribe while the Efik/Ibibio tribes call them afang.

In Nigeria, the leaf of *G. africanum* is used in the treatment of an enlarged spleen, sore throats and as a cathartic (Burkill, 1994). In Ubangi (DR Congo), it is used to treat nausea and is considered to be an antidote to some forms of poison (Burkill, 1994). In Congo-Brazzaville, the leaves of both species are used as a dressing for warts and boils and a tisane of the cut-up stem is taken to reduce the pain of childbirth (Bouguet, 1969). *Gnetum africanum* is also reported to be used for medicinal purposes in Mozambique (Watt and Breyer-Brandwijk, 1962).

However, it is for its edible value that *Gnetum* is most prized. The leaves are either eaten raw or are finely shredded and added to soups and stews (Burkill, 1994). The leaf of *G. buchholzianum* is also edible, although it is reported to be less common in commerce (Busson, 1965). The leaves of both species have very high nutritional value and constitute an important source of protein, essential amino acids and mineral elements (Busson, 1965; Fokou and Domngang, 1989; Mialoundama, 1993; Ouabonzi *et al.*, 1983).

The leaves of both *Gnetum africanum* and *G. buchholzianum* are a very important article of trade in the Central African region, particularly in Cameroon where the leaves are harvested on a daily basis and sold in local and regional markets. As the leaves of both species are evergreen they are available throughout the year. The volume of export trade in these leafy vegetables has significantly increased in recent years.

There are two main ports of exit in Cameroon. Idenau, a coastal fishing village in SW Province, exports large quantities of *Gnetum* to Nigeria; and Campo, near Kribi in the South Province, exports to Gabon and Congo-Brazzaville. Once exported, the *Gnetum* leaves are then traded in large border town markets. These markets are well-organised and are frequented by a wide range of nationalities trading in the product.

To meet the high demand, the search for *Gnetum* has extended to more remote parts of Cameroon so that it is now difficult to find either species in the forests of the Littoral and South West Provinces, where they were previously abundant. It is common to see vehicle loads of *Gnetum* heading to the border market of Idenau on Wednesdays and Thursdays every week from the forests of the Centre, East and South Provinces of the country. It is estimated that 600 tonnes a year leave from this port alone with a local market value of 1 800 000 000 CFA (Bokwe and Ngatoum, 1994). This large volume of trade offers valuable employment to many young people in Cameroon and surrounding countries. As much as 450 000 CFA / month is reported to be made from the sale of *Gnetum* by one of the full-time traders in the product in the Idenau market in 1997 (pers. comm.).

### **3. The unsustainable harvest of *Gnetum***

*Gnetum africanum* and *Gnetum buchholzianum* thrive in a wide range of habitats, including farm fallows or abandoned farmland, secondary forests, and closed forest. The vines of both *Gnetum* species climb supporting big and small trees, dead trees, saplings, shrubs, other climbing vines such as rattan palms, and a host of other plant materials in the complex tropical humid forest, where they grow luxuriantly and produce great quantities of leaf biomass.

Under wild conditions, both species grow and form underground tubers or roots that store plant food reserves. These can remain alive for many years when the vegetation and the *Gnetum* vines above ground are cleared and the soil surface is laid bare. It has been reported

that some local tribes in East Cameroon and the Congo eat these tubers as wild yams, particularly during lean seasons (Bahuchet, 1990). In the course of harvesting the vines, the buds on the tubers are damaged and it may take a long time for new buds to develop into a vine. In some cases, the forceful pulling of vines creates wounds on the tuber/root for fungal attack that can cause tuber/root rot disease. Hence the effects of harvesting does not ensure the growth and supply of future *Gnetum* leaves. It is, therefore, not a sustainable means of collecting the leaves.

On occasion, during the collection, the trees that the *Gnetum* vines are growing on are often felled, creating widespread damage. It is clear then, that the harvesting of *Gnetum* from the wild is not sustainable. In addition, much of the forest in which the *Gnetum* occurs is being degraded by illegal and uncontrollable exploitation of timber, farming, road construction and other forms of economic development.

#### **4. Achieving sustainability in the supply of *Gnetum***

To begin to alleviate some of the problems of the over-exploitation of *Gnetum*, a domestication programme has been developed. It is hoped that cultivated sources of supply will not only reduce pressure on the existing wild resource, but will also contribute to the incomes of local communities through the establishment of village-based co-operative cultivation systems.

During the first trials to assess the potential of *Gnetum* for cultivation, many multiplication techniques were studied. These included seed germination and rooting of leafy vine cuttings. In addition, selection of the best rooting medium and the identification of the cheapest and most efficient propagators that could be transferred to local farmers, were also determined.

The initial propagation trials ruled out the multiplication of *Gnetum* by seeds as they did not germinate under nursery conditions despite being commonly found germinating on the forest floor.

##### **4.1. Vegetative propagation**

From our work, it is clear that the vegetative propagation technique of rooting leafy vine cuttings provides the optimum means of *Gnetum* multiplication. During the period 1994-95, 65 provenances were collected from the forest zone of South West and Littoral Provinces. These provenances were selected based on the fact that they are the most commonly harvested as palatability varies widely in *Gnetum*. Thirty-five cuttings of each provenance were put into simple and cheap non-mist and portable propagators made of wooden frames, with separate wooden frame covers framed with polythene sheets (see Figure 1).

Whilst in the propagators, the cuttings were watered twice a day for a maximum period of six weeks when enough roots were formed to allow transplanting to pots to take place. After an initial period of hardening-off (4-6 weeks) these are then ready for planting.

##### **4.2. Field trials**

Aside from the initial propagation work, further studies have been undertaken to evaluate the cultivation potential of *Gnetum* in the field. Five cuttings representing twenty-eight provenances were randomly assigned to one of twenty-eight study plots under five different hardwood species planted for timber production studies in the Southern Bakundu Forest Reserve. After planting, they have been managed by staking and weeding. Vine growth, leaf

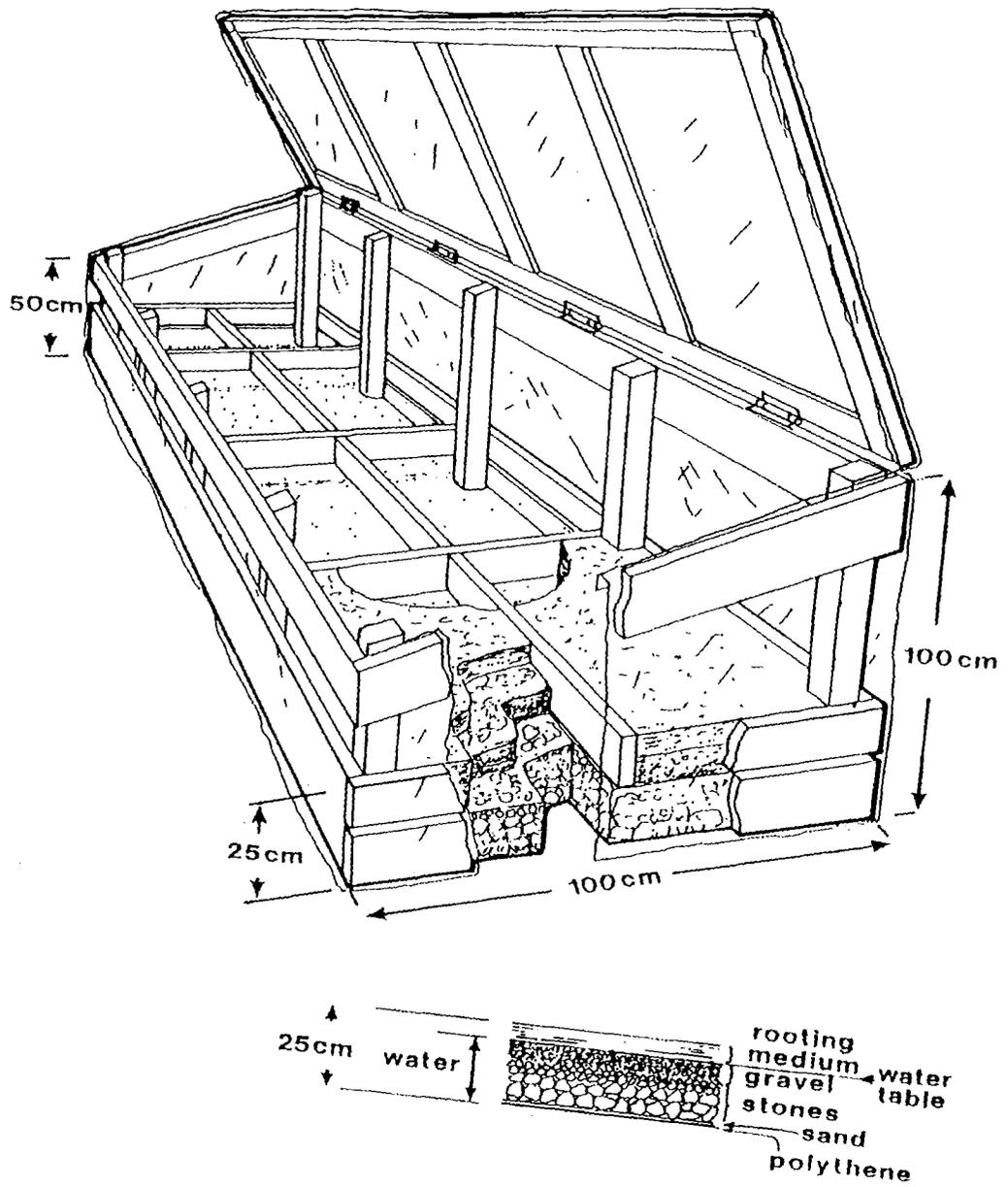


Figure 1 Rooting cuttings of tropical trees (from Longman, K.A. 1993)

biomass production and survival have been monitored, and data so obtained has been recorded on data sheets designed for this purpose.

A harvesting regime has also been implemented to determine the effects of leaf removal and the rate of re-growth. Five regimes were implemented:

- The removal of alternate leaves only;
- The removal of two pairs of leaves were removed leaving behind a pair so that there remained a pair of leaves after every two nodes;
- The harvest of all the mature leaves;
- Cutting of the vine tops just above the height where the mature leaves end;
- Cutting of vines at ground level.

## **5. Results**

In October 1997, the number of leaves produced by the *Gnetum* planted in August 1996 were counted and subjected to an analysis of variance test after data transformation. Not surprisingly, there was considerable variation in vine length between the provenances, with some growing much more vigorously than others. The rate of growth of the rapidly-growing provenances was twice the rate of those that were slow-growing. The rate of growth has an enormous affect on the potential for increased yield and recovery from harvest. In general, survival rates were good (when measured 18 months after planting). The highest survival rates of 78.2% and 76.7% were recorded in the two most vigorous provenances, while the poorest survival rate was 57.1%.

Generally, the vines that were left with some leaves after harvest produced new leaves and some new vines were also produced at the nodes where leaves were harvested. As far as the pruning method is concerned, a maximum of three new vines sprouted from the first three nodes below the cut surface. There was no regrowth in the vines cut at ground level. It was also observed that when cuttings were taken from cloned vines in the nursery or propagation unit, many sprout vines and many more leaves were produced. This demonstrates that *Gnetum* biomass production can be sustainably harvested if the appropriate harvesting techniques are applied.

## **6. Conclusions and recommendations**

The results of this work have shown clearly that the two *Gnetum* species are easily domesticated. On-station and on-farm trials have also shown that *Gnetum* has considerable potential for inclusion into agroforestry and subsistence agriculture systems and, if suitably managed, can provide a sustainable supply of leaves for both household use and sale.

It is recommended that more research be undertaken on the cost-benefits of cultivation and whether the cultivated sources of *Gnetum* can indeed alleviate the reliance on the wild resource whilst contributing to the household economy.

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## References

- Bahuchet, S. 1990. The Akwa pygmies: Hunting and Gathering in the Lobaye Forest. In *Food and Nutrition in the African Rain Forest*. Food Anthropology Unit 263, UNESCO.
- Bokwe, A. & D. Ngatoum. 1994. *Effectuée autour du Mont Cameroun (Province du Sud-Ouest) relatif au recensement de certaines especes des produits forestiere secondaires en voie de disparition*. Rapport de la mission. MINEF, Yaounde.
- Bouguet, A. 1969. *Féticheurs et medecines traditionnelles du Congo (Brazzaville)*, Paris: ORSTOM.
- Burkill, H.M. 1994. *The Useful Plants of West Tropical Africa. Volume 2: Families E-I*. Kew. Royal Botanic Gardens, Kew.
- Busson, F. 1965. *Plantes alimentaires de l' Ouest Africain: Etude botanique, biologique et chimique*. Marseille: Ministere de la Cooperation.
- Dutta, A.C. 1979. *Botany for Degree Students* 5th Ed. Oxford University Press.
- Fokou, E. & F. Domngang. 1989. *In vivo* assessment of the nutritive value of proteins *in situ* in the leaves of *Solanum nigrum* L., *Xanthosoma* spp. and *Gnetum africanum* L. *Indian Journal of Nutrition, and Dietetics* 26 (12): 366-373.
- Letouzey, R. 1986. *Manual of Forest Botany: Tropical Africa, Vol. 1. General Botany*. CTFT, Norgent Surmarne, France.
- Lowe, J. 1984. *Gnetum* in West Africa. *Nigerian Field* 49 (1-4): 99-104
- Mialoundama, F. *et al.* 1984. The periodic induction of dormancy during the rhythmic growth of *Gnetum africanum*. *Physiologia-Plantarum* 61(3): 309-313
- Mialoundama, F. & P. Paulet. 1986. Regulation of vascular differentiation in leaf primordia during the rhythmic growth of *Gnetum africanum*. *Canadian Journal of Botany*. 64 (1): 208-213.
- Mialoundama, F. 1993. Nutritional and socio-economic value of *Gnetum* leaves in Central African forest. In Hladik, C.M. *et al.*, *Tropical forests, people and food: Biocultural interactions and applications to development*. Carnforth, UK: Parthenon Publishing Group
- Okafor, J.C. 1980. Edible indigenous woody plants in the rural economy of the forest zone. *Forest Ecology and Management*. Vol. 3: 45-55.
- Ouabonzi, A., M.L. Bouillant & J. Hapin. 1983. C-Glycosylflvones from *Gnetum buchholzianum* and *Gnetum africanum*. *Phytochemistry*. Vol. 22, No.11. pp 2632-2633. Pergamon Press Ltd.
- Watt, J.M.A & M.G. Breyer-Brandwijk. 1962. *The medicinal and poisonous plants of Southern and Eastern Africa*. Edinburgh: E & S Livingstone.

# THE ECOLOGY AND SUSTAINABILITY OF *PAUSINYSTALIA JOHIMBE*: AN OVER-EXPLOITED MEDICINAL PLANT OF THE FORESTS OF CENTRAL AFRICA

Terry C.H. Sunderland, Marie-Laure Ngo-Mpeck, Zacharie Tchoundjeu and Amougou Akoa

## Abstract

*Pausinystalia johimbe* (K. Schum.) Pierre ex Bielle, or yohimbe, is a widely-used medicinal plant, the bark of which is used to treat male organic impotence. The species is exploited in large quantities for both the local medicinal and growing export markets. Recent advancements in the development of yohimbe-based remedies have led to an increased demand for the export market. This demand is generating considerable over-exploitation and local scarcity of the species.

Concerned over the fact that future supplies might be compromised by current levels of over-exploitation, Boehringer Ingelheim, a German pharmaceutical company which import *P. johimbe* bark directly from Cameroon through Plantecam, a subsidiary of Laboratoires Fournier, commissioned the International Centre for Research in Agroforestry (ICRAF) to undertake a pilot study on the ethnobotany, ecology and natural distribution of the species. The study also assessed the effects of current harvesting practices. Further information was gathered with a view to include the species as part of ICRAF's domestication programme for use in agroforestry systems. That field research forms the basis of this paper.

**Key words:** *Pausinystalia johimbe*, yohimbe, medicinal plants, cultivation

## 1. Introduction

*Pausinystalia johimbe* is a tree native to the coastal forests of Central Africa and is distributed from South East Nigeria to the Congolese Mayombe (Vivien and Faure, 1985). Its bark contains up to 6% of a mixture of alkaloids, the principle one being yohimbine (Tyler, 1993) which is also known as aphrodine, quebrachine or corynine (Lawrence Review of Natural Products, 1990). *P. johimbe* is used extensively as part of traditional health care systems. Its many recorded uses vary from being used directly as an aphrodisiac (Small and Adams, 1922; Greenish, 1929; Ainslie, 1937; Dalziel, 1937; Raponda-Walker and Sillans, 1961; Motte, 1980; Farnsworth, 1984; Oliver-Beyer, 1986; Tyler, 1993) to that of a local anaesthetic (Greenish, 1929; Oliver Beyer, 1986), a mild stimulant to prevent drowsiness (Raponda-Walker and Sillans, 1961; Obama pers. comm.; author pers. obs), a hallucinogen (Tyler, 1993), a treatment for angina (Lawrence Review of Natural Products, 1990), a hypertensive (Oliver-Beyer, 1986; Lawrence Review of Natural Products, 1990), a general tonic (Ainslie, 1937), a performance enhancer for athletes and as a remedy to increase the clarity of the voices of singers during long festivals (Motte, 1980), an ichthyotoxicant, and as a tonic to increase the resilience of hunting dogs (Raponda-Walker and Sillans, 1961).

In addition to its widespread local use, the species has been long exported to Europe for western medicine in both prescription and herbal markets. The most common use of yohimbine-based prescription drugs today is in the treatment of diabetes-related male organic impotence (Lawrence Review of Natural Products, 1990; Vaughan, pers comm.). Sexual stimulant products available over-the-counter often contain yohimbine. In the United Kingdom, yohimbine-containing drugs have become fashionable as one of the “herbal highs” reported in the British press (Castle, 1997) and yohimbe-based products have long been a common sight in “sex-shops” in Europe (Tyler, 1993).

Pfizer, a United States pharmaceutical company, has recently launched a new pharmaceutical for organic impotence which is not derived from yohimbe. The name of the drug is Sildenafil but is marketed under the name Viagra (Montague, 1997). This drug has been the recent focus of huge media attention and has created massive public interest in the availability of so-called aphrodisiacs and cures for impotence. This interest has had a knock-on effect and has led to a resurgence of sales in more easily-available herbals remedies, in particular those that are yohimbe-based (Laird, pers. comm.).

## **2. Autoecology**

### **2.1. Natural distribution and population structure**

*P. johimbe* is found within the forest type classified by Letouzey (1985) as Atlantic Biafran Evergreen Forest with Caesalpiniaceae, an extensive forest formation extending from South East Nigeria through Cameroon, Equatorial Guinea, Gabon and Congo Brazzaville (Vivien and Faure, 1985). *P. johimbe* is a fast-growing tree but does not reach a great diameter (a recorded maximum of ca. 50 cm dbh). This seems to be a natural feature of the genus and is not regarded as being a direct result of over-exploitation of the larger size class individuals.

*P. johimbe* has been referred to as “common” (Raponda-Walker and Sillans, 1960). However, it would seem that the species, whilst not being rare, is far from being regarded as common. Recent inventory data from Cameroon and Equatorial Guinea suggests that there are, on average, 15 trees >1 cm dbh / ha with only 4 trees >10 cm dbh / ha trees that are potentially harvestable (Sunderland *et al.*, 1997). With this number of trees/ha, we could not support the premise that the species is common.

### **2.2. Reproductive ecology**

The light winged seeds of *P. johimbe* are wind dispersed and their lightness and winged structure mean that they can travel long distances. Consequently, regeneration is not commonly found close to the mother tree and in fact the closest recruit found was 25m from the parent. More commonly, in fact almost exclusively, seedlings were found without the presence of parent trees, indicating long-distance dispersal.

Although the species occurs mainly in closed-canopy forest, light is needed for seed germination and seedling development. Few seedlings survive in closed-canopy forest, except in areas of light to moderate disturbance and the survival rate of seedlings under a closed canopy is extremely low, suggesting that *P. johimbe* is a light demander in the early stages of regeneration. Similar observations have recently been made with *Lovoa trichilioides*, an important commercial timber species (Tchoundjeu, in press).

**Table 1:** Cumulative inventory data of *P. johimbe* from field sites in Cameroon and Equatorial Guinea (Sunderland *et al.*, 1997).

Study site	Vegetation description	Sampling method	Sample area	No of stems >1cm dbh	Stems/ha >10cm dbh
Campo F.R. Cameroon	Early -mid secondary	1000mx10m transect	1ha	0	0
Campo F.R. Cameroon	Mid-late secondary	1000mx10m transect	1ha	1	1
Campo F.R. Cameroon	Closed canopy forest	100mx100m square plot	1ha	16	7
Ntole F.R. E. Guinea	Closed canopy forest	500mx10m transect	0.5ha	10	6
Ntole F.R. E. Guinea	Closed canopy forest (lightly disturbed)	1000mx10m transect	1ha	3	2
Ntole F.R. E. Guinea	Closed canopy forest	1000mx10m transect	1ha	7	2
Angoma E. Guinea	Closed canopy forest (20 yrs post-logging)	500mx10m transect	0.5ha	29	8
<b>AVERAGE NUMBER OF HARVESTABLE STEMS /HA = 4</b>					

### 3. Sustainability

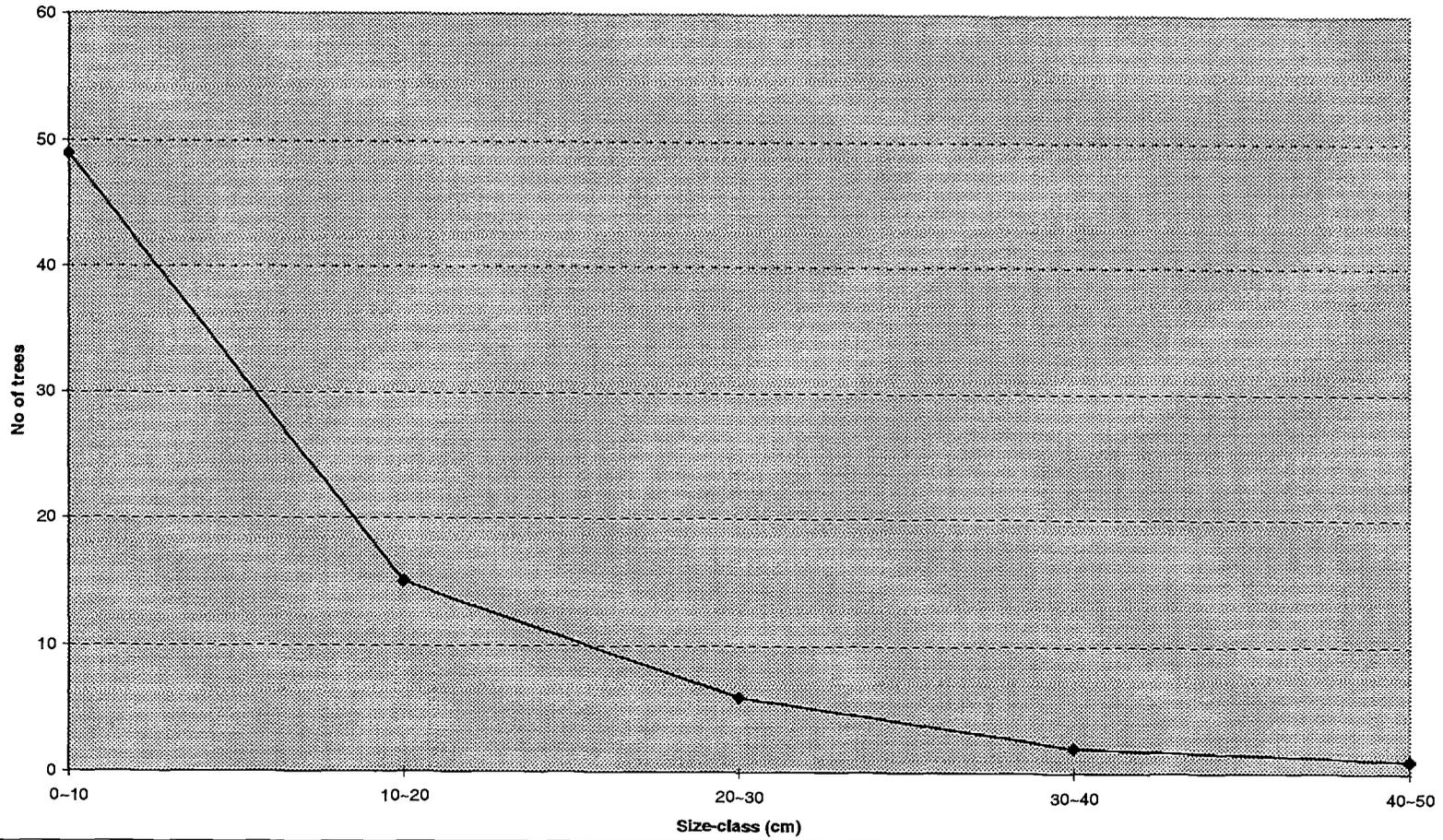
#### 3.1. Current commercial *P. johimbe* bark exploitation practices in Cameroon

All *P. johimbe* bark is currently exploited from wild populations. This exploitation currently takes place exclusively in Cameroon, although interest is currently being shown in the possibility of exploitation in Equatorial Guinea and Gabon. Interestingly, much of the exploitation of *P. johimbe* is related to timber prospecting with individual stems of the species being identified during the inventories preceding exploitation. After the timber harvesting activities are completed, the yohimbe trees are then also felled and stripped, often by the logging company employees.

Currently, Plantecam is the sole supplier of *P. johimbe* bark to Europe and currently supplies around 100 tons annually (120 tonnes in 1996 (Simons, 1997)). Unlike the situation where Plantecam has their own collection teams providing *Prunus africana* bark (up to 33% of the total) for their factory, all of the *P. johimbe* bark is exploited by outside contractors. These contractors are registered local businesses who have licenses to exploit medicinal plants. These licenses are provided by the Forestry Department. (See Box 1.) Plantecam state that they will not accept plant material from companies or individuals without these licenses (Nkuinkeu, pers. comm.).

In actual fact, however, the majority of bark is collected by local people who are paid at the roadside for the delivery of bark. These local people do not have any permits or authorisation to exploit *P. johimbe* and, unbeknown to Plantecam who claim to be following the letter of the law, are supplying bark illegally to the contractors. Thus Plantecam, in turn, may be supplied with illegally exploited bark.

Figure 1. Cumulative size-class distribution curve of *Pausinystalia johimbe* in field sites in Cameroon and Equatorial Guinea





**Figure 2.** Unsustainable exploitation of *Pausinystalia johimbe* (Photo: T. Sunderland).

**Box 1:** *Permis d'exploitation*

The large scale exploitation of non-timber forestry products such as medicinal plants is subject to the acquiring of a *permis d'exploitation*. This permit determines the quantities to be exploited or collected within a specified geographic area. The volume or amount of material allowed to be exploited depends on the desired material (e.g. fruits, bark, leaves etc.). This quota would be set by the Department of Forestry, although base line and monitoring data for estimating potential sustainable yield is woefully incomplete. The length of the exploitation permit would not usually exceed one year (National Forestry Law no. 94/01; *article 56*; October 1994), except by special arrangement. For example, Plantecam has permits for *Prunus africana* exploitation issued for a period of up to three years duration (Cunningham and Mbenkum, 1993). Exploitation permits also apply to special products, which could include medicinal species or those which are of particular interest. Even if special products are found on lands belonging to private individuals, they remain the property of the State, except where the said products have been acquired by the individual concerned.

Prices paid per kilo of bark by Plantecam range from 125-280 CFA / kg, depending on the moisture content, with higher prices being paid for dried bark. However, the price paid at roadside to the local collectors vary from 75 CFA (paid to pygmies who supply fresh bark along the Kribi-Campo road) to 150 CFA to Bulu suppliers at Bivoumba, who dry the bark over meat-drying racks. Recently, the President of the North-West Traditional Healers Association, Chief Fomentum, was asked to supply large quantities of bark to a contractor, to sell on to Plantecam, for 50 CFA / kilo for *P. johimbe* and 75 CFA / kilo for *Prunus africana*. Clearly, the profit-margin for the contractors is high and local people are not receiving a fair price for their work. However, none of the local collectors interviewed were aware of the true price of the bark and thought it worthwhile to collect bark to supply the contractors.

*P. johimbe* bark exploitation is a seasonal activity as the yohimbine levels are highest during the rainy season (Paris and Letouzey, 1960). During the months of May - September, the contractors travel into the areas where *P. johimbe* is known to occur, contacting villagers to exploit the bark directly and promise to return subsequently with transport and payment in two to three weeks. The majority of the contractors have been operating in the same regions for a number of years and use the same local exploiters.

The principles guiding the so-called sustainable exploitation of bark that have been applied to *Prunus africana*, i.e. removal of opposite two quarters of bark and then subsequent removal, years later, of the other two quarters, have not been applied to *P. johimbe*. The bark exploited is often collected from the main stem only (except when the bark is harvested by pygmy exploiters - see below) and not the branches. This is surprising, given that yohimbine occurs in not only both the branches and young stems, but also in the leaves. Often, to increase outputs, the trees are felled and Plantecam themselves admit that during exploitation “..98% of the trees exploited are probably felled” (Nkuinkeu, pers. comm.). According to the majority of informants interviewed, the trees can be harvested when they are around 10cm dbh. Although all stated that it was easier and more economic to harvest from larger diameter trees, these individuals were not so commonly found.

In the field it was explained to us that whilst the *P. johimbe* trees callused well after a small amount of bark removal<sup>1</sup>, removal of large quantities of bark led to an attack by a stem borer which penetrated the unprotected stem, killing the tree. That is why many harvesters preferred to fell the tree, as “the tree would die anyway” (Bivina, pers. comm.). Bakola (pygmy) harvesters, who were commonly employed to harvest yohimbe all along the Edea - Campo road, not only fell the trees but cross-cut them into portable pieces. The bark was removed from the cut logs, carried to the roadside and sold. All the bark from the tree is removed, including that of the branches. The remaining logs were then used for fuelwood (Mana, pers. comm.).

### 3.2. Impacts of exploitation

Despite current levels of exploitation, *P. johimbe* presently has a healthy recruitment and there does not seem to be a problem with regeneration. However, these data are rather deceiving as, although the current regenerative capacity of the species is not yet compromised, removal through felling of reproductive individuals especially at current rates of exploitation in certain areas will ultimately affect future regenerative potential (i.e. less seed trees = less seedlings = reduced recruitment = less future harvestable trees).

### 4. Confusion between *P. johimbe* and *P. macroceras*

Henry (1939), in a study of *Pausinystalia johimbe* and related species concluded that *P. macroceras* contains a number of alkaloids, especially large quantities of the inactive alkaloid yohimbine, which led to *P. macroceras* being named “false yohimbe” (Small and Adams, 1922). Yohimbine itself is present in *P. macroceras*, although in very small quantities. Despite this low concentration of yohimbine, *P. macroceras* bark is widely used as an aphrodisiac throughout its range, especially where *P. johimbe* does not occur (Motte, 1980; author pers. obs.) and it seems the two are used correspondingly as part of local health care strategies (*ibid.*).

In the field, the two species are reputedly distinguished through slash characters. Yohimbine becomes yellow-orange-brown on exposure to light. *P. johimbe* oxidises red-brown very

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<sup>1</sup> A sample of this bark was collected to determine the amount and quality of yohimbine, the results of which have implications for potential sustainable management of wild populations.

slowly and *P. macroceras* oxidising rapidly. However, in the field it is clear that this character is not reliable. With the bark and bole characteristics of both species being highly similar, the two species are almost impossible to tell apart using slash characters. The confusion between the species is not helped by the fact that the two species appear to be highly allopatric, meaning that direct comparison in the field is not often possible. However, the leaves of both species are highly distinctive with *P. johimbe* having sessile, obovate leaves 15-25 cm long, often in whorls of three with distinctive cordate leaf bases, while *P. macroceras* has petiolate, ovoid leaves 6-15 cm long.

More subtle differences between the two species include the fact that the bark of *P. johimbe* is extremely bitter to the taste and easy to peel, whilst *P. macroceras* bark is less bitter and is extremely difficult to peel, often needing beating first to loosen the cambial layer from the sapwood. Interestingly, Plantecam suggested that all *P. johimbe* bark needed to be beaten before being removed. However, our field work did not suggest this was the case and, with all of the *P. johimbe* trees we collected samples from, the bark peeled extremely easily.

Interestingly, of all the different cultural groups interviewed, only one, the Bulu, distinguished between *P. johimbe* and *P. macroceras*, with the former named “crocodile” and the latter “caiman”. The remaining groups, the Fang, Bassa, Bali, Beti, Baka and Bakola did not differentiate between the two species stating that the bark of both have corresponding uses. Even though the Bulu distinguish between the two species, they use the bark of each for the same purpose. Indeed our informant assured us that there was no difference in the effects of bark treatment from each species (Bivina pers. comm.). In addition, it is claimed that *P. macroceras* bark is harvested more often because it is more common.

Given the field evidence and, given that some bark supplied to Plantecam is known to have an extremely low yohimbine content, there can be no doubt that a good proportion (ca. 60-70%) of the bark received by Plantecam is that of *P. macroceras*, which is known to have very low levels and very poor quality yohimbine. With a simple field guide prepared for collectors, it would be a simple task to ensure that all bark received is *P. johimbe* which would both conserve the resource (individual trees of *P. macroceras*) whilst ensuring profitability (gaining higher concentrations of the desired alkaloids from the processed bark).

## **5. Implications for management and sustainability**

### **5.1. Potential for domestication**

Due to the destructive harvesting methods employed and the rapidly-growing market for aphrodisiac remedies, ICRAF have begun a research programme to investigate the potential of *P. johimbe* for domestication and inclusion into their agroforestry systems programme.

One of the greatest dilemmas with initiating a domestication programme for any forest product is whether to begin work that could provide material for a hypothetical future market that could no longer exist when the products reach maturity. In contrast, one could decide that the volatile nature of such markets makes the investment prone to risk and no action is taken inevitably leading to the extirpation of the species. In the case of *P. johimbe*, as for *Prunus africana*, along with the obvious biological urgency, the market seems secure enough in the short-medium term to warrant the development of cultivated systems. If the market no longer exists in the long-term, the species can be used for other purposes such as fuelwood, aside from serving a valuable ecological function.

**Table 2:** Diagnostic bark characters of *P. johimbe* and *P. macroceras* (modified from Small and Adams, 1922).

	<i>P. johimbe</i>	<i>P. macroceras</i>
<b>Macroscopic characters</b>		
<b>Thickness</b>	4-20mm	2-5mm
<b>Outer surface</b>		
<b>Colour</b>	Grey to reddish-brown	Light or dark brown
<b>Surface</b>	Longitudinal furrows; many transverse cracks, 1-2cm apart	Often scraped; longitudinal furrows and ridges; few or curved transverse cracks
<b>Lichens</b>	Grey or white; few or many	Grey, usually numerous
<b>Cork</b>	Thin or thick, often easily detached	Thin, adhering closely
<b>Inner surface</b>		
<b>Colour</b>	Reddish-brown	Dark-brown or reddish-brown
<b>Surface</b>	Finely striated and ridged	Ridged and wrinkled
<b>Fracture</b>	Short, fibrous, sometimes splintery on inside, surfaces soft, velvety	Same as <i>P. johimbe</i>
<b>Microscopic characters</b>		
<b>Cork</b>		
<b>Width of cork</b>	1/20 to 1/3	1/4 to 2/3
<b>Width of cortex (No of cells)</b>	3-30	2-40
<b>Colour</b>	Grey to dark brown	Dark brown
<b>Phelloderm</b>		
<b>No of cells wide</b>	2-12	4-20
<b>Colour</b>	Yellowish grey to reddish brown	Same as <i>P. johimbe</i>
<b>Cortex</b>		
<b>Width of cortex</b>	1/16 to 1/1	1/6 to 1/1
<b>Colour</b>	Yellowish brown to reddish brown	Same as <i>P. johimbe</i>
<b>Medullary rays</b>		
<b>TS inner bast width</b>	1-4 cells	1-3 cells
<b>Regularity</b>	Straight	Straight
<b>TS outer bast width</b>	1-3 cells	1-3 cells
<b>Regularity</b>	Diverging, cells elongating tangentially	Curving irregularly, cells elongate tangentially
<b>Ends</b>	Straight or curved	Often distorted, curved
<b>LS tangential width</b>	1-3 cells	1-3 cells
<b>Depth</b>	6-35 cells	5-20 cells
<b>Shape</b>	Narrow spindle or rectangular	Somewhat rectangular with slightly tapering ends
<b>LS radial depth</b>	8-30 cells	5-20 cells
<b>Bast fibres</b>		
<b>Grouping</b>	Usually in one-cell wide rows, 1-3 occur "beaded", no "twinning" in outer bast	Radial rows 2-3 cells wide common but not "beaded"; "twinning" in outer bast
<b>Diameter</b>	22-29 $\mu$	22-23 $\mu$
<b>Length</b>	0.7-1.6mm	0.6-1.9mm
<b>Shape TS</b>	Rectangular	Rectangular
<b>Shape LS</b>	Long spindle, pointed ends	Spindle with sharply pointed ends
<b>Lumen</b>	Punctiform or sometime linear	Linear or sometime punctiform
<b>Wall</b>	Thick, not striated	Thick, not striated

## 5.2. Vegetative propagation

The stumps of felled damaged individuals of *P. johimbe* are known to coppice well from the point of breakage and these new shoots are often both healthy and prolific. This ability to produce shoots is a positive indication that a great deal of clonal propagation material can be obtained from a few well-selected stock plants and initial vegetative propagation trials have been extremely positive (Tchoundjeu *et al.*, in press).



**Figure 3.** Coppice shoots of *Pausinystalia johimbe* (Photo: T. Sunderland).

## 5.3. Seed propagation

The seeds of *P. johimbe* are orthodox. Such seed is often able to lay dormant in the soil seed bank for some time and germinate only when the red/far red light ratios change, notably when more direct light can penetrate the forest floor. Seed collection and germination tests have indicated that seed propagation is possible, but the young seedlings are prone to “damping off”; a fungal disease that attacks the newly emerged cotyledons. Further research into the optimum methods of seed propagation is continuing.

## 5.4. In-situ management

Whilst it is of course important to initiate a domestication programme for a potentially threatened species such as *P. johimbe*, it is also essential that this is implemented alongside a rational forest management regime. The ecology of *P. johimbe* (fast-growing, reproductively gregarious, light demanding) suggests that, with further work on the potential sustainability of bark harvesting from standing trees, a reasonable assessment could be made regarding the quantities that could be harvested from standing forest.

In addition, it is also essential that local communities benefit from the exploitation of a resource such as yohimbe. In Cameroon, and soon in Gabon and Equatorial Guinea, the

moves towards Community Management of forest resources with a view to sustainability should ensure that the communities managing such resources not only benefit from their exploitation, but are also paid a fair price for the resource. This is not the case at present. *P. johimbe* could undoubtedly provide a good case study for the equitable and sustainable management of such high-value forest products.

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### References

- Ainslie, J.R. 1937. A list of plants used in native medicine in Nigeria. *Imperial Forestry Institute Paper No. 7*.
- Anon. 1922. Replies to Correspondents - How to dose a boar with yohimbe. *Pharm. Jour.* Vol. 55: 578
- Anon. 1982. Scorned African aphrodisiac scores against organic impotence. *Medical World News.* 23:115.
- British Pharmaceutical Codex. 1949. London. pp 949-950.
- Castle, S. 1997. Jail for retailers of "herbal highs". *The Independent.* 24th August.
- Cunningham, A.B. & F.T. Mbenkum. 1993. *Sustainability of harvesting Prunus africana bark in Cameroon: A medicinal plant in international trade.* People and Plants Working Paper #2. Paris, UNESCO.
- Dalziel, J. 1937. *The Useful Plants of Tropical West Africa.* Supplement to: The Flora of West Tropical Africa. Kew, Royal Botanic Gardens.
- Farnsworth, N.R. 1984. The role of medicinal plants in drug development. In P. Kogsgaard-Larsen, S. Brogger Christiansen & H. Kofod. Proceedings of the Alfred Bezon Symposium, Copenhagen.
- Greenish, H.G. 1929. *Materia Medica.* London, J. & A Churchill.
- Henry, T.A. 1939. *The Plant Alkaloids.* London, J. & A Churchill.
- Krakoff, T. 1907. *The Clinical Effects of Yohimbe.* US Dispensary - 19th ed.
- Lawrence Review of Natural Products. 1990. Yohimbe. Facts and comparisons. St. Louis.
- Letouzey, R. 1985. Notice de la carte phytogéographique du Cameroun. *Institute de la Carte Internationale de la Vegetation, Toulouse, France.*
- Mann, J. 1992. *Murder, magic and medicine.* Oxford University Press. pp105.
- Medical Letter. 1968. Afrodex and impotence. *Med. Lett. Drugs. Ther.* 10:97.
- Miller, W.W. 1968. Afrodex in the treatment of male impotence: a double-blind crossover study. *Curr. Ther. Res.* 10:354.
- Montague, A. 1997. Love is here to stay. *The Guardian.* July 15th.
- Morales, A. *et al.*, 1981. Nonhormonal pharmacological treatment of organic impotence. *Jour. Uro.* 128: 45.
- Morales, A. *et al.*, 1982. Yohimbine for treatment of impotence in diabetes. *New Engl. Jour. Medicine.* 305:1221.
- Motte, E. 1980. Les plantes chez le pygmies Aka et les Monzombo de la Lobaye (Centrafrique). *Societe d'etudes Linguistiques et Anthropologiques de France.*
- Nelson, A. 1951. *Medical Botany.* E. & S Livingstone, Edinburgh. pp 426.
- Oliver-Beyer, B. 1986. *Medicinal Plants in Tropical West Africa.* Cambridge University Press. pp 62.
- Paris, R. & R. Letouzey. 1960. Repartition des alcaloides le Yohimbe (*Pausinystalia johimbe*) (K. Schum.) ex Pierre (Rubiaceae). *Jour. d'Agric. Trop. et Bot. Appl.* Vol. 7. No 4-5: 256-258.

- Plantecam. 1993. Pygeum bark and yohimbe received by Plantecam (Mutengene) from 1/7/92 to the 30/6/93. Internal annual report.
- Raponda-Walker, R.A. & S. Sillans. 1961. *Les Plantes Utiles de Gabon*. IRA, Paris.
- Simons, T. 1997. Cameroon Trip Report; 1st-10th May. ICRAF.
- Small, J. & F.M.J. Adams. 1992. Yohimbe bark: Its history and identification in commerce. *Pharm. Jour.* Vol. 108. No. 3051: 282-286.
- Stoffelen, P. 1993. Systematische studie van de Afrikaanse genera *Corynanthe* en *Pausinystalia* (Rubiaceae - Coptosapelteae). PhD Thesis. Katholieke Universiteit, Leuven.
- Stoffelen, P., E. Robbrecht & E. Smets. 1996. A Revision of *Corynanthe* and *Pausinystalia* (African Rubiaceae - Coptosapelteae). *Bot. Jour. Linn. Soc.* 120:287-326.
- Sunderland, T.C.H. A. Njiamnshi, A Koufani, M.-L Ngo-Mpeck, C. Obama & D.F. Njingum. 1997. *The ethnobotany, ecology and natural distribution of yohimbe (Pausinystalia johimbe); An evaluation of current bark harvesting practices and recommendations for domestication and management*. A report prepared for the International Centre for Research in Agroforestry, ICRAF.
- Tyler, V.E. 1993. *The Honest Herbal - A Sensible Guide to the Use of Herbs and Related Remedies*. 3rd ed. Haworth Press, London. pp 327-330.
- Tchoundjeu, Z., M-L. Ngo-Mpeck, & B. Duguma. Main factors affecting the rooting of juvenile cuttings of *Pausinystalia johimbe*, an over-threatened medicinal plant of West and Central Africa (in press).
- Tchoundjeu, Z & R.R.B. Leakey. Vegetative propagation of African mahogany: effects of provenance, substrates, auxins and leaf areas (in press).
- Vivien, J. & J.J. Faure. 1985. *Arbres des forêts denses d'Afrique Centrale*. Ministre des Relations Exterieures Cooperation and Developpement et Agence de Cooperation Culturelle et Technique, Paris.

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- Ba Aloysius Sah, Traditional Healer, Bali, NW Province.
- Dr John Vaughan, Diabetes Specialist, Royal Sussex County Hospital, UK.

# THE CONSERVATION THROUGH CULTIVATION PROGRAMME AT THE LIMBE BOTANIC GARDEN: ACHIEVEMENTS AND BENEFITS

Joseph P. Nkefor, Nouhou Ndam, Paul C. Blackmore and Terry C.H. Sunderland

## Abstract

The Conservation through Cultivation Programme was developed by Limbe Botanic Garden to support the conservation of the rich and fragile biodiversity on Mount Cameroon. Its primary aim is to help conserve wild, threatened economic species by reducing harvesting pressures through the provision of cultivated material. This is undertaken through the implementation of a structured research programme aimed at developing cheap and efficient domestication and cultivation methods for the target species.

This paper will present the methodology implemented by the Conservation through Cultivation Programme and the immediate and long term environmental and social benefits of the work undertaken so far. Some of the relevant problems encountered by the research programme are also discussed.

**Key words:** Conservation, cultivation, non-wood forest products, Limbe Botanic Garden, Cameroon

## 1. Introduction

Mount Cameroon is an area of extremely rich and fragile biodiversity with a large number of endemic plants and animal species. This rich biodiversity is under threat due to habitat destruction caused by rapid conversion of forest into plantations, the encroachment of shifting cultivation and associated bushfires, low-impact timber exploitation and over-harvesting of non-wood forest products such as *Prunus africana*, *Gnetum* spp. (eru), and other species. In response to the latter problem in particular, in 1994 the Limbe Botanic Garden (LBG) developed the Conservation through Cultivation Programme which aims to mitigate some of the impacts of the over-exploitation of NWFPs, whilst contributing to household incomes and ensuring the equitable sharing of benefits from such forest resources.

## 2. Aims and objectives

The aim of the Conservation through Cultivation Programme is to conserve wild populations of NWFPs by reducing the harvesting pressure on them. This is achieved through the following process:

- Developing and promoting cost-effective and scientifically-sound methods of germplasm collection
- Developing simple and effective methods of bulk propagation

- Developing and promoting cost-effective and transferable methods of cultivation
- Establishing accessible means of dissemination to allow local communities to benefit directly from the research

The programme is structured in such a way that these aims are achieved through implementing a coherent research strategy for each target species in a systematic order. The primary research methods include:

- Preliminary research (literature search)
- Field germplasm collection
- Germination and propagation trials
- Distribution and planting
- Characterisation and evaluation
- Publication and dissemination
- Extension

### 3. Methods

#### 3.1. Selection of target taxa

The Programme has strict principles for the selection of target species. These are based on the following social and institutional criteria:

- Demand from local population (villagers, extension workers, farmer cooperatives)
- Wider policy recommendations (e.g. the cultivation of rattans recommended by Project 59 of the National Forestry Action Programme of Cameroon (1996); replanting of *Prunus africana* as stipulated by the Cameroon Forestry Law Article (88) 2 of 1994)
- Requests from collaborating partners (e.g. ICRAF, IPGRI, CDC)

And reinforced by the following biological criteria:

- The taxa must be indigenous and of economic or cultural importance
- The taxa must be harvested directly from the wild
- The taxa must be considered threatened by extreme harvesting pressure, e.g. *Prunus africana*, *Gnetum* spp.

This selection process is augmented by market studies indicating the local demand and the rate of consumption of certain NWFPs, and by discussions with local harvesters through consultations with LBG staff and Mount Cameroon project geographical officers who are in continual close contact with villages in the region.

#### 3.2. Preliminary research

The preliminary research involves an extensive literature search aimed to obtain as much available information as possible on the target taxa. This literature search provides the necessary background for the programme to implement a coherent research strategy for each species selected and particular attention is paid to taxonomic data, abundance and

distribution, and ecological and socio-economic aspects of the species. As the majority of the target species have not been cultivated previously, there is often little access to existing cultivation data.

An eco-geographic survey is also undertaken. This is both a library and herbarium based study of target taxa and aims to produce both a clear taxonomic description of the species concerned and an understanding of the geographical distribution and ecological variation to permit a wide genepool sampling. This study also takes into account the phenology of the taxa to ensure that seed collecting trips can be planned as accurately as possible. The eco-geographical survey is the secret to the success of the collecting mission and essential if we are to obtain as representative a sample as possible of the wild resource in cultivated systems.

### **3.3. Field collection of germplasm and sampling method**

It is important to obtain the largest sample of the genepool as possible. The important principle here is that random samples should be taken from the entire geographical range of the population taking care to target as many ecotypes as possible. For example, in the case of *Prunus africana*, consideration is given to its distribution over distance and altitude. Within these two geographical factors are different ecological conditions giving rise to a wide variety of ecotypes. Great care is taken to maintain the collections separately during the domestication process (Blackmore, 1997). Detailed collection data (provenance data) is obtained during germplasm collection. The information collected must consist of geographical data (altitude, longitude, latitude, soil type, ground conditions, aspect and vegetation type) as well as data concerning the collectors, i.e. collection date, collectors names etc. This information is vital to the conservation and the scientific value of the material.

The quality of the collected germplasm relies heavily on the physical handling of the material during and after collection and the maintenance of the identity of each separate genotype. Every effort is made to prevent the collection from becoming mixed at both the seed and plant stage.

### **3.4 Germination tests and propagation trials**

Propagation and multiplication trials are carried out to identify the most cost-effective methods of mass production. Seed dormancy is one of the greatest problems to the Conservation through Cultivation Programme, especially with many rattan species which often take up to nine months to germinate. However, it is possible to overcome seed dormancy by using a range of pre-sowing treatments. The experimental process to establish which method is required takes a considerable amount of time. Often, as in the case of *Gnetum* spp., cuttings are the most appropriate means of multiplication. Experimenting with the various types of cutting and husbandry regimes entails a substantial amount of trial and error before the most appropriate and transferable methods of propagation are determined.

### **3.5 Distribution and monitoring**

The success of the Conservation through Cultivation Programme depends on effective plant distribution and post-planting monitoring. The majority of the plants produced are made available to local communities at a minimum cost. From experience, it has been found that plants given away for free are often not maintained or valued in the same way as when they are purchased directly. No matter how small the investment, when a plant is purchased it is

highly valued and is often well-maintained. The sale of plant material also helps LBG to recover a small proportion of the investment costs of the propagation and cultivation trials. In many cases, distribution of plant material is undertaken through the Mount Cameroon Project village network as well as through the existing extension services, farmers co-operatives and, more recently, NGOs. A condition of plant distribution through these agents is a requirement by LBG staff to monitor the growth and development of the plants distributed.

### 3.6 Characterisation and evaluation of germplasm held

Characterisation is the observation of characters that are highly heritable and that are maintained in a range of environments. Such characters are important as they determine the qualities of the germplasm, both on a genetic level and on an exploitable level (i.e. high quantities of alkaloid activity for medicinal species; good nutritional value for edible species). Evaluation data is the observation and measurement of how the germplasm interacts with the new environment. Such characters are important as they indicate the survival or loss of certain genotypes and their characteristics in different conditions (Ford *et al.*, 1986) and this rationale forms the basis of the monitoring programme for target taxa by LBG.



**Figure 1.** ICRAF/LBG *Prunus* trials at Tote (Photo: T. Sunderland).

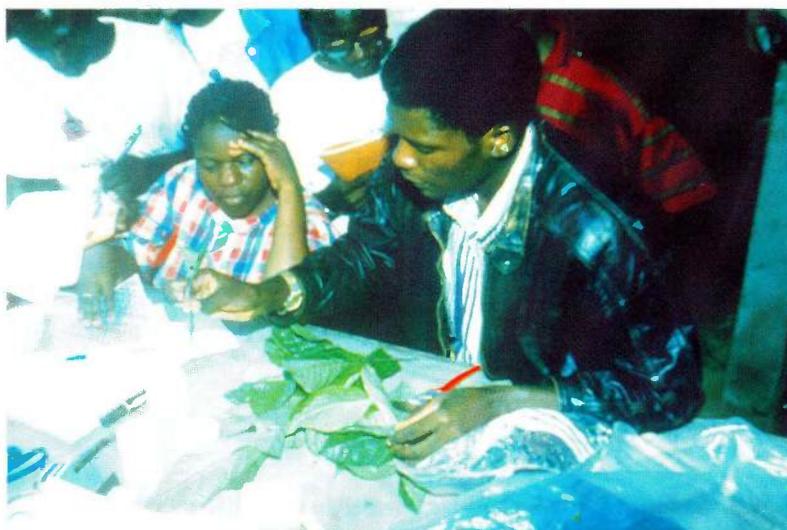
### 3.7. Publication and dissemination

A number of publications have resulted from this work with the intention of disseminating the knowledge gathered during the course of the research (Sunderland and Nkefor, 1997b; Earth Love Fund, 1997)

Dissemination has also taken place through scientific meetings (Sunderland and Nkefor, 1996a; Sunderland and Nkefor 1996b; Sunderland and Nkefor 1997a), as well as through informal presentations of the work at the Limbe Botanic Garden to farmers' groups and extension agents.

### 3.8. Extension

Once appropriate and transferable methods of bulk propagation have been determined for each target species, it is necessary to impart this newly-acquired knowledge to those who would be able to implement it. One of the most important contributions of the programme has been the training of trainers and extension workers in the propagation methods suitable for each species. This training has taken place both on a formal and informal basis and has entailed the training of university/professional students in horticulture and related subjects, including eight students from the Regional College of Agriculture Bambili, the Forestry School Mbalmayo and the University of Buea. Field staff from the Ministry of Environment and Forestry (MINEF) have also been trained.



**Figure 2.** Dissemination of research findings and propagation techniques (Photo: T. Sunderland).

### 4. Achievements of the Conservation through Cultivation Programme

Aside from technical data gathered through the methodology described above, the following achievements have been realised through the use of material resulting from the cultivation programme:

- An experimental 8.8 ha plantation of *Prunus africana* has been established in Moliwe by the Cameroon Development Corporation.
- A further 1.5 ha plantation of *Prunus* has been established by a Women in Development co-operative in the North-West Province of Cameroon. In addition, two hundred assorted timber tree species were also supplied for an agro-forestry programme with the same co-operative. (See Burnley, this volume.)
- One thousand *Prunus* seedlings were supplied to a Women in Development co-operative in Fako Division, South-West Province, Cameroon. They were distributed by the co-operative to many women for small-scale planting on fallow farm areas and to crop association programmes.

- Further *Prunus* material was supplied to the Mbalmayo Forest Research Division to undertake further trials in vegetative propagation.
- The Medicinal Plant Area in the Limbe Botanic Garden was further developed using material grown through the Conservation through Cultivation Programme. An educational booklet about this collection has recently been published (Laird *et al.*, 1997).
- An intensive domestication trial area of eru (*Gnetum* spp.) has been established in LBG for research and education (Ndam, *et al.*, 1998).
- A rattan arboretum has been established in LBG for taxonomic research in order to monitor the changes in morphology between juvenile and adult forms of the species. This work has important economic and development implications. (See Sunderland, this volume.)
- The Useful Products Theme in LBG has been augmented by material grown through this programme. This has led to the development of educational trails through the Garden including a kitchen trail, industrial trail and a medicinal trail with associated published literature.

## **5. Benefits of CTC Programme**

### **5.1 Benefits for local people**

In summary, this programme has led to the following benefits for local people:

- The supply of plant material for which there is a guaranteed income from well-established and stable markets.
- The economic empowerment of local people by providing the means by which they can enter the lucrative markets of such products such as *Gnetum* spp. and *Prunus africana* through supply, which has been traditionally denied them through the uncontrolled exploitation of such material from the wild, predominantly by outside parties.
- An increased diversification of products grown by both individuals and groups leading to greater crop diversification and hence economic security.
- In many cases, a guaranteed supply of raw material ensures that price fluctuations are minimised. Hence those crops bought in markets by the vast majority of urban people in particular (*Gnetum*, *Cola* spp., etc.) remain affordable and within the price range of the majority of families.
- Traditionally in SW Province, it has been forbidden for women to own land directly. However, with the formation of women's co-operatives, they have been able to purchase or obtain land for long-term cultivation (Burnley, this volume). In Cameroonian common law, planting an economic tree on a piece of land implies tenure over that land. The Conservation through Cultivation Programme has enabled the empowerment of women, through the supply of economic species.

- The use of LBG as an educational resource has been highlighted, benefiting both visitors and recipients of current literature.

## 5.2 Environmental benefits

The corresponding environmental benefits may be summarised as follows:

- The long term benefit is that harvesting pressure on selected wild populations will be significantly reduced with alternative supplies coming from cultivated sources. The benefits are not only confined to individual taxa but also through the maintenance of ecological integrity. For example, the continual felling of *Prunus africana* in the wild to exploit the maximum bark yield causes large and discontinuous gaps in the forest, affecting dynamic processes.
- Individual taxa are protected from serious levels of endangerment by over-harvesting through *ex-situ* conservation efforts and a certain degree of domestication. This is the case at both species, provenance and genetic levels.
- Planting trees on otherwise fallow areas has had a direct impact on the amount of reforestation in SW Province, both at a commercial and subsistence level. Greater potential yields per hectare are anticipated through the low input/high output systems encouraged.
- Mixed cropping with tree species and herbaceous agricultural crops mimics far closer natural processes, with a multi-storey canopy. This has a direct positive impact on soil erosion, with a corresponding increase in species/ha, thus encouraging a more balanced, albeit impoverished, ecosystem.
- Planting within the designated themes of LBG highlights the institutional policy of presenting the inextricable link between plants and people.

## 6. Problems encountered

Initial problems have centred on the technical question of determining the optimum method of bulk propagation for each target taxa. To solve these problems, variations in approach are developed, i.e. if seed propagation is a problem, clonal propagation is adopted.

The distribution of plant material has been hampered by the fact that many local farmers groups, NGOs and even extension agencies have no access to transport and are unable to facilitate the movement of plant material from the LBG nursery to the planting site. The ODA component of the Limbe Botanic Garden has provided significant support to this, although no previous budgetary allocation had been made for this additional expenditure.

## 7. Threats to success of the CTC programme

- Change of demand for target taxa due to new tastes or change in market requirements
- Economic instability, e.g. programme funding
- Loss of good genetic material through genepool erosion

## 8. Additional comments and proposed next steps

The next step of the Programme is to continue to identify suitable species to continue and augment the work undertaken so far and to use the expertise gathered for the benefit of other threatened species. Equally important is the monitoring of the existing plantings, especially in plantation situations, to determine the viability of such an approach. A monitoring programme has been established by LBG and is at the implementation phase. For many of the target taxa a cost-benefit analysis should be undertaken to determine the economic viability of the cultivation of such products.

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## References

- Blackmore, P.C., N. Ndam & J.P. Nkefor. 1997 *The conservation through cultivation programme policy of the Limbe Botanic Garden*, October 1997.
- Cheek, M. 1992. Outline botanical survey of the proposed Etinde Forest Reserve in S.W. Cameroon. Overseas Development Administration/Government of Cameroon.
- Earth Love Fund. 1997. Bark from Cameroon. *Earth Love Fund Newsletter*. No.1.
- Ford-Lloyd, B. 1986. *Plant Genetic Resources: An introduction to their conservation and use*. Edward Arnold Publishers Ltd, London, UK.
- Laird, S.A. with M. Betafor, M. Enanga, C. Fominyam, M. Itoe, E. Litonga, J. Mafani, J. Menyoli, J. Meseke, W. Mukete, M. Motia, P. Ndumbe, J. Nkefor, J. Nning, N. Ndam, T. Sunderland, P. Tchouto, & M. Wana. 1997. *Medicinal Plants of the Limbe Botanic Garden*. Limbe Botanic Garden, Cameroon.
- Ndam N., J.P. Nkefor & Blackmore P.C. 1998. Domestication of eru (*Gnetum africanum* and *G. buchholzianum*), a threatened wild forest vegetable of West and Central Africa [in press].
- Nkefor J.P., N. Ndam, P.C. Blackmore & E.A. Ebile. 1997. Conservation of *Prunus africana* (Hook.f) Kalkman: Opportunities for agroforestry and plantation development. Paper presented to the workshop: The conservation of *Prunus africana* on Mount Cameroon. Limbe Botanic Garden, December 1997.
- Sunderland, T.C.H. & J.P. Nkefor. 1996a. Conservation through cultivation: The propagation of *Prunus africana* (Hook.f.) Kalkman. Paper presented to the workshop: The conservation of *Prunus africana* on Mount Cameroon. Limbe Botanic Garden, 16-17 February.
- Sunderland, T.C.H. & J.P. Nkefor. 1996b. Conservation through cultivation, a case study: *Prunus africana*. Paper presented to: International workshop on the commercial production of indigenous plants as phytomedicines and cosmetics. Lagos, Nigeria, 24-25 June.
- Sunderland, T.C.H. & J.P. Nkefor. 1997a. Trees as crops: The case of *Prunus africana*. Paper presented to the Tropical Agriculture Association seminar; Trees as crops. St Anne's College, Oxford, UK, 20-21 September.
- Sunderland, T.C.H. & J.P. Nkefor. 1997b. Conservation through cultivation a case study: The propagation of *Pygeum (Prunus africana)*. *Tropical Agriculture Association Newsletter*. December.

# RECENT RESEARCH INTO AFRICAN RATTANS (PALMAE): A VALUABLE NON-WOOD FOREST PRODUCT FROM THE FORESTS OF CENTRAL AFRICA

Terry C.H. Sunderland

## Abstract

Four genera, representing 16 species, of rattan occur in West and Central Africa. African rattans 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 rattan species are used locally for a multiplicity of purposes, two widespread and common species, *Laccosperma secundiflorum* (formerly *Ancistrophyllum*), and *Eremospatha macrocarpa*, are favoured throughout the region and are integral to both subsistence-level and commercial utilisation.

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 greater role within the regional NWFP sector. However, the development of the rattan resource in Africa has long been hindered by a lack of basic knowledge about the exact species used, their ecological requirements and hence appropriate management strategies that might be implemented to ensure sustainable exploitation. As increased interest is being shown in the potential role of NWFPs to contribute to the conservation and development paradigm, rattan has been one of the oft-mentioned products that could be developed and promoted in a meaningful way. Because of this interest, recent work by the African Rattan Research Programme has concentrated on the taxonomy, ecology and utilisation of these taxa; baseline research that is critical for the development and promotion of any high value NWFP.

**Key words:** Rattan, climbing palms, conservation and development, NWFP.

## 1. Introduction: The trade in rattan

The international rattan trade is currently worth some US\$ 6.5 billion a year (ITTO, 1997) with the majority of this trade concentrating on species of Asian origin. In the past ten years, restrictions in the trade of raw cane by some of the larger supply countries, notably Indonesia, has encouraged rattan dealers and gross users such as China and the Philippines to investigate non-traditional sources of rattans, predominantly Indo-China, Papua New Guinea and more recently, Africa. Some raw cane has been recently exported from Ghana and Nigeria to South East Asia. In addition, trade within and between countries is reported to be growing significantly across West and Central Africa (Falconer, 1994; Morakinyo, 1995). However, as this trade grows, the pressure on remaining wild populations also increases and a number of workers report the increasing scarcity of rattans and the associated market implications (Pokam-Wadja, 1979; Shiembo, 1986; Defo, 1997; Sunderland, 1998).

Historically, there has been a significant and proven trade in African rattans. Cameroon and Gabon supplied France and its colonies (Hedin, 1929), and Ghana (formerly the Gold Coast) supplied a significant proportion of the large UK market in the inter-war period (Anon., 1934). The export industry was not restricted to raw cane and in 1928 alone over 25 000 FF worth of finished cane furniture was exported from Cameroon to Senegal for the expatriate community there (Hedin, 1929).

More recently, an initiative promoted by UNIDO in Senegal was exploiting wild cane for a large-scale production workshop and export enterprise (Douglas, 1974). After managed exploitation, replanting was undertaken using seedlings and wildings grown on in nurseries. There is no information as to the status of the workshop and associated activities today.

## 2. The African rattans - biology

Rattans are climbing palms (family, Palmae) that belong to the sub-family Calamoideae (Uhl & Dransfield, 1987). The Calamoid palms are characterised by distinctive scaly fruits and the sub-family includes not only rattans but also *Raphia*, another African taxa of considerable economic importance. Worldwide, there are estimated to be around 650 species within the Calamoideae belonging to twenty-two genera (Uhl and Dransfield, 1987). The majority of these genera occur in the humid tropical forests of south and south-east Asia, Malaysia, and the west Pacific. Indeed, the word rattan is derived from the Malay “rotan” meaning, literally, “climbing palm”.

In Africa, there are around 16 species of rattan, representing four genera. Three of these, *Laccosperma*, *Eremospatha* and *Oncocalamus* are endemic to Africa and possess a unique morphology to that of the Asian taxa. The species of these genera climb with the aid of an extension to the leaf called a cirrus which is often up to 2-3m long. The cirrus possesses large grapnel hooks which are modified leaves and these aid the progress of the rattan into the canopy. These hooks are called acanthophylls. The fourth genus present in Africa, *Calamus*, is specifically an Asian genus with over 370 species there and only one highly variable species in Africa (Uhl and Dransfield, 1987). *Calamus deërratus* differs from the other African taxa in that it climbs with the aid of a flagellum, a long appendage arising directly from the stem that is armed with small recurved prickles, the whole representing a modified sterile inflorescence.

## 3. Ecology and distribution

Rattans in Africa grow in a wide range of ecological conditions. The majority of the species naturally grow in closed tropical forest and are early gap colonisers. Because of this they are extremely light demanding and respond well to a reduction in the forest canopy. Increases in forest disturbance, such as logging activity, encourages the regeneration of rattans and they are often a common feature along logging roads and skid trails. For some rattans such as *Oncocalamus*, their light demanding characteristics are such that they are often the earliest colonisers of heavily disturbed areas. Other species of rattan, notably *Calamus deërratus*, grow in swamps or alongside river banks prone to flooding whilst other species, such as *Eremospatha hookeri*, are highly shade tolerant and grow under the forest canopy.

Even after germination, rattan seedlings can remain on the forest floor for some time, waiting for the optimum light conditions needed to begin the long journey to the canopy. High numbers of seedlings of light demanding species in particular are a common component of closed forest. The seeds of most rattans are dispersed mainly by hornbills but also by some primates, the drill and mandrill (two species of forest primate related to the baboon), chimpanzees and gorillas, and are often scattered far from the mother plant. However, significant germination also occurs near to the parent plants through natural fruit fall and further predation by rodents accounts for some additional, although limited, dispersal. Interestingly, despite intensive field work and herbarium collection in the past two years, there appears to be no obvious phenological pattern to flower development and seed production for the majority of the species.

Because of their proclivity for the colonisation of recently-disturbed forest, rattans are widespread throughout West and Central Africa and are a common component of the forest flora. Some species, such as the two main commercial species, *Laccosperma secundiflorum* and *Eremospatha macrocarpa*, have large ranges and occur from Liberia to Angola, whilst *Calamus deerratus* occurs from Côte d'Ivoire to Kenya. In terms of diversity, the greatest concentration of rattan species is found in the Guineo-Congolian forests of Central Africa. Over 90% of all the known rattan species occur in Cameroon and during a recent survey of the small territory of Rio Muni in Equatorial Guinea (an area of only 26 000 km<sup>2</sup>), eleven species of rattan were recorded; 70% of the total number known to occur on the whole continent (Sunderland, 1998).

#### **Box 1. The African Rattan Research Programme**

The African Rattan Research Programme is a multi-disciplinary initiative of the Royal Botanic Gardens, Kew, and University College, London, in close collaboration with a number of local institutions including the Limbe Botanic Garden, Cameroon and the National Herbarium of Equatorial Guinea. The Programme's aim is to undertake a regional (Central and West Africa) survey of the biology, distribution and utilisation of African rattans to assess their role in indigenous management systems and the regional forest economy, as well as their potential to contribute to the thriving world export market. It is hoped that this information will provide the basis for further development of the rattan resource by conservation agencies, community-based research initiatives and for-profit concerns.

However, despite the relative abundance of rattans throughout West and Central Africa in areas where large quantities of cane are sold and processed, such as Yaoundé in Cameroon and Bata in Equatorial Guinea, over-harvesting and poor management practices are causing considerable local scarcity. Many of these urban centres are currently experiencing significant price increases of raw cane due to the mounting costs of transportation (Defo, 1997; Sunderland, 1998).

#### **4. The importance of basic ethnobotany and taxonomy for conservation and development**

The long flexible stems of rattan make it ideal for furniture, basket making and a multiplicity of other uses. Rattan canes are used extensively across West and Central Africa by local communities and play an important role in indigenous subsistence strategies for many rural populations. The range of indigenous uses of rattan canes is vast; from baskets to beds; from fish traps to furniture; from crossbow strings to fishing rods; from food to medicine (author pers. obs). Despite these many uses, there is a common misconception among development agencies that all rattans are useful, and therefore have potential commercial applications. Recent work has highlighted that while there may indeed be substantial spontaneous use for many species, only two species, the large-diameter cane *Laccosperma secundiflorum* and the small diameter cane, *Eremospatha macrocarpa*, form the basis of both subsistence and commercial-level utilisation in Central Africa (Morakinyo, 1995; Sunderland 1997a; Trefon and Defo, 1998; Sunderland 1998).

It is only through a thorough understanding of both ethnobotany and taxonomy that meaningful development of the rattan resource can take place. Until recently, very little was known about the taxonomy of the African rattans and estimates of species numbers ranged from 12 or so (Dransfield, 1982) to 30 or more (Beccari, 1908) and in Africa the name rattan became ubiquitous for all climbing palms and their presumed utilisation; hence the lack of distinction between species and the misunderstanding that "all rattans are useful". This

situation prevailed until recently, despite the calls of many palm workers that a thorough understanding of the taxonomy and utilisation of the African rattans should precede any development of the resource (Fosberg, 1960; Tomlinson, 1962; Moore, 1971; Letouzey, 1978; Shiembo, 1987; Thomas *et al.*, 1989; Dransfield, 1993; Morakinyo, 1994; Tuley 1995 and 1996).



**Figure 1.** *Laccosperma secundiflorum*, a light-demanding species of rattan preferred for its large diameter stems. (Photo: T. Sunderland).

The poor knowledge of the African rattans may be best explained by:

- The paucity of material held in botanical collections: rattans are notoriously unpleasant to collect because of the fiercely spiny leaf sheaths and barbed climbing whips. The frequent presence of ants amongst the spines and bee nests higher in the crown mean also that attack by ants and bees is a common occurrence for collectors and harvesters (Falconer, 1994).
- The considerable morphological variation between juvenile and mature canes of the same species: this is often evident within single clumps. Species descriptions have been based on juvenile herbarium material of previously described species. For example, *O. acanthocnemis* is undoubtedly a juvenile form of *O. mannii* (Russell, 1968).
- The considerable infraspecific variation throughout the geographic range of the rattan taxa: some species, notably the genus *Calamus*, have been split based on undoubtedly natural geographic variation (Beccari, 1908).

Recent work by the African Rattan Research Programme has concentrated on addressing this situation by undertaking an intensive programme of botanical collection of all species of

rattan. To ensure that the research is as comprehensive as possible, the programme is attempting to undertake collections in as many areas of West and Central Africa as is feasible. To date, extensive surveys have been undertaken in Cameroon, Equatorial Guinea (Rio Muni) and SE Nigeria with further field work planned for Bioko (Equatorial Guinea), the Niger Delta, Ghana and Gabon during the next twelve months. The importance of this field work cannot be over emphasised. The taxonomic confusion surrounding the African rattans has been clarified somewhat and the field study has provided a clear understanding of rattan utilisation in terms of which species have potential commercial application.

**Table 1.** Currently recognised genera and species of African rattans.

Genus	Species	Authority
<i>Calamus</i>	<i>deërratus</i>	G. Mann & H. Wendl.
<i>Laccosperma</i>	<i>secundiflorum</i>	(G. Mann & H. Wendl.) Kuntze
	<i>acutiflorum</i>	(Becc.) J. Dransf.
	<i>laeve</i>	(G. Mann & H. Wendl.) Drude
	<i>opacum</i>	(G. Mann & H. Wendl.) Drude
<i>Eremospatha</i>	<i>cabrae</i>	Wilde.
	<i>cuspidata</i>	(G. Mann & H. Wendl.) H. Wendl.
	<i>hookeri</i>	(G. Mann & H. Wendl.) H. Wendl.
	<i>laurentii</i>	Wilde.
	<i>macrocarpa</i>	(G. Mann & H. Wendl.) H. Wendl.
	<i>haullevilleana</i>	Wilde.
	<i>wendlandiana</i>	Becc.
	<i>sp. nov.</i>	
<i>Oncocalamus</i>	<i>mannii</i>	(G. Mann & H. Wendl.) H. Wendl. & Drude
	<i>sp. 1.</i>	
	<i>sp. nov.</i>	

### 5. The use of folk taxonomy

The value of folk taxonomy has long been recognised and has often been adopted into Linnaean-based classification (Berlin, 1992; Cunningham, 1994). However, both folk taxonomy and customary knowledge of important plant species remain under-utilised in conservation and management strategies for both wild and crop plants, yet knowledge of local nomenclature, and often use and management, is integral to the understanding of the resource (Berlin, 1992).

During the course of the field work undertaken so far, a number of indigenous classification systems throughout the Central African region have been studied. As there are over 230 linguistic groups in Cameroon alone, this has not been a straightforward process. However, as discussed below, this activity has highlighted the complementarity between the study of local classification and nomenclature alongside classical Linnaean taxonomy. Of immense

assistance to the study is the fact that because of the high level of spontaneous use, many of the species are ascribed local names.

In many dialects, one rattan species can have two local names based on the usage of the plant part used highlighting the different properties of juvenile and mature stems. For example, in the Fang/Bulu tribal group of southern Cameroon, Equatorial Guinea and Gabon, *Eremospatha macrocarpa* and *Oncocalamus* sp. have different names for juvenile - (asalong) and mature stems (ongam). Differentiation is also often made between the raw cane and the cleaned product e.g. the stems of wild *Laccosperma secundiflorum* are termed 'aka' prior to harvesting and 'nkan' after cleaning. In addition, use of umbrella terms such as 'nlong' or 'melong' for juvenile forms of *Eremospatha macrocarpa* and *Oncocalamus* sp., for two distinct species led many workers not to differentiate between these species during resource inventories (van Dijk, 1995) despite one species having considerable economic value and the other being of little value. In contrast, the use of local nomenclature has helped clarify the taxonomic differences between species such as *Laccosperma secundiflorum* (aka, nkan, meka) and *L. acutiflorum* (ekwass), two morphologically similar species but the latter is not utilised on any level by local people.



**Figure 2.** Rattan plays an integral role in indigenous subsistence strategies. Fish trap from Equatorial Guinea. (Photo: T. Sunderland).

The understanding of folk classification for African rattans has been crucial in the determination of species delimitation, through an understanding of the radical changes in morphology from the juvenile to adult forms for most species, but also through the utilisation both of preferred species for large-scale subsistence and commercial purposes but also for more limited spontaneous use.

**Table 2:** Fang/Bulu names for rattans in southern Cameroon and Rio Muni, Equatorial Guinea.

<i>Laccosperma secundiflorum</i>	aka, nkan, meka
<i>L. acutiflorum</i>	ekwass
<i>L. laeve</i>	ndele
<i>L. opacum</i>	npue-nkan
<i>Eremospatha macrocarpa</i>	melong, asa-nlong, ongam
<i>E. laurentii</i>	ebuat
<i>E. wendlandiana</i>	akot
<i>E. cuspidata</i>	ndera
<i>Oncocalamus sp. 1</i>	melong, asa-nlong, ongam

## 6. Harvest and management of the wild resource

Harvesting rattan is currently undertaken solely from the wild and is an unpleasant and often dangerous occupation with dead branches being dislodged from the canopy, as well as ants and wasps being disturbed. The raw cane is bundled and then head-portered out of the forest and either used at the village site or transported further afield to urban centres of production. The majority of harvesting, for commercial trade in particular, is undertaken by individuals, usually farmers, hunters or other people primarily involved in other occupations (see Defo, this volume). Rattan harvesting provides an invaluable source of extra revenue, especially at time 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.

In general, harvesters collect cane from the same area of forest. On each visit, if the harvester is not local to the area, the Chief of the local village is often paid a small retainer for access to the forest. Through their regular trips to the forest, many harvesters know the position of each clump that is potentially harvestable and prefer to collect as close to a motorable road as possible to avoid head-portering the bundled cane too far. 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. This is especially the case where local scarcity is forcing harvesters to cut cane further from many urban centres.

From each rattan clump, harvesters tend to cut only the mature canes; young stems are often left and can be harvested during a later visit. The stems selected are those with no lower leaves and often only the bottom 6m (2 lengths of cane) are cut and harvested. This is because the living nodes provide a considerable obstruction when the cane is split and so the remaining 30m or so of each mature stem is left in the canopy. Previously harvested rattan clumps are often marked by the presence of many dry stems in the canopy. The major disadvantage to this harvesting procedure is that, with the top sections of the cut stems remaining *in situ*, there is little or no light penetration to the clump. This often means the rhizome has little or no regeneration capacity and, when all of the adult stems have been cut, the clump often dies. However, in some areas in South West Cameroon and South East Nigeria, there is some level of management of wild rattan. Often, the cut stems are also removed to deliberately allow adequate light penetration which is sufficient for the clump to regenerate. The same clump can then be harvested again, 3-5 years later. Some clumps have been known to have been harvested up to four times (author, pers. obs.).

Many harvesters interviewed during the course of our field work have lamented the fact that in the immediate vicinity of many urban centres where indigenous management of the resource is not practised, they were having to travel further and further into the forest to obtain sufficient quantities of raw cane. As discussed above, this added portorage is slowly causing price increases of raw cane. The lack of management of rattan in some areas is undoubtedly due to the lack of tenure or ownership of many forest products *per se*, and as such, are considered as an open access resource. The majority of rattan harvesters believe that even if they did manage their wild rattan clumps there is no guarantee that somebody else would not come and harvest instead.

The African Rattan Research Programme is undertaking long-term monitoring of the potential yields and growth rates of rattan to determine possible levels of sustainable harvest of the commercial species of rattan. Table 3 shows the potential yield and value of a one-off harvest from selectively-logged forest in southern Cameroon although this figure is much less than estimated projections of income from the harvest of rattan from the forest of SE Asia (Bøgh, 1996). Future estimates of off-take will include a consideration of the growth rates for each species; information that is essential in order to achieve and maintain levels of economically and biologically sustainable exploitation (Peters, 1996).

**Table 3.** Yield and potential value of one-off harvest of *Laccosperma secundiflorum* in 1 hectare of selectively-logged forest, Campo, Cameroon.

Total no. of harvestable stems	Average stem length (m)	Total harvestable stem length (m)	Market value
56	21	1,180	78 700 CFA (US\$132)

As well as taking into consideration the ecological and market factors of the rattan resource, ultimately sustainability is also dependent upon the issues of tenure and long-term control over and benefits from that resource (Cunningham, this volume). Recent forest legislation in Cameroon now allows for the community management of forest resources to ensure that forest communities benefit from the management and income from those resources. Similar legislation will soon also be in place in Equatorial Guinea and Gabon. The empowerment of rural communities through recognising of community forests as a legal entity will undoubtedly provide the impetus to the undertaking of the baseline biological and ecological research needed for sustainable resource management. For example, in Gabon, local scarcity of commercial quality rattan has forced many harvesters to collect cane further into the forest where local communities exert strong resource rights over much of this forest. These communities now benefit from these rights both in monetary terms (harvesters pay a fee to collect on communal forest lands) as well as ensuring that harvesting is undertaken with regard for the future resource through monitoring and control of the harvesting process (Profizi, this volume). Without doubt, as a high value NWFPP that is capable of rapid regeneration, rattan will play an integral role within the management of community forests.

## 7. Local trade

Across the Central African region, the unit of trade for commercial cane is the “packet”. For the large diameter cane (*Laccosperma secundiflorum*) a packet represents twenty stems, with each stem being 3-4m in length. For the small diameter cane (*Eremospatha macrocarpa*) a packet equals twenty stems of 5m length. In general, however, the harvester is paid per stem and, depending on quality, each stem (of both species) is worth between 100 CFA and 200 CFA (US\$ 0.16 - 0.32). For very large diameter stems of *Laccosperma secundiflorum*, the

price per stem can be 250 CFA to 300 CFA (US\$0.40 - 0.48). In general, a good harvester can cut around 140 stems a day, providing a potential daily income of 35 000 CFA (US\$ 58.50). When the average daily wage in Cameroon is at present 1 500 CFA (US\$ 2.50), this represents a significant income.

Large quantities of raw cane enter the urban centres of Central Africa each day (Trefon and Defo, 1998; Sunderland, 1998). An attempt was recently made to quantify the trade in Bata, Equatorial Guinea, through the interview of a sample of artisans and rattan traders (Sunderland, 1998). Artisans were selected to represent as wide a range of workshops as possible, from the smallest operator to the largest. All of the artisans encountered were male and generally under the age of forty. The older men in the business are responsible for the design and production of the furniture and generally, the young boys (“apprentices”) provide labour for the laborious task of cleaning and preparing raw cane for production, as well as basic weaving and other time-consuming activities.

**Table 4:** The artisans of Bata, Equatorial Guinea, and raw cane quantities used per month.

Company	No. of workers	Amount of cane used per month	Value CFA
AFROM GUINEA	20+	360 packets (7,200 stems)	1 440 000
Estabon OVONO	7	120 packets (2,400 stems)	480 000
Crisantos OBIANG	10	75 packets (1,500 stems)	300 000
S.A.G.E <sup>2</sup> .	5	40 packets (800 stems)	160 000
Antonio A. NGUEME	3-4	40 packets (800 stems)	160 000
Thomas OBIANG	2	20 packets (400 stems)	80 000
Fernando EDU	5	12 packets (240 stems)	48 000
ANISETTO	2	7 packets (140 stems)	28 000
Pedro ESONO	3	6 packets (120 stems)	24 000
Martin MBO	3	5 packets (100 stems)	20 000
		<b>TOTAL =</b>	<b>2 740 000</b> <b>(US\$4 560)</b>

Almost without exception, the artisans stated that the demand for rattan was increasing and a much greater amount of cane is being processed in Bata today than was being worked five or ten years ago. This is also the case in other high-consumption areas such as Douala and Yaounde in Cameroon (Defo, 1997; Trefon and Defo, 1998) and Lagos, Nigeria (Morakinyo, 1995). The high value of rattan indicates that, as a non-wood forest product, it compares favourably with other forms of forest extraction and, whilst quantitative data for other NWFPS is incomplete, rattan exploitation and trade is probably one of the most important sources of forest-based revenue outside of the bushmeat trade and commercial timber exploitation (Ndoye, 1994; Sunderland, 1998).

## 8. Propagation and cultivation

Rattans are harvested almost exclusively from wild populations in Africa and elsewhere. In some areas of SE Asia, rattan is 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, although the ecological and social factors prevalent there are favourable to a cultivated and managed rattan resource.

<sup>2</sup> Societe Artisanal de Guinea Ecuatorial.

Recent research by the African Rattan Research Programme, in collaboration with the Limbe Botanic Garden, Cameroon, has initially concentrated on the aspects of seed technology through a series of propagation trials, aimed at breaking the prolonged germination of the seed of many of the African taxa. 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). Growth rates as well as the economic viability of cultivating an African rattan in a plantation system such as this will be monitored and assessed during the seven-year trial period. Further on-farm trials will take place as planting material becomes available with the aim of introducing the commercial species of African rattan into agroforestry systems. This work will be undertaken in collaboration with the International Centre for Research in Agroforestry (ICRAF).

In 1995, a rattan arboretum was established at the Limbe Botanic Garden and now has good semi-mature specimens of a number of species. The intention of this living collection is to monitor changes in morphology as the plants develop from juvenile to mature providing an invaluable taxonomic, as well as an educational resource.

## 9. Conclusion

Within the current milieu of forestry reforms taking root across Central Africa, allowing for direct community forest control and access through applied resource management regimes, as well as the inclusion of rattan in small-scale agroforestry systems, African rattans could provide a real opportunity for the development of a non-wood forest product that would make a meaningful contribution to forest conservation whilst augmenting rural incomes. There is also considerable scope for the African taxa to be introduced to the thriving world rattan market, further increasing the potential growth of forest-based economies.

## References

- Anon. 1934. *Shipments of rattans to the UK and USA from the Gold Coast*. Gold Coast Forestry Department Annual Report.
- Beccari, O. 1908. Contributo alla conoscenza delle "Lepidocaryeae" Africane. *Webbia*. Vol. 3: 247-294.
- Berlin, B. 1973. Folk systematics in relation to biological classification and nomenclature. *Ann. Rev. Ecol. Sys.* Vol. 4: 259-271
- Berlin, B. 1992. *Ethnobiological classification - Principles of categorisation of plants and animals in traditional societies*. Princeton University Press.
- Bøgh, A. 1996a. Abundance and growth of rattans in Khao Chong National Park, Thailand. *Forest Ecology and Management* 84: 71-80.
- Cunningham, A.B. 1994. The role of ethnobotany and customary knowledge in the conservation and use of plants. *Strelitzia* pp 141-146.
- Defo, L. 1997. *La filière des produits forestiers non-ligneux: l'exemple du rotin au Sud-Cameroun*. Dept. of Geography, University of Yaounde.
- Dijk, H. van. 1995. Assessment of the abundance and distribution of non-timber forest product species. Intermediate Report: Tropenbos - Cameroon Programme.
- Douglas, J.S. 1974. Utilisation and industrial treatment of rattan cane in Casamance, Senegal (Return Mission). United Nations Industrial Development Organization.
- Dransfield, J. 1982. Nomenclatural notes on *Laccosperma* and *Ancistrophyllum* (Palmae: Lepidocaroidae). *Kew Bull.* 37 (3).
- Dransfield, J. 1988. Prospects for rattan cultivation. In M.J. Balick. *The Palm - Tree of Life: Biology, utilization and conservation. Advances in Economic Botany* 6: 190- 200.

- Falconer, J. 1994. *Non-timber forest products in southern Ghana - Main report*. Natural Resources Institute.
- Fosberg, F.R. 1960. Random notes on West African palms. *Principes*. Vol. 4: 125-131.
- Godoy, R. 1992. Raw Materials for Craft Industries: The case of rattan. In T. Panyatou & P. Ashton. *Not by timber alone: Economics and ecology for sustaining tropical forests*. Island Press.
- Hedin, L. 1929. Les Rotins au Cameroun. *Rev. Bot. Appl.* Vol.9: 502-507.
- International Tropical Timber Organization. 1997. Bamboo & Rattan: Resources for the 21st Century? *Tropical Forest Update*. Vol.7. No.4.
- Moore, H.E. 1971. Wednesdays in Africa. *Principes*. Vol. 15: 111-119.
- Morakinyo, A.B. 1995. Profiles and pan-African distributions of the rattan species (Calamoideae) Recorded in Nigeria. *Principes*, 39(4), pp 127-209.
- Ndoye, O. 1994. New employment opportunities for farmers in the humid forest zone of Cameroon: The case of palm wine and rattan. Paper presented to the Rockefeller Fellow Meeting, Addis Ababa, November 14-18.
- Peters, C.M. 1994. *Sustainable harvest of non-timber plant resources in tropical moist forest: an ecological primer*. Washington DC, Biodiversity Support Program.
- Pokam-Wadja, K. 1979. *Artisans et Commerce de Detail a New Bell, Douala, Cameroon*. University of Yaounde, Cameroon.
- Russell, T.A. 1968. Palmae. In F.N. HEPPER (ed). *Flora of West Tropical Africa*. Vol. 3. Crown Agents, London. pp159-172,
- Shiembo, P. 1984. *Development and utilisation of minor forest products in Cameroon with particular reference to Raphia and rattan palms*. MSc Thesis. University of Ibadan, Nigeria.
- Sunderland, T.C.H. 1997a. African Rattan Research Programme Annual Report.
- Sunderland, T.C.H. 1997b. *Guide to rattans and rattan collecting in West and Central Africa*. African Rattan Research Programme Technical Note No. 1.
- Sunderland, T.C.H. 1997c. *The abundance and distribution of rattan palms in the Campo Faunal Reserve, Cameroon and an estimate of market value*. African Rattan Research Programme Technical Note No. 2.
- Sunderland, T.C.H. 1998. *The rattans of Rio Muni Equatorial Guinea: Utilisation, biology and distribution*. Report to CUREF / EU.
- Thomas, D.W., J.M.Thomas, W.A. Bromley & F.T. Mbemkum. 1989. *Korup Ethnobotany Survey*. Final report to the World Wide Fund for Nature (UK).
- Trefon, T. & L. Defo. 1998. Can rattan help save wildlife? *APFT Briefing Note* No.10.
- Tuley, P. 1995. *The Palms of Africa*. Trendrine Press, UK.
- Tuley, P. 1996. Regional priorities in Africa and Indian Ocean Islands. In D. Johnson (ed). *Palms: Their Conservation and Sustained Utilisation*. IUCN/SSC Palm Specialist Group, IUCN, Gland.
- Uhl, N. & J. Dransfield. 1987. *Genera Palmarum*. Allen Press, Kansas.

# EXTENDING ECOLOGICAL RESEARCH TO MEET LOCAL NEEDS: A CASE FROM BRAZIL

Patricia Shanley

## Abstract

Rural communities who make their living within regions beset by logging and fire are increasingly faced with biotically impoverished forests. Although a multitude of scientific research projects have been undertaken, little of this has direct, immediate relevance for forest communities. In eastern Amazonia, when the loss of game, fruits and fibres began to outweigh the financial benefits of selling timber, some rural communities asked: "Are there NWFPs that we can sell in lieu of timber?" To answer questions posed by the communities, research was designed to describe the density, regeneration and production of regionally valued NWFPs. Parallel research efforts examined the markets for and household use of NWFPs.

Generating locally useful information was only a first step; disseminating results to isolated, semi-literate communities posed additional challenges. These were overcome by designing participatory workshops in which data was given back through posters, skits, songs and illustrated booklets on the ecology, use and management of NWFPs. Outcomes of these extension efforts have been substantial: increased use, processing and sale of NWFPs, improved negotiations with loggers and the creation of community forest reserves. Results indicate that rural education is an underutilized and under explored tool for conservation and development.

**Key words:** Non-wood forest products, environmental education, ethnobotany, extension

## 1. Introduction

The ecological research process often involves an outside team entering an area, taking measurements, posing questions, leaving and writing scientific articles. Unfortunately, the results presented in scientific articles rarely reach the local communities in which they were generated. Indeed, if the pages of such manuscripts ever were to reach the local level, it is doubtful that they would be useful for anything other than rolling tobacco or lighting fires.

Although policy-makers and scientists are important audiences for research results, forest-based communities are also a critical public to reach. First, there is a strategic reason for sharing research results with forest-dependent communities: local communities represent a critical group of people in determining how forest resources are used and protected. Second, forest-dependent communities often have their own key research questions upon which their livelihoods may depend. Third, after taking up considerable amounts of a host community's time, eating their food and involving them in the research process, there is a moral imperative for outside researchers to give back their results in a locally useful form.

To meet the needs of both local and international communities, an ecological research programme must often accommodate two distinct research agendas: on the one hand, it needs to generate rigorous data aimed at informing the scientific community and policy-makers; on the other, it needs to produce and disseminate information useful to communities directly dependent on forest resources. Juggling these two agendas may require that data is collected, analysed and presented in different ways for different audiences.

This paper addresses this challenge by describing the education and extension spin-offs of a non-wood forest product (NWFP) research project in the Brazilian Amazon. After a brief outline of the research setting, a description is given of each facet of the project (ethnobotanical, ecological and economic), conventional scientific products resulting from the research and the limitations of these products in meeting local needs. Subsequent sections describe how results of the research were presented in a practical way for local communities and how they were disseminated through extension and education.

## **2. Background: NWFP research designed to meet local needs**

In Pará, the easternmost state of the Brazilian Amazon, a recent explosion of selective logging, fire and ranching has diminished the diversity and abundance of non-wood forest products (Veríssimo *et al.*, 1992, Martini *et al.*, 1994, Vieira *et al.*, 1996). While logging offers much needed cash to shifting agriculturists, the local costs of timber extraction, such as lower densities of fruit and medicinal species, longer travel time to collect forest resources, and lower game populations, catalyzed some communities to search for forest management alternatives.

By the early 1990s, several *caboclo* communities (peasant farmers of mixed descent) along the Capim River (120 km from the logging center of Paragominas) felt that the loss of game, fruit and fibre was beginning to outweigh the financial benefits of selling timber and questioned if there were NWFPs that they could sell in lieu of wood. With the assistance of the Rural Workers Union of Paragominas, they sought out research collaborators. Our team of multi-disciplinary researchers from the Woods Hole Research Center (forester, wildlife biologist, ethnobotanist/environmental educator) was contacted and, in conjunction with the community, developed a research plan and objectives.

The foremost questions posed by the community included: “Are the resources we lose from logging more valuable to us than the cash we get from selling our trees?” and “Are there other (i.e., non-wood) forest resources we might sell *in lieu* of timber?” At that time, these same questions were concurrently being posed by the international conservation community. In this case, by tackling locally relevant questions, the research could also contribute to filling gaps concerning the role of NWFPs in a potential conservation/development strategy (Scoones *et al.*, 1992; Godoy and Lubowski, 1992).

In spite of the similarity of questions, many differences nonetheless existed between the scientific and local communities regarding the time frame and products. For instance, *caboclo* communities sought rapid answers which would result in cash for forest goods and an increased density of game and fruit species. Due to the inconsistent phenology of locally valuable forest products, however, a rigorous ecological and economic study of selected NWFPs would require many years. Juggling these two agendas took flexibility and patience on the part of both the research team and the community.

## **3. Ethnobotanical inventory**

As a first step in the research process, a one hectare ethnobotanical inventory was conducted to document the floristic composition of the region and to identify species with high use-values (Alexiades, 1996). Traditional outcomes of ethnobotanical inventories are lists of the scientific names of plants and collections of voucher specimens which are sent to national and international herbaria. Although critically important to botanists, such products are inaccessible to semi-literate rural communities. To address this, our research team gathered extra plant specimens for the community’s use in addition to those collected for herbaria. Although they will disintegrate with time, the specimens catalyzed group discussion,

promoted an exchange as to plant uses, and demonstrated how scientific names clarify the identity of plants possessing various common names. To familiarize literate community members with botanical nomenclature and to remove doubt about the identity of certain species, common names as well as scientific names were placed on aluminum tree tags.

Instead of abandoning the study hectare after the inventory was concluded, the hectare continues to support ongoing research efforts aimed at documenting the longitudinal use of non-wood forest products. To this day (six years later) the owner of the hectare and his family weigh the game, fruit, fibre and medicinal plants which they consume from the study site. Annually, we jointly compare the subsistence value of these products with that of the value of the hectare if logged. While a graph of net present value might mean little to the family, they know that their long-term survival is linked to the fruit trees and the game their fruit attracts. This is in contrast to the sale of their trees, which offers a single, and relatively trivial, amount of money.

To ensure the usefulness of the hectare to the wider community, we designed it as a forest “reserve.” To this purpose, a winding trail was constructed to guide visitors by trees of economic interest. Underneath several of the largest trees, small clearings were made to serve as resting and meeting points. As research in the Capim basin bore results, the small reserve served as a “forest value” workshop site in which villagers shared the project’s results with neighbouring communities. One weekend workshop drew 140 elders, mothers, children and villagers of all ages who trekked to the site by canoe and foot from as far away as 50 km. Villagers who had been involved in the research process presented ecological and economic data through stories and illustrated posters. Upon viewing the grandeur of the piquiá (*Caryocar villosum*) and bacuri (*Platonia insignis*) trees, visitors from a heavily deforested neighbouring region spontaneously hugged trees and filled their pockets with seeds.

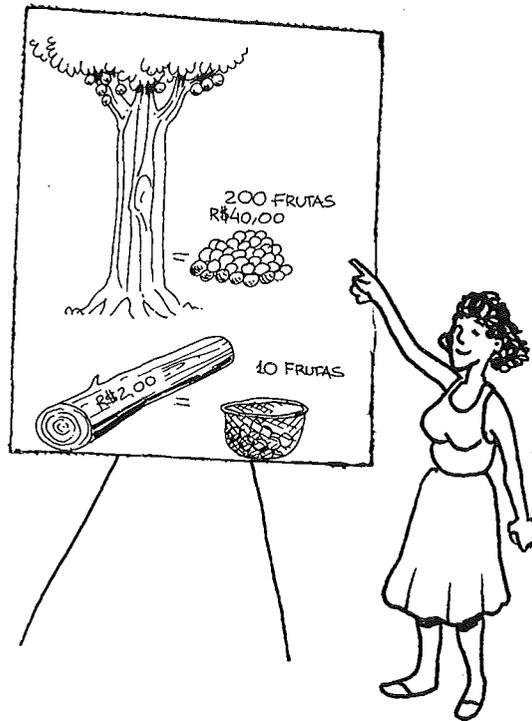
In addition to sharing data resulting from the research, community members exchanged recipes, management techniques, NWFP processing tips, and lore. Hands-on sessions with local experts included medicinal plant preparation, soap making from forest fruits, jam and basket making. Such traditional ethnobotanical information had immediate utility for households, many of which no longer recalled how to extract oil from the fruit of uxi (*Endopleura uchi*), how much oil of andiroba (*Carapa guianensis*) was needed to make soap, or the proper dosage of pau d’arco bark (*Tabebuia* spp.) for the relief of internal inflammation.

#### **4. Population ecology studies**

To explore the marketing potential of products with the highest use-values as indicated by the ethnobotanical inventory, it was necessary to know how much of the various resources were present in the forest. Therefore, basic ecological information was gathered concerning the density, distribution, size class and fruit production of the three most promising species (*Caryocar villosum*, *Platonia insignis*, *Endopleura uchi*). Local research assistants took part in species selection and helped to locate conspecific trees throughout a 3 000 hectare area. Due to the extreme irregularity of annual fruit production, production studies were carried out over a relatively long-term time frame (six years). The work involved was often tedious and time-consuming and the routine results, histograms and regressions do nothing to fill the stomachs of hungry smallholders.

To provide more rapid results to the community, preliminary data from the first and second years were presented. Research assistants who had learned how to use a compass and create transects exhibited the information on maps. Other villagers made posters displaying the mean fruit production of different species, showing how entire trees sell for values equivalent to the

cost of a meager basket of ten fruits. The escalation of prices along the marketing chain became abundantly clear when villagers presented posters showing the prices of wood as sold from their own forests (\$5 - \$40/tree) as opposed to the prices of wood as sold in sawmills (\$40 - \$300/m<sup>3</sup>).

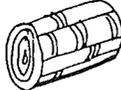
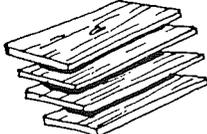


**Figure 1.** Presenting ecological data.

To make data fully accessible, data give back to locals required different analyses and presentation than for a scientific audience. For instance, a commonly used unit of measurement for ecologists and economists, yield per hectare, was of little use to *caboclos* when applied to species which exist in densities of less than one tree per hectare. Instead, illustrations depicted production per tree. Similarly, the economic value of a pile of fruit may be meaningless in monetary terms to persons with little access to cash. However, comparing prices and sacks of fruit with sacks of farina (the primary agricultural commodity) was clearly understood, as was the amount of labour involved in each activity.

To determine where clumped densities of economic species occurred, the research team made poster-size maps indicating different species of fruit trees and the trails which linked these. Although mapping the forest resources was time consuming and did not offer any immediate source of cash to the community, understanding how much of the resource existed in the community's forest was a first step in estimating the economic value of their standing forest and was critical for successful negotiations with loggers. Prior to mapping the trees, residents had severely overestimated the abundance of particular fruiting species occurring on their land, inaccurately assuming that it was possible to sell timber from large swaths of land and still retain a profusion of fruit and medicinal oil trees. Mapping the economic species present on their 3,000 hectares made clear that, instead of the estimated thousands of particular fruit trees, a few hundred actually existed.

## Wood prices: Paragominas, 1998

	 Standing	 1 m3 roundwood	 1m3 sawnwood
madeira branca	R\$ 5	R\$ 10	R\$ 100
maçaranduba	R\$ 10	R\$ 25	R\$ 120
piquiá	R\$ 15	R\$ 45	R\$ 140
ipê	R\$ 40	R\$ 105	R\$ 300

**Figure 2.** A comparison of wood prices: value of standing tree; and values of 1 m3 in roundwood and sawnwood for 4 different timber species (in Brazilian real, R\$).

### 5. Market studies and subsistence use of NWFPs

To examine the comparative economic value of non-wood forest products and timber, the research team conducted market surveys of locally valued fruits, medicinals, game and fibres in the closest city, Paragominas, and in the state's capital, Belém. Rather than offering complicated economic analysis to villagers, we discovered that the research team's greatest contribution to the community's economic understanding was simply keeping them informed of up-to-date market prices. Time and again villagers underestimated the value of forest goods (two to ten-fold).

The community had hoped that the research would demonstrate that they could gain more from the sale of NWFPs than timber. While the combined ecological and economic results did highlight the significantly higher economic value of select forest fruits and medicinal oils as opposed to timber, this did not necessarily translate into increased income for many villagers. Logging companies arrive in distant communities; fruit vendors do not. Because loggers appear with money-in-hand, cash-poor villagers commonly accept anything they are offered from timber companies.

The tendency of many communities to market wood in lieu of NWFPs does not signify that NWFPs have no economic value. Subsistence (direct use) of non-wood forest products contributes significantly to the well being of rural households (Schreckenber, 1996; Melnyk, 1996; Falconer, 1990). However, both smallholders and economists rarely account for the economic value of subsistence use of NWFPs. One reason for this is that measurement of the "invisible" economic value of subsistence utilization of NWFPs requires tedious, invasive methodologies (i.e. daily diaries). In this instance, our research team asked 30 families from one community to weigh all fibres, fish, game and medicinal plants and to count and record all fruits they consumed each day throughout the course of an entire year. While the exercise itself may have acted as a learning tool for the families involved, the conventional products

(i.e. graphs of fruit consumption and pie charts of game off-take) did nothing to solve the problem of decreasing game capture and hunger.

What did appear to be useful to the community was to portray the economic value of the direct-use (subsistence or non-market) value of NWFPs to individual households. For example, the heads of four families stood in front of the community holding posters (hidden behind their backs) with a number representing the weight of game or the fruits their families had consumed monthly and the cost of these products if purchased in the nearest market. Other community members guessed the market value of the game or fruit these families had consumed. They frequently based their estimates on the household's hunting ability, the number of children, the proximity of the home to forest or, in one case, the size of the father's stomach. Invariably, the value of NWFPs consumed from forests was hugely underestimated, awakening villagers to the very substantial "invisible income" that they daily gain from their forest.

## 6. Forest value workshops

Generating information and giving it back to the communities in which it was generated was only a first step. Disseminating concrete information to surrounding communities under pressure from logging and ranching posed additional challenges. In the hopes of slowing rampant deforestation throughout the region, extension teams composed of villagers and researchers traveled to neighbouring communities, sharing the data described above in participatory workshops (Shanley *et al.*, 1997).

To effectively reach different audiences and to accurately portray the value of NWFPs in various regions, it was necessary to recognize the fact that fruits and medicinal plants were not the most highly valued non-wood forest products. Instead, to a chronically hungry and sometimes protein-deficient population, game animals often took precedence as the forest product of greatest local value (Bodmer *et al.*, 1997; Redford *et al.*, 1992). Data demonstrating that during one year, 79% of game consumed by the community was captured in the mature forest (as opposed to secondary forests or agricultural fields) offered a strong incentive for habitat protection and the creation of community forest reserves (Cymerys *et al.*, 1997). By ranking select fruit species according to their ability to attract game, hunters quantified the fact that the economic value of particular species is not limited to the fruit that they produce. Over time, avid hunters became workshop leaders and proponents of reserves, recognizing that without an area to reproduce, the game population would continue to steadily decline.

To further highlight the value of standing forests and the substantial economic loss that often accompanies their sale, socioeconomic and ecological data were woven together and used in skits. *Caboclos* acted out the roles of loggers, ranchers and fruit vendors, while their fellow villagers watched with a mixture of mirth and sorrow as smallholders were sweet-talked out of their forest for a pittance. Based on real-life tales, 40 hectares of virgin forest were traded to a logger for a stove; one hectare of forest worth hundreds of dollars in fruit and game was "sold" to a logger for one fifth of its non-wood value; and one logger removed thousands of dollars worth of trees from a villager's forest and left, without ever paying.

As our extension team traveled to different villages, we collected additional ethnobotanical, ecological and market information, songs, stories and lore on a wide range of species. We preferentially focused on locally and regionally valued forest tree and palm species, with wide distribution throughout Amazonia, and on those which had received insufficient research attention. As the team's species specific knowledge base grew, so did the relevance of our workshops throughout a greater geographic range.



**Figure 3.** A forest value workshop comparing the value of timber harvesting and fruit collection (Photo: P. Shanley).

### **7. A different kind of manuscript: Illustrated booklets**

After traveling on foot, canoe and muddy logging roads to arrive in remote villages throughout Pará, our extension team realized that the need for such information in isolated niches of Amazonia was far greater than direct outreach efforts could meet. Although the written word is not fully understood by all residents of rural communities, we wondered if it would be possible to put our workshops on paper in book form, in a way that would be readily comprehensible to both literate and semi-literate audiences. Such an illustrated text could reinforce outreach efforts where workshops were conducted, be used as a training tool for extensionists, and arrive in distant communities which our team could not reach.

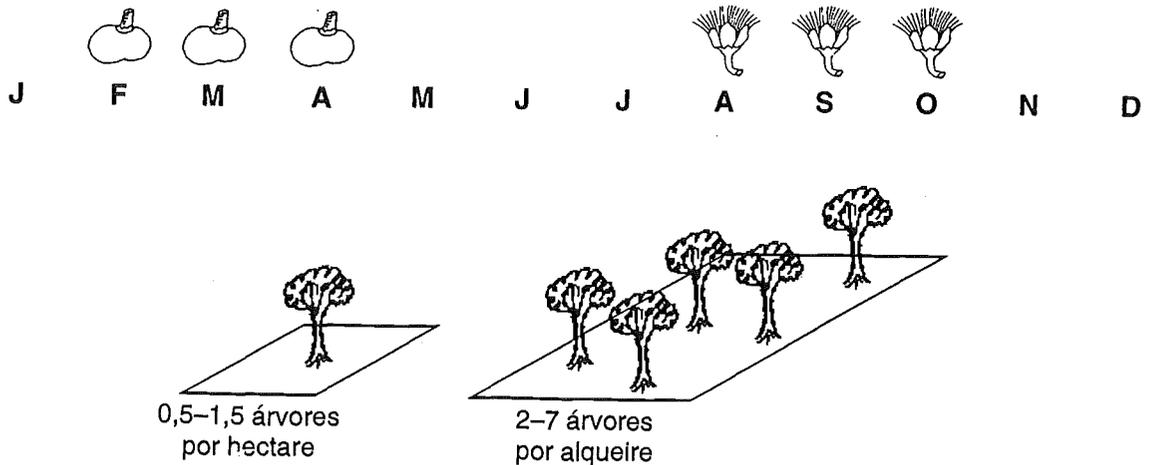
We took the ecological and market data, posters, songs and lore used in workshops and presented them on paper. The resulting book describes thirteen forest fruit and medicinal oil species which have broad distribution and economic significance throughout Amazonia (Shanley *et al.*, 1998). Simple, accompanying text conveys information in the language of small holders, describing the ecology, use, nutrition, economics and management of the trees, many of which had received scant prior study. Blending scientific literature, market data, forest inventory results, lore and traditional knowledge, the book offers an example of how to return relevant data to communities to assist in improving rural livelihoods and in conserving forest resources. To help all populations comprehend the book, many botanical and popular illustrations are included on each page (See Figure 4).

### **8. Practical outcomes of give back**

When the extension team began to give back our research data to communities through workshops and books, we did so in the hope that the information could, in a small way, contribute to lessening deforestation and to improving rural livelihoods. The outcome of workshops exceeded our expectations. We discovered that the skits, posters and stories embedded in the forest value workshops and the fruit book served not only to expose unfavourable prices, but to catalyze improved strategies for negotiating logging contracts. In

subsequent interactions with timber companies, villagers began negotiating to conserve fruit and medicinal oil species (see Figure 5). They also limited the number of hectares logged, in some cases preserving areas with clumped distributions of economic species as forest and game reserves. In a number of cases, logging contracts were cancelled. Return visits to communities in which workshops had been conducted demonstrated that in each case favourable forest management choices had been made.

### Months of flowering and fruit production



**Figure 4.** Flowering and fruit months of *Caryocar villosum* (a timber species with edible fruits), and presented in number of trees per hectare and per 'alqueires' (a local unit of land measurement).



**Figure 5.** Small holder insisting logger abides by contract.

Through the rescue and exchange of traditional NWFP recipes, families preserved fruit by making jams, jellies and soaps, thereby increasing the use and processing of NWFPs while decreasing timber sales. Women of the communities, who customarily said little regarding the sale of timber rights, began to speak up and to attend community meetings, urging the men not to sell the logging rights cheaply and to preserve the fruit and medicinal oil trees for the future.

Newly aware of market prices for NWFPs, women began experimental sales of fruit and medicinal oils and contributed a section to the book entitled: "Lessons learned from fruit sales" which offers practical tips on packaging, transport and marketing. The incremental income that they earned was wisely invested in goods to benefit their families and community. This was in stark contrast to the profits from timber sales which, landing in the hands of husbands, was commonly spent on parties, radios and liquor.



**Figure 6.** Preparing and selling medicine oil of *Carapa guianensis*.

## **9. Rural extension: Underutilised potential in conservation and development**

In spite of the success that can result from solid educational programmes, a cautionary note is needed. Even the best extension programmes cannot forestall the waves of logging and fire that are sweeping forested regions worldwide. While smallholders can make fire barriers, conserve forest fruit trees and create reserves, fundamental changes in forest policy are desperately needed to lessen both biotic and human impoverishment.

Moreover, as deforestation proceeds at an unprecedented pace, it is imperative that ecologists begin to recognize that scientific publications are no longer a tenable measuring stick of success for our research endeavours. Rather we need to question who the primary beneficiaries of our research really are, as well as the common assumption that our research is complete once the scientific article has been sent to press. Rural extension is an underutilized, cost-effective way to ensure that hard won field data not only lands on the desks of other scientists but is also given back to the forest-based communities who need it most.

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## References

- Alexiades, M. 1996. *Selected guidelines for ethnobotanical research: A field manual*. The New York Botanical Gardens, Bronx, New York.
- Bodmer, R., Penn, J., Puertas, P., Moya, L., & T. Fang. 1997. Linking conservation and local people through sustainable use of natural resources: community-based management in the Peruvian Amazon. Pages 315-358. In C. H. Freese (ed.) *Harvesting wild species: Implications for biodiversity conservation*. Baltimore, John Hopkins University Press.
- Cymerys, P., Shanley, P. & L. Luz. 1997. Quando a caça conserva a mata. *Ciência Hoje* 22(129): 22-24.
- Falconer, J. 1990. *The major significance of minor forest products: The local use and value of forests in the West African humid forest zone*. Community Forestry Note 6. FAO, Rome.
- Godoy, R. & R. Lubowski. 1992. Guidelines for the economic valuation of non-timber tropical-forest products. *Current Anthropology* 33:4.
- Martini, A., Rosa, N. & C. Uhl. 1994. An attempt to predict which Amazonian tree species may be threatened by logging activities. *Environmental Conservation* 21(2): 152-162.
- Melnyk, M. A. 1995. *The Contributions of forest foods to the livelihoods of the Huottuja (Piaroa) people of southern Venezuela*. Ph.D. Thesis. Imperial College, University of London.
- Redford, K., Klein, B. & Mucia, C. 1992. Incorporation of game animals into small-scale agroforestry systems in the neotropics. Pages 333-358. In K.H. Redford and C. Padoch (eds.) *Conservation of Neotropical forests: Working from traditional resource use*. New York, Columbia University Press.
- Schreckenber, K. 1996. *Forests, fields and markets: A study of indigenous tree products in the woody savannas of the Bassilia region, Benin*. Ph.D. dissertation. School of Oriental and African Studies, University of London.
- Scoones, I., Melnyk, M. & J. Pretty. 1992. *The hidden harvest: Wild foods and agricultural Systems: A literature review and annotated bibliography*. International Institute for Environment and Development, London.
- Shanley, P., Cymerys, M. & J. Galvão. 1998. *Frutíferas da mata na vida Amazônica*. Belém.
- Shanley, P., Luz, L., Galvão, J. & P. Cymerys. 1997. Translating dry data for rural communities: science offers incentives for conservation. *Overseas Development Institute, Rural Development Network News*: 19 e.
- Vieira, I., Nepstad, D., & J. Roma. 1996. A renascimento da floresta no rastro da Agricultura. *Ciência Hoje* 20: 19.
- Veríssimo, A., Barreto, P., Mattos, M., Tarifa, R., & C. Uhl. 1992. Logging impacts and prospects for sustainable forest management in an old Amazonian frontier: The case of Paragominas. *Forest Ecology and Management* 55: 169-199.

## **SOCIO-POLITICAL ISSUES**

# SOCIO-ECONOMIC RESEARCH AND NON-WOOD FOREST PRODUCTS: AN OVERVIEW

Christine Kabuye

## Abstract

Forest people and communities neighbouring forests who depend on them for their livelihood have a wealth of knowledge about useful non-wood forest products. They use the forest resources for food, medicine and many other needs. They usually have first hand information on location, abundance, and management of such resources and methods of obtaining the products. Any research that deals with conservation, utilisation and development of forest resources has to take into account the socio-economic aspects related to them. Socio-economic research in NWFPs has in the past been low key, mostly treated as a by-the-way subject to support other aspects. It is emphasised that this be the starting point. Considering that any research on NWFPs is in the first instance to benefit the local people, starting from what they know and value, would be very rewarding to the development process.

Priorities in socio-economic research centre around indigenous knowledge on what is useful and for what purpose, value attached to the products both in socio-cultural and economic terms, and practices which govern harvesting and sustainability of the resources. The understanding of these and related issues should form the basis for the conservation and development of the resources. Moreover, the participation of local people in identifying and formulating the research agenda and decision-making on research projects on NWFPs would undoubtedly benefit future development of forest resources for local use and income generation.

**Key words:** socio-economic, communities, non-wood forest products

## 1. Introduction

Non-wood forest products, which have in the past ten years attracted the attention of many development agencies, have always been the life support for many rural communities. These communities have lived in and out of the forests using forest resources for their daily needs. NWFPs have contributed to the livelihood of rural populations as they depend on them for food production, health care systems, shelter, clothing, home crafts and many other needs. Historically, this fact tended to be ignored by early forest workers who thought that forests were good only for the continued supply of timber. Many people who had depended on forests for millennia were alienated from the ancestral lands as forests became “protected” from the people as they were converted into forest reserves with the sole purpose of timber production. Fortunately, not all forest lands were protected under these draconian conditions and some have continued to be used by rural communities for their needs, while in other areas regulations were later relaxed to allow rural communities to collect firewood and undertake other low-impact uses.

In addition, as societies have developed in recent years, new food production systems have been introduced, the sick now go to hospitals, no longer relying on traditional health care systems, and clothing and many household items formerly made from forest resources have been replaced by imported products. However, not all daily needs can be satisfied in this way and not all rural communities can afford the new systems. The continuation of obtaining the necessary products from the forests is not by design but by necessity. With NWFPs being the

life support for survival of many rural communities, they have thus continued to be very important in the lifestyles of forest dwellers.

We have also witnessed in recent years that often the same forest products are required, even desired, by people in urban centres. With the ever-increasing market economy, the demand for forest products has extended from being for subsistence-level use to trading in both local and international markets. With this increase in demand there is a possible threat to the resources themselves, raising questions of sustainability. If the resources are threatened, then the livelihoods of rural communities are threatened too.

Developing the NWFP sector has many facets to it and serious thinking must go into sustainability issues. One of the most important areas to start with should be socio-economic research.

## **2. Why socio-economic research?**

This question is an intricate one. It has been stated that one of the main aims in the development and promotion of NWFPs is in the first instance to alleviate poverty of the communities by marketing the products. As the issue involves the people and the resources that are to be promoted, a number of factors have to be considered. These are relevant to the relationship between the people and the resources. The following may be the questions that need answers before other steps are taken:

- What is the role of forests in people's livelihoods?
- What is known to be useful?
- Who owns and who uses the resources?
- What value is attached to them?
- Would the people be interested in commercialisation and if so, would the production be sustainable and would there be alternatives?
- What skills are available for resource and product development?
- What institutional framework exists for management?
- How are the local people to participate?

### **2.1. The role of forests in people's livelihoods**

While it is known that many rural communities depend on NWFPs for their livelihoods, the extent of dependency needs to be established.

### **2.2. What is known to be useful?**

The materials used can only be ascertained by carrying out socio-economic studies among the communities as the uses vary from community to community, even within small geographic locations. The information may relate to food items, medicine, home crafts, building materials and other products, including their relative importance.

### **2.3 Who owns and who uses the resources?**

In some communities the resources are owned or inherited by different individuals, family or clan and use may be limited to the owner, thus controlling access.

## **2.4. Value attached to the resources**

Some resources may be for cultural or religious purposes, which may not allow development for markets.

## **2.5. Interest in commercialisation**

One can find out if any of the products are actually sold and the size of the markets. The community members have to decide whether to commercialise. This could depend on sustainability or other considerations.

## **2.6. Skills available**

Particular people may be skilled in producing particular items; for example while men may be involved in collecting honey, women would be better at making baskets. The number of such skilled individuals would make planned production easier. The special skills of traditional healers would make exploitation of medicinal plants especially useful.

## **2.7. Management institutions**

Communities mostly have organised institutional frameworks under which resources are managed and activities controlled. With such frameworks the decision-making on practices for development, conservation and suggestion of alternatives where needed would make it easier for the community to choose options.

## **2.8. Participation**

The existence of management institutions could ease the participation of the community in developing market ventures and mechanisms for sharing benefits.

The above points are not inclusive but they can show that it would make sense if these socio-economic issues were researched at the beginning of any intended venture in developing and marketing of NWFPs. In the past when planning started from a product, working backwards to local communities, it tended to leave gaps in socio-economic issues. The advantage of starting from socio-economic issues is that it makes it possible to see what can lead to practicable ventures from the beginning and saves time, and considerable effort, in the long run.

## **3. Indigenous knowledge**

Indigenous knowledge encompasses the body of knowledge which indigenous people have accumulated over generations concerning their environment. It includes knowledge on identification, utilisation and management of resources built through observation, experimentation and innovation. Although it is passed on from generation to generation it is not static. People adopt what is passed on, add newer inventions and the whole is then passed on to the next generation. Indigenous knowledge and its application is perpetuated through practices, norms and beliefs which are embedded in different cultures. It is this knowledge that has guided men through ages in living within their environment. They have hunted and gathered from forests for food, medicine and other materials for their needs and they have also used the forests for religious and ceremonial purposes. In essence, developing a relationship with nature. Indigenous knowledge therefore holds what is known by any one community about the useful resources that support livelihoods. Rural communities who have continued to use these resources have tremendous knowledge about them. Through the long

association with the resources, they are the best source of information on what can be exploited. The important NWFPs can be easily identified using indigenous knowledge. It has to be remembered that in a community some people are more knowledgeable than others about certain resource use; for example women would be more knowledgeable about food as they are responsible for feeding their families.

#### **4. Values**

Rural communities have different values of forests. Apart from the fact that they obtain food, medicine and other utility items, they have cultural values connected to forests. Some forests are sacred and used for religious and cultural ceremonies. Harvesting of products from these forests is regulated by elders and mostly only allowed for the extraction of medicinal plants. This regulated access to the forests helps to conserve a large number of species acting as a reservoir for future use, especially as a source of germplasm for establishing useful plants on farms. A number of NWFPs themselves are used for cultural purposes. Socially there is definite interest in conserving the sources of these products.

#### **5. Practices**

The practices connected to NWFPs aim at the conservation and management of product sources within sustainable levels, thus care is normally taken not to over-harvest. Some plants are tended in the forest, encouraging survival of seedlings, while some are introduced directly to the farm and others are left on farmland when clearing the standing forest. These practices ensure some level of conservation. Other practices touch on NWFP processing and go hand-in-hand with the skills and craftsmanship in producing items from forest products. In addition, the roles of women, farmers and traditional healers and other groups have to be specially noted.

#### **6. The potential for markets**

Based on the existing indigenous knowledge of NWFPs, their value and applied practices in use and management, attention can be pointed to the potential for marketing. The potential for wider markets can be explored with products that have often appeared in barter trade or in urban markets, such as fruits, medicines, honey, crafts and others. But it must be shown that the demand does not or is not likely to exceed supply. The local communities will decide on this depending on their knowledge about distribution and abundance of the resources. Decisions taken would ensure sustainability and where necessary lead to looking for alternatives or introduction of some critical species on-farm.

#### **7. Developing NWFPs**

Developing NWFPs for income generation should be guided by possible markets and decisions taken by local communities based on the results of socio-economic research described above. Thus, it is clear that the development of NWFPs has to start from basic socio-economic studies if it is to be seen as a local people's programme.

#### **8. The necessary socio-economic research**

For the success of developing NWFPs aimed at alleviating poverty of rural communities, the following research issues are recommended:

- Indigenous Knowledge of any chosen community covering what is useful, what is used for home consumption (some of which may be developed for income generation), what appears in barter trade or in markets;
- Indigenous Management Systems on uses, harvest, processing and conservation including product substitution and domestication, tools and techniques;
- Indigenous Knowledge of the Resource Base, covering the ecological factors of NWFPs such as distribution, regeneration and seasonality of the products;
- Subsistence Requirements of local people and the impact of market forces on their livelihood, and possible conflicts;
- Traditional Institutional Framework for guidance and decision-making, business management, social value systems and gender division of labour;
- Traditional Resource Rights, ownership, access and control, and possible benefit sharing from the income generating activities.

Of course, all the above activities should be undertaken with the local communities as full participants in the research.



**Figure 1.** Decomposing fruits of bush mango (*Irvingia gabonensis*) prior to sowing (Photo: T. Sunderland).

## 9. Conclusion

Considering that development and promotion of markets for NWFPs is in the first instance to alleviate poverty in rural communities, the socio-economic research has to be the starting point for any activities before this can take place. This will also be an exercise to identify products with which local communities are familiar and for which they may have skills and understanding.

# COMMUNITY MANAGEMENT OF NON-WOOD FOREST RESOURCES: A CASE STUDY FROM THE KORUP FOREST, CAMEROON

Ruth Malleson

## Abstract

'Community' involvement in forest resource management is now regarded as an essential component of forest conservation projects. However, progress in community consultation and participatory processes has largely been poor. This paper contends that this is partly because some projects have overlooked some of the most pertinent social and economic characteristics of the individuals, institutions and settlements that make up what is referred to as the 'community' and other groups from outside the 'community,' who also have an interest in the forest. Forest conservation projects have also generally failed to take into account the historical, social and economic context in which forest users are placed.

This paper looks at the case of the Korup Forest, home of the Korup Project, established to conserve and develop the Korup National Park and surrounding areas. It analyses:

- the various types of individuals and institutions with an interest in the forest;
- the potential and constraints of their forest resource use strategies;
- the conflicts that exist within and between them;
- the ways forward.

In conclusion, this paper argues that sustainable forest management is crucially dependent on a thorough understanding of how forest products feature in people's livelihood strategies.

**Key words:** Rainforest, Cameroon, conservation, community, participation

## 1. Introduction

The Korup National Park is 125,000 ha. of tropical rainforest in Cameroon's Southwest Province which the Korup Project, an internationally funded programme, aims to conserve and develop. Despite having started over a decade ago, the Project has made poor progress. I contend this is because it has largely failed to take into account the social and economic characteristics of the area.

This paper presents some of the key issues relating to community forest management:

- forest livelihoods in the distinct settlement types;
- the potential and constraints of the local institutions relating to forest resource management;
- the implications for community forest management.

The findings are drawn from the fieldwork carried out between 1992 and 1994. Prior to this the author worked for six years as a rural development adviser for the Korup Project.

## 2. Settlement types in the Korup Forest

Settlements in the Korup Forest can be grouped broadly on the basis of differences in forest conditions, demographic changes, and accessibility to markets. I have termed these groups: 'Remote Settlements', 'Creek Settlements', 'Roadside Settlements' and 'Plantation Camps'.

**Remote settlements** are surrounded by relatively intact high forest, but poor market access limits the range of livelihoods. For this reason, Remote Settlements are largely socially homogenous. Many people have moved to Roadside Settlements in search of a better standard of living. Remote Settlements are distinguishable by their access to high forest. **High Forest Edge** settlements are surrounded by intact forests with a relative abundance of wildlife, whilst **Abandoned Forest Frontier** settlements are surrounded by old fallow land, with little wildlife and few valuable timber trees.

**Creek Settlements** are to a large extent also surrounded by high forest. However, in contrast to Remote Settlements, they have access to markets in Cameroon and Nigeria. This has led to the development of a wide range of forest, mangrove and farm-related livelihoods, and a more ethnically diverse population.

**Roadside Settlements** have access to the markets of Southwest Province, Cameroon, but, because of relatively higher population densities, the forests surrounding them are relatively degraded. These settlements are the most ethnically diverse, with migrants from the Remote Settlements as well as 'outsiders' mainly from Northwest Province and eastern Nigeria.

**Plantation Camps** are also ethnically diverse. Over half the workers are from Northwest Province and others are from elsewhere in Southwest Province and Nigeria.

## 3. Local institutions

### 3.1. Village councils

The Government Chief is the most prominent political figure at the settlement level. He is elected by the village council which is mainly composed of elderly men and a few elderly women. Village councils are the traditional custodians of land and forest resources within the settlement boundaries. According to traditional land tenure conceptions, land may be divided into two types:

- areas where indigenes have acquired customary rights to farm, either by clearing or by inheritance;
- village forest known as 'moliki nwamoki' which no individual can claim rights to.

Access to village forest depends on whether you are a citizen or a 'stranger' i.e. from outside the village. Every indigene has the right to harvest forest resources on village land, but strangers must ask permission from the Chief and village council. The Chief and village councillor/s have the potential to play an influential gate-keeping role in relation to forest resource management but there are some constraints.

In contrast to some neighbouring ethnic groups where the Chief has considerable political influence over his subjects, the Chiefs of the Korup Forest tend to be less powerful. As Ngwane (1992) puts it: "the Chief cannot, with the wave of his hand, order his subjects to line up..."

The Chief serves as a spokesperson and a mediator between villagers and the Government and other outsiders (such as local officials, extension workers, the Korup Project and timber concessionaires). But "this dual role is often hard to reconcile, as the wishes of the Government and those of the people may not coincide..." (Devitt, 1988).

### **3.2. Traditional societies**

Traditional societies, which involve both men and women, are largely responsible for the settlement's cultural and ritual affairs. Although their political influence is declining, particularly in Roadside Settlements, they play an important judicial role dealing, for example, with many offences relating to the misuse of natural resources.

### **3.3. The elites**

The elites are the most prominent political representatives of rural communities at the regional level. They are largely successful, influential and wealthy people such as civil servants, business people, politicians and clergy. Elites are often senior members of the traditional societies and this enables them to win the support of village council members and effectively control them.

Elites play an extremely influential role in relation to forest resources, acting as brokers or intermediaries with other forest stakeholders at regional and national levels, including government bodies and non-government organisations such as the Korup Project and timber concessionaires.

### **3.4. Cultural development associations**

These were formed during the 1970s, largely in response to the need for unity and collective action for regional development projects, particularly for the construction of roads into the hinterland area (Achu, 1988; Elangwe, 1988).

### **3.5. Youth groups**

Youth groups tend to involve men and women ranging from their teens to mid-thirties. Membership is usually restricted to young people living in a particular town or belonging to a specific ethnic group. They function as fora for young people to discuss development issues and for socialising.

Youth groups are one example of a growing number of relatively new local institutions established in response to a decline in confidence in traditional leadership structures, particularly amongst the youth.

Mistrust has stemmed mainly from the conflict of interests between the youth, elites and 'elders' over issues relating to land and forest resources. Many youths accuse the settlement leaders of selling land to strangers and giving out logging concessions for personal gain rather than in the interest of the community as a whole (Sharpe, 1998).

### **3.6. Village development committees**

As part of their remit, Ministry of Agriculture extension workers have established village development committees in each settlement, to co-ordinate village development activities, such as building a school or new classroom, or improving drinking water supplies.

Committee members are elected by the village as a whole and therefore tend to be less elitist than the village council. Although they often include young people and women, the less vocal strangers and poorer households may not be fairly represented. The achievements of such committees tend to be extremely varied depending on the settlement.

#### **4. Forest livelihoods in the Korup Forest**

##### **4.1. Remote settlement livelihoods**

The relative abundance of wildlife around high forest edge settlements offers good opportunities for hunting and trapping. 'Bushmeat', being relatively light to carry and highly valued, is the main source of income for most men in these settlements. Male youths, who had left to find work in urban areas, are increasingly returning home to hunt because of the lack of job opportunities. As a consequence, High Forest Edge Settlements tend to have much higher proportions of young and middle-aged men than Abandoned Forest Frontier Settlements. In addition to indigenous hunters and trappers, there are groups of strangers who hunt within the Korup Forest from Abandoned Forest Frontier settlements, francophone Cameroon and Nigeria.

Most inhabitants of High Forest Edge Settlements are well aware of the economic and social decline that has taken place in Abandoned Forest Frontier Settlements. In response, men in some High Forest Edge Settlements have decided to prevent strangers from hunting within their village boundaries. The men's traditional society '*Ekpe*' and local Youth Groups play an important role in enforcing this, illustrating that local institutions can play a significant role in forest resource management.

Whilst fairly good income-earning opportunities exist for young men in High Forest Edge Settlements, the situation in Abandoned Forest Frontier Settlements is very different. Cocoa and coffee were important sources of income, but poor market access and relatively low selling prices currently make the cost of trading with other areas prohibitive.

The shortage of income-generating opportunities for young women in Remote Settlements, and for young men in Abandoned Forest Frontier Settlements, has led them to search for work elsewhere. Many are involved in the trade of bushmeat and forest spices, buying from people in Remote Settlements and selling to traders in Roadside Settlements.

The sale of forest spices, such as bush mango (*Irvingia* spp.) njansang (*Ricinodendron heudelotii*) and sleeping mats (made from *Pandanus* spp.), provide the main source of cash for women in Remote Settlements.

##### **4.2. Creek settlements**

Easy access to Nigerian markets means that cross-border trade is an important activity in the creek area. Broadly speaking, the main imports from Nigeria are fuel, manufactured and processed goods, whilst the main exports from the Korup Forest are forest products.

The chewing stick species ikongo (*Massularia acuminata*) is one of the principal forest product exports from the Creek Settlements. Almost all of the cross-border chewing stick trade is in the hands of strangers, most of whom are Nigerians. Even though considerable quantities of chewing sticks are exported, the inhabitants gain very little income from them. This is mainly because village leaders normally accept only a small, one-off payment usually in the form of several bottles of afofo (distilled palm wine), or a small amount of cash from

the chewing stick dealers to allow the collection of unlimited amounts of chewing sticks within the settlement's forest.

The situation appears to be very different over the border in Cross River State, Nigeria. Here the inhabitants charge individual collectors and dealers according to the quantity of chewing sticks collected and transported; in addition to the introductory fees paid by the dealers (Okafor, 1989). Indigenes as well as non-indigenes are involved in the collection, processing and marketing of chewing sticks, thereby generating a regular source of income both for individuals and the settlements as a whole.

The chewing stick business is relatively new to the Korup Forest. This may explain why it is not as well organised as in Cross River State. However, the situation in Nigeria illustrates that there is potential for the inhabitants of the Creek Settlements to increase their income from this trade, and that opportunities exist to improve the management of this resource.

#### **4.3. Plantation camps**

Wages make up the largest proportion of men's income in plantation settlements. Since these are generally low, and delays in their payment are common, forest products often provide significant sources of supplementary income for many labourers. Some workers, mainly from the Northwest Province, are involved in the production of rattan furniture, whilst others hunt and trap. The sale of pepe soup (made with bushmeat), forest spices and edible snails are also important sources of income for plantation workers' wives and children.

#### **4.4. Roadside settlements**

Forest spices, bushmeat and pepe soup tend also to be important sources of income for women, particularly for relatively poor elderly widows and single mothers in Roadside Settlements. Elderly men also gain significant income from rattan cane basketry and palm wine. However, income from these sources will probably decline as their access to forest resources becomes more restricted, as more land is converted to farmland, and as competition from other forest users increases.

Elites are one of the main groups competing with these relatively poor households. They use capital accumulated from permanent salaried positions, or other ventures, to develop other, often forest-related enterprises. For example, a large proportion of the local timber trade is controlled by elites who not only have access to capital but also to land through their powerful influence over village Chiefs and councillors.

New farming methods have been adopted by elites which entail clearing large areas of land to make way for the cultivation of yams, cassava and other crops. These methods are not only used to earn cash from farm sales but also to generate income from the timber trees felled during clearing. Some of these valuable tree species, such as njabe (*Baillonella toxisperma*) and komea (*Coula edulis*) also provide economically important forest products for less wealthy households.

### **5. Implications for community forest management**

I have shown that communities in the Korup Forest consist of a variety of social and economic groups with competing and often conflicting forest-related livelihood strategies. The Korup Project's approach to community participation has focused firstly on working with a limited number of local institutions, namely Chiefs, councillors and elites and, secondly, with project initiated natural resource management committees. Arguably, this approach has

not, to date, promoted effective participation of all local forest stakeholders groups. Traditional leadership institutions are dominated by the elites whose interests often conflict with other forest users, such as youth and women.

Other local institutions such as Youth Groups have been largely excluded in Project discussions over forest management although they have been involved in some of the Project's development interventions. The mobility of the youth often excludes them from involvement in traditional local institutions where forest resource management issues may be discussed.

If forest users see the value of, and their access to, forest resources diminishing, they will have little incentive to manage them sustainably. The formation of new structures such as natural resource management and village development committees does not automatically overcome the conflict of interests between different forest users or guarantee their effective participation. The sustainability of such committees is also questionable; there must, arguably, be clear economic advantages for maintaining them (Mosse, 1996).

I contend the way forward is, firstly, to focus on strengthening existing local institutions which I have shown, currently or potentially, to have significant contributions to make to forest management; secondly, to lay more emphasis on involving specific groups of forest users whose interests so far have generally been overlooked. Above all, to ensure the sustainable management of forest resources, it is vital to give the people of the Korup Forest more power to make decisions relating to the forest and its resources. Without engaging and empowering all of those people who have a stake in the forest, the Korup Project is unlikely to achieve its aims.

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### **References**

- Ashu, J.F. 1988. *A brief history of the settlement of some Oroko speaking villages South and East of the Korup National Park*. Paper No. 5 of the Korup National Park Socioeconomic Survey. World Wide Fund for Nature, Godalming, UK.
- Cowen, M., & K. Kinyanjui. 1977. *Some problems of capital and class in Kenya*. Institute for Development Studies, Nairobi, 1977.
- Elangwe, P. 1988. *An outline of the Batanga-Bima and Ngolo People*. Paper No. 4 of the Korup National Park Socioeconomic Survey. World Wide Fund for Nature, Godalming, UK.
- Geshiere, P & P. Konings. 1993. *Pathways to Accumulation in Cameroon*. Kathala, Paris.
- Mosse, D. 1996. *Local institutions and farming systems development: thoughts from a project in tribal western India*. Agricultural Research and Extension Network Paper No. 64. Overseas Development Institute, London.
- Ngwane, G. 1992. *Fragments of Unity*. Nooremac Press, Limbe.
- Okafor, J. C. 1989. *Agroforestry Aspects*. Appendix No.2 of WWF Oban Feasibility Study. Cross River National Park, Oban Division. Plan for Developing the Park and its Support Zone. World Wide Fund for Nature, Godalming, UK.
- Sharpe, B. 1998. "First the Forest...", "Conservation", "Community" and "Participation" in South West Cameroon. *Africa* Vol.68. No.1: 25-45.

# THE USE OF FARMER KNOWLEDGE IN NON-WOOD FOREST PRODUCT RESEARCH

Jonathon Okafor

## Abstract

Farmers and other rural inhabitants possess considerable indigenous knowledge arising from their long utilization of NWFPs. This knowledge is chiefly documented through ethnobotanical surveys. Ethnobotanical information is essential for assessing plant diversity, intra-specific variation, selection of superior strains, adaptation and the introduction of NWFP species within traditional farming systems. The farmers' vision as well as their classification of biodiversity was applied in recent work on indigenous fruit trees in Nigeria (Okafor, 1990), and is presented in this paper. The problems as well as the prospects for conservation of biodiversity (including NWFPs) as perceived by farmers are essential in focusing and implementing research on NWFPs (Okafor, 1995). The potential for commercial exploitation of indigenous species is discussed. The major lessons learned from farmer-participatory projects, and a suggested action plan, are also highlighted.

**Key words:** Non-wood forest products, indigenous knowledge, genetic diversity, ethnobotany

## 1. The importance of indigenous knowledge

Farmers and forest dwelling people possess a great deal of indigenous knowledge arising from their utilization of NWFPs and agricultural crops. Local people are aware of the extent of variation as well as the traits displayed by genetically superior individual trees or infraspecific taxa. This knowledge of tree-to-tree variation and consumption uses is valuable in NWFP research and development. This paper examines the genetic gain and other contributions made by farmer knowledge in the context of applied NWFP research, through extensive ethnobotanical and socio-economic surveys.

## 2. What is ethnobotanical information?

The information that local communities possess about their natural resources are concentrated on how plants are used, how plant resources are distributed across the ecosystems they manage, the classification and identification of plant diversity, and the relationships between plants, people and animals in their ecosystem (Eyzaguirre, 1995; Aameeruddy, 1994). Ethnobotanical information which emanates from ethnobotanical and socio-economic surveys and literature reviews often represents the indigenous knowledge of local people. The farmer's vision of biodiversity classification is also often crucial for NWFP research and development.

## 3. Surveys to obtain an idea of indigenous knowledge (IK)

The procedure and methods adopted in conducting ethnobotanical and socio-economic surveys, which generate information on IK, (Shepherd and Okafor, 1991) consist of the following:

- Stratification of the area according to ecological zones, urban and rural setting;
- Selection of sample villages or communities;
- Village group meetings;
- Interviews with key informants using structured questionnaire forms;

- Study of natural resources of the area including uses of forests, wild and planted species;
- Traditional classification systems based on ecological distribution, taxonomic differentiation in relation to local cultivar designations (e.g. fruit types, phenological attributes etc.) and social symbolic roles;
- Field observation of the traditional farming systems including home gardens/compound farm subsystems and fetish groves;
- Market survey to document various products emanating from the local environment;
- Collection of herbarium specimens, seeds, seedlings and wood samples to authenticate the various products identified during the various stages of the survey.

#### **4. Using ethnobotanical information to target collecting and development of plant genetic resources of NWFPs**

Eyzaguire (1995) has stated that ethnobotanical information is essential for assessing diversity and adaptation of crops and that in eco-geographical terms "much still remains to be learned about socio-eco-edaphic diversity of crops, and to understand crop adaptation to micro-niches and micro environments". When collecting genetic resources of cultivated and economically useful species, ethnobotanical information (including cultural differences, the socio-economic systems, the institutional environment, as well as land use locations) is important in targeting the areas where collecting can capture significant variation within the species. Ethnobotanical information is also essential for identifying micro-environments and niches (spatial and temporal) within the farming system and its surrounding non-agricultural environments.

Finally, ethnobotanical data provides information on selection and intra-specific variation, the adaptation of plants to their environment (i.e. indications of a plant's competitive, complementary and symbiotic relationships with other species, and its resistance to pests and diseases). The application of ethnobotanical information is useful in NWFP research (especially in the domestication and selection of desired genotypes of fruit trees) within the forest zone of Nigeria, as discussed below.

### **5. Selection**

#### **5.1. Diversity**

The enormous range of forest species and their corresponding multifarious range of uses illustrate one aspect of the diversity of NWFPs in tropical West Africa. The existence of natural variation within fruit trees, resulting in well-defined intra specific taxa sometimes at varietal level, is another aspect of diversity. Both of these aspects of diversity are crucial in efforts aimed at the domestication of edible forest species (Okafor, 1985).

During the course of our research, nineteen rapidly-disappearing woody species were selected for intensive study by our programme (funded by the Biodiversity Support Programme of the World Wildlife Fund). These species were selected because of their importance as known sources of spices, fruits, nuts, seeds and leafy vegetables, and were identified by farmers as being of primary importance for their livelihoods.

#### **5.2. The extent of intraspecific variation**

The existence of intraspecific variation is useful in the selection, breeding and utilization of many tree species (Whitmore, 1976; Okafor, 1980a). Examples of varietal delimitation in West African fruit trees include *Irvingia gabonensis* (Okafor, 1975), in which one of the varieties was raised to the rank of species (*Irvingia wombolu*) by Harris (1996); *Treculia africana* subsp. *african* (Okafor, 1981b); and *Dacryodes edulis* (Okafor, 1983). These examples show great

potential for extending the period of fruit availability, increasing the range of products and yield, and choosing the desired pattern, as well as the season of yield (Okafor, 1978, 1981a; Okigbo, 1977). Some taxa also exhibit intraspecific variation in traits such as more profuse flowering, early flowering, lower height of fruit set, greater yields of fruit, and better quality of fruits, than others (Okafor 1985).

**Table 1.** Species studies with ethnobotanical value (Okafor, *et al.*, 1996a)

Botanical Name	Family	Vernacular Name (ibo, English)	Part Eaten	Traditional Food Type
<b>Trees</b>				
<i>Chrysophyllum albidum</i>	Sapotaceae	<u>udara</u> , star apple	Fruit pulp	Fruit
<i>Dacryodes edulis</i>	Burseraceae	<u>ube</u> , pear	Fruit pulp	Fruit
<i>Dannettia tripetala</i>	Annonaceae	<u>mmimi</u>	Fruit	Spicy
<i>Garcinia kola</i>	Guttiferae	<u>akuilu</u> , bitter kola	Seeds	Seeds as kola
<i>Irvingia gabonensis</i>	Irvingiaceae	African mango	Fruit/seeds	Fruit pulp, seed condiment
<i>Monodora myristica</i>	Annonaceae	<u>ehuru</u> , nutmeg	Seeds	Spice
<i>Pentaclethra macrophylla</i>	Mimosoideae	<u>ukpaka</u> , oil bean	Seeds	Fermented product
<i>Pterocarpus mildbraedii</i>	Papilionoideae	<u>oha</u>	Leaves	Leafy vegetable
<i>P. santalinoides</i>	Papilionoideae	<u>nturukpa</u>	Leaves	Leafy vegetable
<i>P. soyauxii</i>	Papilionoideae	<u>oha</u>	Leaves	Leafy vegetable
<i>Treculia africana</i>	Moraceae	<u>ukwa</u> , breadfruit	Nuts	Roasted nuts
<i>Xylopia aethiopica</i>	Annonaceae	<u>uda</u>	Seeds	Spice
<b>Climbers</b>				
<i>Dioscoreophyllum cumminsii</i>	Menispermaceae	<u>utobili</u> , serendipity berry	Fruit	Sweetener
<i>Gnetum africanum</i>	Gnetaceae	<u>okazi</u>	Leaves	Leafy vegetable
<i>G. buchholzianum</i>	Gnetaceae	<u>okazi</u>	Leaves	Leafy Vegetable
<i>Gongronema latifolium</i>	Sapotaceae	<u>utazi</u>	Leaves	Leafy vegetable
<i>Piper guineense</i>	Piperaceae	<u>uziza</u> , Guinea pepper	Seeds	Spice
<i>Plukenetia conophora</i>	Euphorbiaceae	<u>ukpa</u> , conophor	Nuts	Nuts
<b>Shrubs</b>				
<i>Vernonia amygdalina</i>	Compositae	<u>onugbu</u> , bitter leaf	Leaves	Leafy vegetable

### 5.3. Biodiversity: The farmer's vision

Aumeeruddy (1994) reports several accounts which support the view that traditional societies have their own systems of classification, based on the representation of the natural world. For example, plants may be classified into "hot" or "cold", according to wider symbolic representations of the environment. According to this mode of classification, all elements of the environment, whether inert or alive, are attributed a hot or cold value. Water is associated with cold. Consequently the rivers, springs and flooded low-lying land are cold, as are the plants associated with them. Any plant with fleshy parts and watery exudate is regarded as a "cold" plant. Plants with an acid taste are also classified as "cold", as are species with strong and persistent perfumes, such as *Ocimum* spp. and members of the ginger family, *Zingiberaceae*.

"Hot" plants are those with an irritant character (latex or irritant leaves) or very spicy perfumes. These are plants that release a hot essence which distinguishes them from other cold perfumed

plants such as *Ocimum* spp. Spiny plants and plants which dry out soils (e.g. *Imperata cylindrica*) are also hot plants. The classification of plants as either hot or cold has various implications regarding plant use, notably medicinal and food plants, as well as agricultural practices (Aumeeruddy, 1994).

A second system of classification, founded upon symbolic representation separating plants into male and female according to functional, utilization, ecological distribution or morphological attributes, is also used in Nigeria. Plants are classified as “male” or “female” according to criteria such as the size and shape of the fruit, length of internodes, leaf pilosity (hairiness), etc. Some plants are also classified according to their distribution. For example, *Uvaria chamea* is found in distant farms and fallows which are called ‘uda ofia’, the name by which the plant is also referred. This is distinct from some members of the *Xylopia* genus which are called simply, ‘uda’, on compound farms.

Without doubt, these indigenous classification systems are fundamental in the identification and use of biodiversity.

#### 5.4. Pre-requisites and stages of selection

The diversity and variation of NWFP species provide the basis for selection of superior strains. The first prerequisite for selection is the availability of information and distribution data on the species of interest. This requires surveys and exploration of natural forests, traditional farms, local and urban markets and relevant literature, as well as the identification, classification and general evaluation of NWFP species, e.g. indigenous fruit trees (Okafor, 1993). The second prerequisite is the study of their taxonomic variation and phenology.

#### 5.5. Parameters considered in the selection of superior strains

As illustrated in Table 2, the following parameters or desirable characters were identified for three of the study species.

**Table 2.** Desirable characteristics for three highly valued agroforestry trees (Okafor, 1990)

<i>Irvingia gabonensis &amp; wimbolu</i>	<i>Dacryodes edulis</i>	<i>Treculia africana</i>
<ul style="list-style-type: none"> <li>• Fruit size</li> <li>• Fruit yield (quantity)</li> <li>• Flavour</li> <li>• Lack of fibrousness</li> <li>• Short time to reproductive maturity</li> <li>• Wide range of products</li> <li>• High quality and value</li> </ul>	<ul style="list-style-type: none"> <li>• Fruit size</li> <li>• Fruit yield (quantity)</li> <li>• Pulp thickness</li> <li>• Flavour</li> <li>• Extended fruiting season</li> </ul>	<ul style="list-style-type: none"> <li>• Fruit size</li> <li>• Number of fruits heads / tree</li> <li>• Number of individual fruits / head</li> <li>• Size of nuts</li> <li>• Cooking quality</li> <li>• Consistent fruiting (all year round)</li> </ul>

## 6. Research outputs

### 6.1. Development of nursery practices

In order to determine the suitability of potential inclusion into agroforestry systems of many of the species identified in Table 1, it is necessary to investigate the optimum means of propagation. Seed propagation and pre-treatments needed to ensure germination were investigated.

**Table 3:** Optimum seed germination conditions for selected species (Okafor, *et al.*, 1996a)

Species	Days to first germination	Pre-treatment requirement	Germination %
<i>Chrysophyllum albidum</i>	18	Remove testa and soak overnight with cold water	98.9
<i>Dacryodes edulis</i>	12	Remove endocarp	85.0
<i>Dennettia tripetala</i>	28	De-pulp only	66.0
<i>Dioscoreophyllum cumminsii</i>	68	De-pulp and sun-dry for 1 day	69.6
<i>Garcinia kola</i>	55	Bury inside plantain pseudo-stem for 3 weeks	80.0
<i>Gongronema latifolium</i>	6	None	81.6
<i>Iringia gabonensis</i>	14	De-pulp and air-dry for 2 days	80.0
<i>Pentaclethra macrophylla</i>	21	None	84.3
<i>Piper guineensis</i>	33	None	16.2
<i>Plukenetia conophora</i>	15	None	80.0
<i>Treculia africana</i>	7	Remove pericarp and soak overnight in cold water.	86.0
<i>Vernonia amygdalina</i>	16	None	92.0

Bud grafting was also investigated and was successful for some twenty-seven of the species selected. This method of vegetative propagation has been reported to reduce fruiting age from 10 years or more to 2-4 years, and height of fruit at 1-3 meters instead of 8m or more, in several fruit trees (Okafor and Lamb, 1994, Okafor *et al.*, 1996a).

## 6.2. Benefits to local farmers

As research information became available, training seminars and workshops were used to disseminate the techniques of plant propagation to participating farmers. The techniques of *in-situ* budding, as described in Okafor (1990) were demonstrated in the field and have been adopted on a widespread basis.

As a conservation strategy, the local farmers have been involved in establishing hedgerows with leguminous shrubs such as *Cajanus cajan*, *Pterocarpus santalinoides*, etc., and non-leguminous species such as *Acioa barteri*, *Moringa cleifera* and *Ricinodendron heudelotii* for soil enrichment and the provision of useful products (e.g. fodder, stakes, leafy vegetables). Many farmers also planted species developed in the project nursery (and their home nurseries) in their home gardens and traditional farms. Agroforestry practices such as the use of inter-planting, barrier-hedges, live fences, live stakes and alley farming were also adopted by many of them. In addition, the farmers participating in the project voluntarily formed a biodiversity conservation co-operative society which led to the establishment of a vigorous tree planting campaign.

During the technology transfer stage of the programme, the constraints or problems encountered by participating farmers were recorded and are listed in Table 5.

**Table 4:** Trees with edible parts successfully propagated by bud grafting in Southeastern Nigeria (Okafor, 1998)

Species No.	Species Name	Family
1.	<i>Afzelia africana</i>	Caesalpiniaceae
2.	<i>Trilepisium madagascariense</i>	Moraceae
3.	<i>Detarium microcarpum</i>	Caesalpiniaceae
4.	<i>Dialium guineense</i>	Caesalpiniaceae
5.	<i>Afzelia bella</i> var. <i>bella</i>	"
6.	<i>Myrianthus arboreus</i>	Moraceae
7.	<i>Treculia africana</i>	"
8.	<i>Parkia biglobosa</i>	Mimosaceae
9.	<i>Pentaclethra macrophylla</i>	"
10.	<i>Tertrapleura tetraptera</i>	"
11.	<i>Canarium schweninfurthii</i>	Burseraceae
12.	<i>Ceiba pentandra</i>	Bombacaceae
13.	<i>Chrysophyllum albidium</i>	Sapotaceae
14.	<i>Cola accuminata</i>	Sterculiaceae
15.	<i>C. gigantea</i>	"
16.	<i>C. hispida</i>	"
17.	<i>Hildegardia barteri</i>	"
18.	<i>Monodora myristica</i>	Annonaceae
19.	<i>Xylopia</i> sp.	"
20.	<i>Pterocarpus mildbraedii</i>	Papilionaceae
21.	<i>P. santalinoides</i>	"
22.	<i>P. soyauxii</i>	"
23.	<i>Spondias mombin</i>	Anacardiaceae
24.	<i>Vitex doniana</i>	Verbanaceae
25.	<i>Irvingia gabonensis</i>	Irvingiaceae
26.	<i>Dacryodes edulis</i>	Burseraceae
27.	<i>Ricinodendron heudelotii</i>	Euphorbiaceae

**Table 5:** Problems encountered by representative farmers

Problem	Percentage of farmers response
Seedling mortality and survival	91.7
Lack of capital	91.7
Lack of seeds and planting material	83.3
Working tools and materials	66.7
Damage by grazing animals	66.7
Lack of available labour	66.7
Lack of water	58.3
Lack of land / poor tenure	50.0
Lack of knowledge on preservation, storage and utilization techniques	41.7
Lack of knowledge on germination/ growing techniques of species	25.0

## 7. The potential for commercial exploitation of indigenous species

A number of food products from forest/farm species that have significant commercial potential have been described by Okafor (1991), Okafor and Lamb (1994), Okafor *et al.*, (1996a), and Ejiofor and Okafor (1997). The products include jams, jellies and fruit juice from *Irvingia gabonensis*, *Chrysophyllum albidum*; non-alcoholic beverages from the powdered fruits of *Treculia africana*, health drinks from seeds of *Garcinia kola* and calyx of *Hibiscus sabdariffa* and seasoning from seeds of *Piper guineensis*, *Monodora myristica*, *Xylopi* spp. etc. Medicinal preparations from plant parts include balm for arthritis using leaves of *Cassia tora*, and an anti-malaria tea using *Morinda lucida*, *Azadirachta indica*, *Carica papaya* and *Cymbopogon citratus*. Medicated herbal soaps can be made with leaves of various species such as *Aloe vera*, *Cassia alata*, *Azadirachta indica* and *Lonchocarpus cyanescens*. The commercial exploitation of these species results in increased revenues and health care benefits. The value of these products has implications for both development potential and the need for large-scale conservation of the species on which they are based.

### Lessons from the projects

The future of NWFP research, development and utilization in Southeastern Nigeria and other tropical regions, can be favourably affected by the lessons learned from the research outlined above. These are summarised as follows:

- There is great potential for the commercial exploitation of nutritional and medicinal uses of biodiversity, thereby justifying their large scale development and conservation.
- Local participation is greatly enhanced if the objectives of the project are geared to the needs and priorities of the local people who themselves have a great deal of indigenous knowledge of their socio-economic setting.
- The supply of various inputs and conservation education is necessary to promote the conservation and sustainable utilization of indigenous species in rural communities.
- Financial support and other incentives are required to stimulate and sustain conservation interest among local people.
- There are prospects for employment opportunities through the development of nursery procedures among participating farmers and their families.
- Farmers are able to prioritize their production constraints, including lack of cash, labour, land, planting materials, and improved propagation methods.
- Plant propagation techniques are useful for *ex-situ* conservation of forest and derived savanna species in home gardens and distant farms. This may counteract the unsustainable exploitation of wild resources due to large demands for food and medicinal materials.

### Suggested action plan

In view of the tremendous importance of food and medicinal plants and the attendant loss of biodiversity due to deforestation and population pressure, the conservation needs/problems identified during these studies such as access to natural forest/woodland, the increasing difficulty of procurement of plant samples and the need for a coherent conservation awareness campaign, need to be addressed on a continuous basis. Prioritized suggestions for the increased use of medicinal and food plants in the rural economy of the local populace should be developed in consonance with the perceptions of local people, at the individual, community, local government, state, national, and at international levels (Okafor, 1998). Examples of such suggestions include:

- Training and information sharing;
- Organising and financing awareness campaigns through workshops involving community leaders;
- Organising enlightenment campaigns to generate awareness on the economic and ecological importance of medicinal and food plants;
- The enactment of by-laws for protection and conservation of the flora from bush burning and indiscriminate clearing;
- The support of conservation initiatives of local communities e.g. fetish groves (Okafor and Ladipo, 1994);
- The formation of village conservation committees;
- The provision of support to local and national herbaria for documentation of the national flora;
- The facilitation of training of requisite personnel for taxonomic, ecological and ethnobotanical inventories and studies, of forests and woodlands, in order to assess and demonstrate their conservation and socio-economic values.



**Figure 1.** Rattan drying (Photo: T. Sunderland).

## **8. Conclusions and recommendations**

Involving local farmers in the conservation and evaluation of the use of NWFPs has been shown to be a viable strategy for research, development and enhancement of the utilization potential of indigenous woody species in Southeastern Nigeria. This work has shown that there is an urgent need for increased applied research responding to the needs, opportunities and constraints actually faced by farmers themselves. These efforts should focus on helping to identify changing demands and emerging novel products that farmers could exploit. The potential of many of the selected species for agroforestry systems should be further explored for increased sustainable production and environmental protection (Okafor, 1989, 1990b, 1992; Shepherd and Okafor, 1991).

## References

- Aumeeruddy, Y. 1994. Conservation of the environment seen through the prism of local representations. *People and Plants Working Paper 3*, October 1994.
- Eyzaguirre, P. 1995. Ethnobotanical information in plant genetic resources collecting and documentation. International Plant Genetic Resources Institute (IPGRI). Unpubl.
- FORMECU. 1994. *Non-timber forest products (Nigeria)*. Report prepared for the National Tropical Forestry Action Programme (NTFAP). Forestry Management, Evaluation and Coordinating Unit (FORMECU), Federal Department of Forestry, Abuja, Nigeria.
- Harris, D. 1996. A revision of the Irvingiaceae in Africa. *Bull. Jard. Bot. Nat. Belg.* 65:143-196.
- Kio, P.R.O, Z.O. Gbile, B.A. Ola-Adams & D.O. Ladipo. 1985. Strategies for the conservation of natural forests and grazing lands in Nigeria. Technical Report. *Savanna Series No. 52*. Forestry Research Institute of Nigeria, Ibadan.
- Okafor J.C. 1975. Varietal delimitation in *Irvingia gabonensis* (Irvingiaceae). *Bull. Jard. Bot. Nat. Belg.*, 45: 211 - 221.
- Okafor J.C. 1978a. Development of forest tree crops for food supplies in Nigeria. *Forest Ecol. Management*, 1: 235 - 247.
- Okafor J.C. 1978b. Edible Indigenous Woody Plants in the rural economy of the Nigerian forest zone. *Forest Ecol. Management*, 3.
- Okafor J.C. 1979. Edible indigenous woody plants in the rural economy of the Nigeria forest zone. In D.U.U. Okali, (ed). *The Nigerian rainforest ecosystem*. Proceedings of M.A.B Workshop on the Nigeria Rainforest Ecosystem. University of Nigeria.
- Okafor J.C. 1980. Trees for food and fodder in the savannah areas of Nigeria. *Int. Tree Crops Journal*. 1.
- Okafor J.C. 1981a. *Woody plants of nutritional importance in traditional farming systems of the Nigeria humid tropics*. Ph.D. Thesis. University of Ibadan, Nigeria.
- Okafor J.C. 1981b. Delimitation of a new variety of *Treculia africana* Decne. subsp. *africana* (Moraceae). *Bull. Jard. Bot. Nat. Belg.*, 51: 191-199.
- Okafor J.C. 1983. Varietal delimitation in *Dacryodes edulis* (G. Don) H. J. Lam. (Burseraceae). *Int. Tree Crops Journal*, 2.
- Okafor J.C. 1985. Selection and improvement of indigenous tropical fruit trees: Problems and Prospects. *Journ. For. Res.* Vol. I. No. 2: 87 - 95.
- Okafor J.C. 1989. Agroforestry aspects. Appendix No. 2 of J. Caldecott *et al.*, *Cross River National Park. Oban Division: Plan for developing the park and its support zone*. WWF, Godalming, UK.
- Okafor J.C. 1990a. *Agroforestry development in the Boshi-Okwangwo Division of the Cross River National Park*. WWF, Godalming, UK.
- Okafor J.C. 1990b. *Development and selection of commercially viable cultivars from forest species for fruit*. Proc. of the 12th Plenary meeting of AETFAT. Hamburg.
- Okafor J.C. 1991. Improving edible species of forest products. *Unasylva*, 165 (42), 17-23.
- Okafor J.C. 1992. The Korup Project: Agroforestry Programme. Report on Consultancy work carried out for the GTZ, 6 Jan. - 1 Feb.
- Okafor J.C. 1993. Lost crops of Nigeria. Implications for food security (Okojie & Okali Eds.) University of Agriculture Abeokuta Conference Proceedings, No. 3.
- Okafor, J.C. 1995. Conservation and use of traditional vegetables from woody forest species in Southeastern Nigeria: Promoting the conservation and use of under utilized and neglected crops. *Traditional African vegetables*. Proceedings of the IPGRI International Workshop on Genetic Resources of Traditional vegetables in Africa: Conservation and use 29 - 31 August. ICRAF. Nairobi, Kenya.
- Okafor J.C. 1998. *The consumptive uses and conservation strategies of biodiversity in Southeastern Nigeria*. African Biodiversity series. Biodiversity support program. World Wildlife Fund Washington D. C. In press.

- Okafor J.C. & P.E. Okorie. 1990. Environmental Protection and Ethnobotanical Importance of Nigeria Flora. 4th Annual Botanical Conference, Nsukka, 1990.
- Okafor, J.C, M. Ejiofor & H.C. Okolo. 1993. *Development and utilization of disappearing and under utilized edible woody forest species of southeastern Nigeria*. Final technical report of project grant No. 7536. Biodiversity Support Program, WWF, Washington DC.
- Okafor J.C. & Ladipo, D.O. 1994. Fetish groves in the conservation of threatened flora in Southern Nigeria. In L.A. Bennun, B.A. Aman & S.A. Crafter (eds.) *Conservation of Biodiversity in Africa. Local Initiatives and Institutional Roles*, 167 - 179.
- Okafor J.C. & A. Lamb. 1994. Fruit trees: diversity and conservation strategies. In: R.R.B. Leakey & A.C. Newton (eds.) *Tropical trees: the potential for domestication and the rebuilding of forest resources*. HMSO.
- Okafor, J.C. & Onyeka, N. O. 1996. Monitoring and evaluation of biodiversity conservation programme in the rain forest zone of southeastern Nigeria. Final technical report of project grant no. MA 31. Biodiversity Support Programme, WWF, Washington, DC.
- Okafor J.C., M. Ejiofor & Okolo, H. C. 1996. Edible woody forest species of SE Nigeria. In L.J.G. Van Maesen *et al.*, (eds.). *The biodiversity of African plants*, 684 - 695.
- Okafor J.C., N.O. Onyeka & V. Egwuchukwu. 1998. Identification, use and conservation of indigenous plants for health-care delivery in southeastern Nigeria. Final technical report of project grant no. MB 21, Biodiversity Support Program, WWF, Washington, DC.
- Okigbo, B.N. 1977. Neglected plants of horticultural importance in traditional farming systems of Tropical Africa. *Acta Horticulturae* 53: 131 - 150.
- Shepherd, G. & J.C. Okafor. 1991. Cameroon forest management and regeneration project. Socioeconomic survey report. A socioeconomic survey work carried out during November 1991 in the villages around Mbalmayo Forest Reserve. Proposals for the future, based on team findings. London: Overseas Development Institute.
- Whitmore, T.C. 1976. National variation and its taxonomic treatment with tropical tree species as seen in the Far East. In J. Burley and B.T Styles (eds) *Tropical trees: Variation, breeding and conservation*. Linnean Society symposium series, No. 2. London Academic Press.

# THE MANAGEMENT OF FOREST RESOURCES BY LOCAL PEOPLE AND THE STATE IN GABON

Jean-Pierre Profizi

## Abstract

The management of NWFPs in Gabon highlights the role of well-developed markets for forest products that contribute to the increased pressure on the natural environment. A strong rural exodus and high revenues have combined to increase the rate of harvesting of NWFPs, especially near urban centres, for high-value products such as rattan. The concept of resource management through the negotiation of contracts involving all user-groups is the main focus of the framework of the current Gabonese forestry legislation reform.

## 1. Introduction

In Central Africa, the management of forest resources by local people has deeply altered during the past few decades. Gabon is a good example of this change in forest use. The country is 80% covered by forest and one of the most forested countries of the region (See Map 1). The majority of these forests are rich in okoumé (*Aucoumea klaineana*), a species prized in international markets for the manufacture of high quality plywood.

Gabon has been subject to intensive rural de-population and today, around 75% of the population live in urban areas, especially in the Libreville and Port-Gentil areas (See Map 2). This population drift from rural areas has also been accompanied by the grouping of villages along roads and rivers (see Map 3). The obvious consequences of this mass migration are the presence of an imbalance in population numbers between towns and the remaining rural regions.

## 2. Traditional, modern and industrial forest management

With regard to NWFPs, it is common to distinguish two types of environmental management by local people. One is considered "traditional" and the other "modern". In addition to these forms of forest management, large commercial concerns apply "industrial" management of some forest products with the support of the state (See Figure 1).

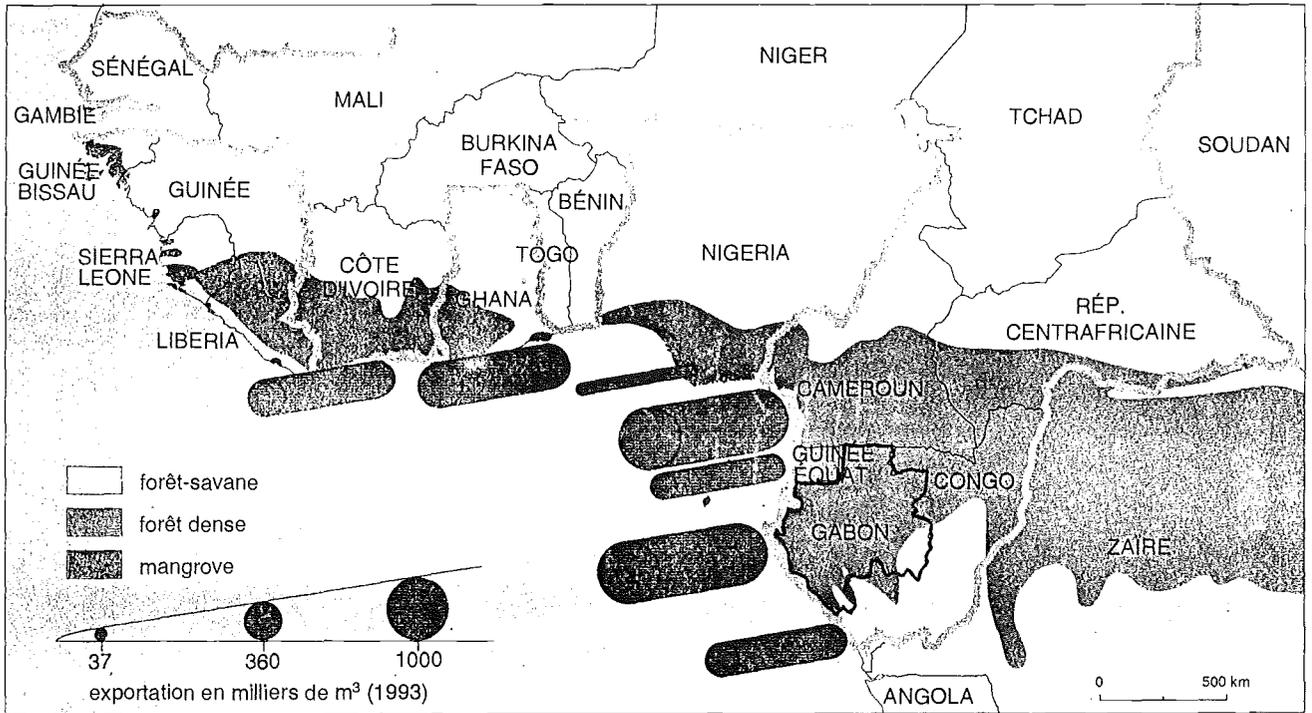
The "traditional" management system is linked to the survival of individuals and communities in the equatorial forest environment which is considered innately hostile but is a regular and limitless supplier of plant and animals products. This system is characterised by mobile and diffuse harvesting, low impact on the environment and little exchange, either in terms of barter or monetary remuneration, with outside parties. This form of traditional management is practised by the majority of forest people for a wide range of forest products.

On the contrary, the "modern" management of forest resources is characterised by intensive harvesting and exploitation, with products being channelled through organised and well-established marketing routes. In general, the revenues from forest products are commonly low, badly distributed, with little control by the state. However, often such exploitation is the sole cash income of rural people and often the need for immediate cash means that destructive harvesting systems are often practised.

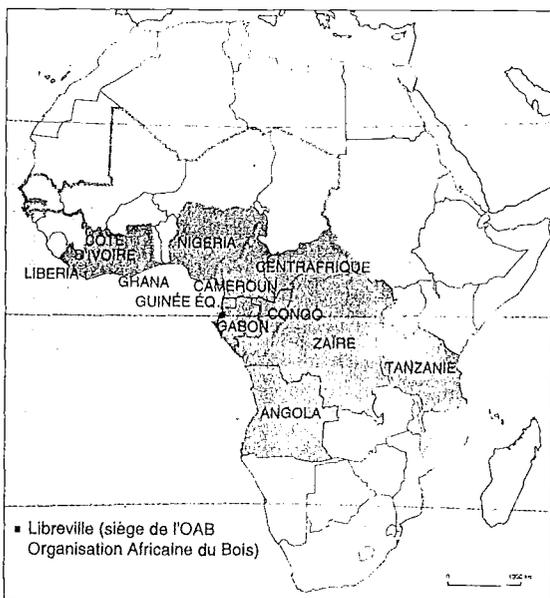
**Map 1: a)** Distribution of dense forest- and savannah forest areas in Central and West Africa, and wood exports of major exporting countries; **b)** Member states of the African Timber Organization (ATO, headquarter in Libreville); **c)** Ranking of countries with highest forest cover rate (forest area as percentage of country).

(R.Pourtier, 1995 - Atlas de la zone franc en Afrique sub-saharienne, Ministère de la Coopération, La Documentation Française, Paris, 1995).

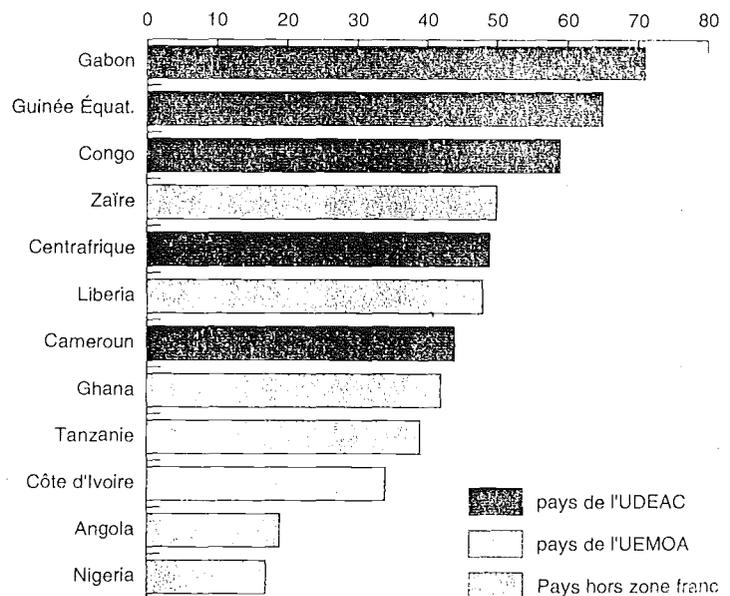
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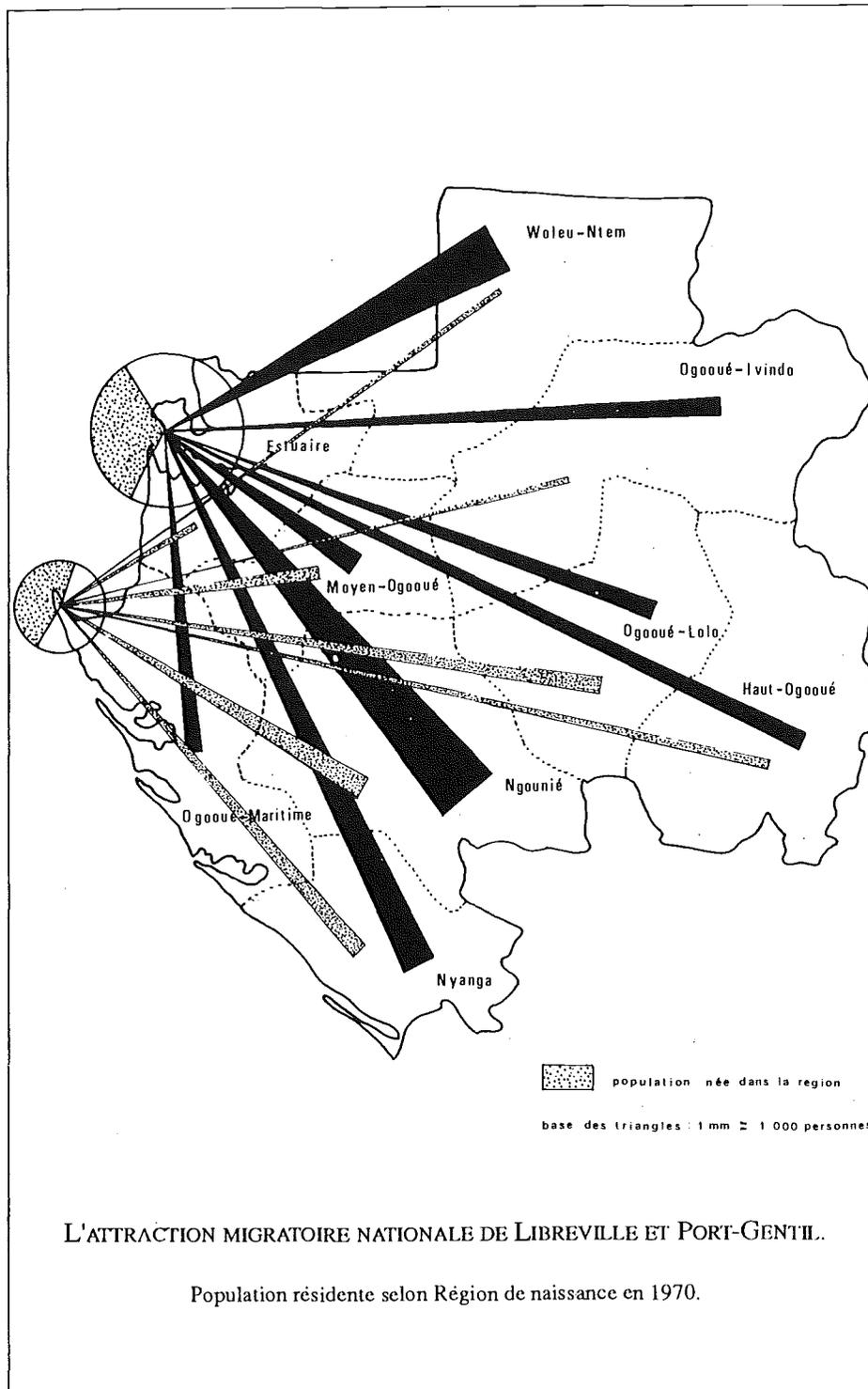
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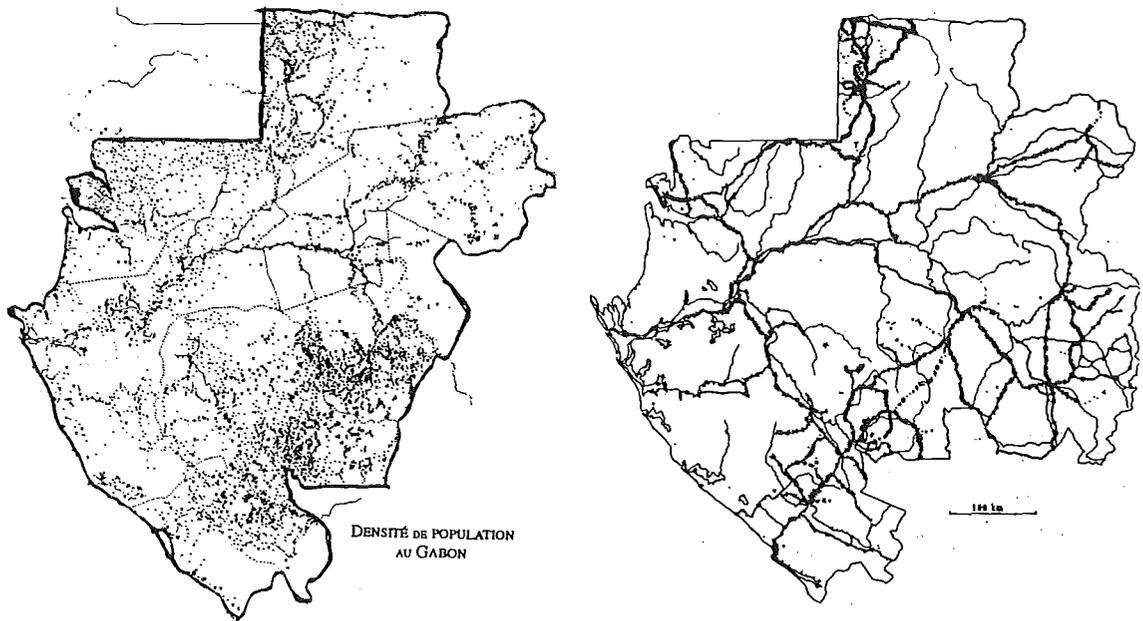
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**Map 2:** Population migration of rural people towards Libreville and Port-Gentil, and their respective amount in the total number of habitants of these 2 cities. (in R. Pourtier, *Le Gabon*, L'Harmattan, Paris, 1989).



**Map 3:** Difference of population density and distribution in Gabon between 1940 and 1970. (in R. Pourtier, *Le Gabon*, L'Harmattan, Paris, 1989).



DISTRIBUTION DE LA POPULATION AU DÉBUT DES ANNÉES 1940.

Réduction de la carte établie par R. Delarozière et Y. Thierry. ORSC 1944.

L'ESPACE LINÉAIRE CONTEMPORAIN.

Répartition par points de 100 hab. de la population des villages. Situation 1970.

**Map 4:** Expanding harvesting areas for rattan around the city of Libreville along the following roads: I) Libreville - Cap Esterias; II) Ntoum - Cocobeach; III) Kougouleu - Medouneu.

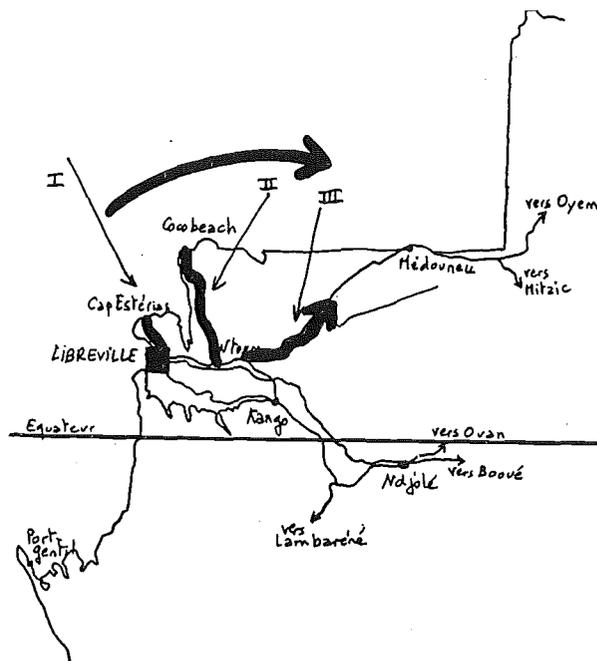


Figure 1. Overview of the NWFP sector in Gabon.

Subsistence strategy "Traditional" management	Commercial strategy "Modern" management (simplified overview)
Individuals, communities  harvesting  self-consumption	decision maker (company)  harvesting done by employed labour  intermediate markets (volume accumulation)  intermediate traders  final market  urban consumers
<p><b>Socio-economic results:</b></p> <ul style="list-style-type: none"> <li>- monetary incomes linked to periodical surpluses,</li> <li>- NWFP are essential for harvester's livelihood,</li> <li>- regulation of harvesting levels is strong and immediate.</li> </ul>	<p><b>Socio-economic results:</b></p> <ul style="list-style-type: none"> <li>- income: low along the chain except for the decision maker (company),</li> <li>- NWFP not essential for harvester's subsistence,</li> <li>- harvesting is adjusted according to resource availability.</li> </ul>
<p><b>Species concerned:</b> majority of known NWFP</p>	<p><b>Species concerned:</b> only "commercial" NWFP (rattan, <i>Garcinia</i>, leaves for wrapping,...)</p>

In the case of rattan, for example, many harvesters have begun to be displaced due to considerable over-exploitation along many of the country's main transport routes, especially the roads from Libreville to Cap Esterias, Ntoum to Cocobeach and, more recently, Kougouleu to Medouneu, the preferred areas for harvesting due to easy access to the raw material. Exploitation now has to take place deeper into the forest and the issues of resource management are rapidly changing in as much as many local people are now allowing harvesters access to the rattan on their forest lands and transporting it to the roadside for direct sale to rattan traders. Many communities are now able to make money from the access to their land and are also able to monitor levels of rattan exploitation and transportation (See Map 4).

"Industrial" forest management is practised by for-profit concerns, and is often supported by the state for which it ensures considerable revenues. It has had a deep impact in the exploitation of forest products and has increased the transition of local people from "traditional" to more "modern" management systems.

However, these classifications are limited as there is no general forest resource management by local people. There is a patchwork of behaviour and practices whose diversity is linked to the species and the product, to traditional property rights, to the country and local community history, and to the organisation of channels of commercialisation and marketing.

# THE ROLE OF WOMEN IN THE PROMOTION OF FOREST PRODUCTS

Mrs. G.E. Burnley

## Abstract

In Cameroon, as in many other developing countries, people at the grassroots, especially women, are unaware of the majority of the debates on "the changing environment". It is postulated that there are direct links between poverty and environmental degradation. Recent field experiences show that alternate means of making a livelihood can save the environment from resource over-exploitation and degradation, especially when alternative income-generating activities are aimed primarily at women. This paper discusses some of the projects undertaken by women in Southwest (SW) Province, Cameroon, both on an individual basis and in groups aimed at protecting the environment and improving their socio-economic situation, as well as gaining time for leisure and increased training opportunities. Some preliminary results are presented, highlighting some of the successes and associated problems.

**Key words:** Women, poverty, deforestation, environment protection, non-wood forest products

## 1. Introduction

In Cameroon, poverty and hardship, following changes in foreign trade balances deepened in the early 1990s with devaluation of the CFA franc in 1994 bringing further economic difficulties. This "economic crisis" caused mass redundancy in the public and private sectors, dismissals, salary cuts, early retirement and freezing of assets, arrears and debts owed to people, particularly civil servants. Many people turned to farming to sustain their families and consequently there has been significant urban to rural migration. As forests have been cleared for subsistence agriculture, the availability of products from the original forest such as firewood, forest fruits, vegetables, leaves for wrapping, nuts, seeds, spices, medicines, stimulants or craft materials has been reduced. In addition, organised, yet illegal, fuelwood merchants have destroyed private farms and forest reserves in public lands often felling trees, including fruit and coffee trees to supply the market for fuelwood which sold at increasing prices because of the high demand. Large trucks with firewood towering high in tottering vehicles have become a common feature of our towns and cities.

To halt this fast-deteriorating situation, a new forestry law was passed in Cameroon in 1994 to define measures to be taken to ensure the wise management of forestry resources. The new measures call for the equitable sharing of benefits, the sustainable and viable use of resources, the enhancement of effective popular participation and the need for more effective partnerships to surmount environmental difficulties. In particular, the new legislation has targeted women as playing an increasingly important role in forest conservation and rural development initiatives.

## **2. Organisation**

Women's groups began timidly in colonial days and, although becoming stagnant in the 1970s and 1980s, have gained much ground in terms of numbers, intensity of activities and political importance in recent years. Growing interest in women's active role in development in the last few years culminated in a massive participation and contribution of Cameroon women at Dakar, 1994, and at the Beijing Conference in 1995.

There are many international NGOs with a strong presence in Cameroon, such as the Associated Country Women of the World, International Council of Women, the International Federation of Business and Professional Women, Soroptimist International, the Association for Creative Teaching which was succeeded by Business Enterprise Development (ACT/BEDO). There is also a plethora of local community-based organisations, common initiative groups and co-operatives. Many of these groups are involved in environmental activities linking the desire for forest conservation with the need to support the family unit from forest-based activities.

## **3. Women and the cultivation of forest products**

The cultivation of fuelwood trees and other forest products by women seemed to be a practical way to help solve one aspect of the environmental destruction by reducing the pressure on the harvesting of wild stocks whilst providing substantial benefits to the family or group concerned. Involving women in large numbers in the cultivation and distribution of a wide variety of forest products seemed to make sense because women constituted the vast majority of both farmers and end-users of many of the products concerned.

### **3.1. Fuelwood**

Fish, especially dried fish, a local staple in many parts of Cameroon, has become very expensive because firewood and charcoal are becoming rather scarce and difficult to obtain. Women often have to travel far into the hills to collect twigs or wait for the firewood dealers, illegal timber merchants, to bring the overloaded vehicles with their merchandise. Many women's groups identified the need and desire to cultivate fast-growing fuelwood species on their farms. To address this need, a joint Limbe Botanic Garden and Women in Development/Business Environment Development initiative began in 1994 with funding from Africa 2000 and, more recently, the Rainforest Alliance.

The project began with the selection and construction of a permanent nursery. Once this was established, suitable species were selected, seed material for propagation was obtained and many thousands of seedlings were raised. Technical training for extension workers and other interest groups as well as advice on planting and care preceded the distribution of the seedlings to a wide range of women's groups, often in demonstration workshops. The extent of planting and preliminary results are discussed below. In addition to the distribution of seedlings, improved wood stoves have also been introduced to ensure fuel wood economy by both domestic and commercial users.

### **3.2. Medicinal plants, stimulants and spices**

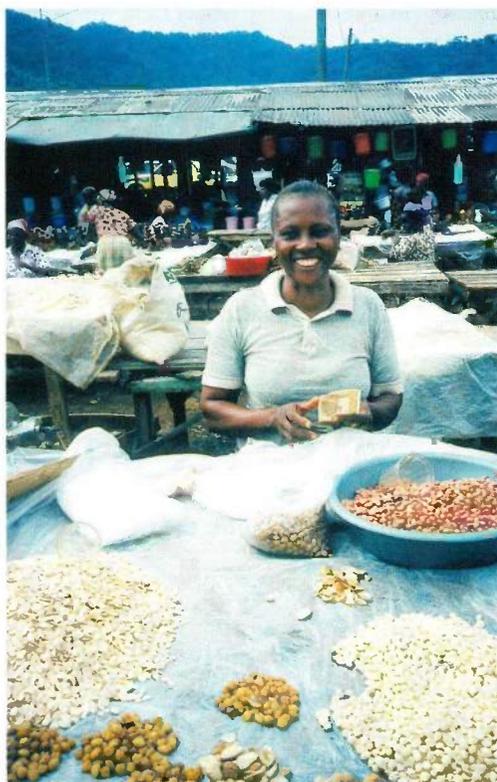
Many forest products which were once cheaply obtained in the market are becoming increasingly scarce and prohibitively expensive. It has long been proposed that many of these products could be easily cultivated in home gardens for both subsistence use and possible sale. In a series of workshops, a wide range of forest products were introduced to many women's groups during excursions to the Botanic Gardens, where they could see for

themselves the possibility of cultivating many of the plants they knew well from the forest. This was especially the case with many medicinal plants, notably those species of a “general” nature, stimulants such as kola nuts and a number of forest spices, many of which are integral to Cameroonian *cuisine*. This has led to a visible increase in the expanding of many kitchen gardens and compound farms, both in terms of size and diversity. Many of the women involved in this activity state that the benefits include a drop in health care expenditure as more traditional home remedies are available. In addition, the high value of many medicinal plants, local spices and kola nuts mean that a surplus beyond immediate home consumption provides a significant income to the household and many of these products are prepared, packaged and sold in local shops or market stalls.

A number of medicinal and spice tree crops, including *Prunus africana*, have also been successfully introduced into capital extensive cultivation systems managed by women’s groups (see Nkefor *et al.*, this volume). This is an indication that many of the co-operatives are concerned with the long-term benefits of cultivation as well as immediate profits.

### 3.3. Fruit trees

A number of high-value and high-yielding fruit trees have been propagated as part of this programme and distributed to many women’s groups and individuals. Species such as bush mango (*Irvingia gabonensis*) and bush plum (*Dacryodes edulis*) are extremely popular and provide potential for income generation through the sale of surplus fruits after harvesting.



**Figure 1.** Non-Wood Forest products on sale at a local market (Photo: T. Sunderland).

### 3.4. Eru (*Gnetum africanum*)

Foo-foo and eru is popular throughout Cameroon and is an important component of the national *cuisine*. Demand for eru has reached the point that it is now being exported to neighbouring countries like Nigeria and, from there, further afield to Europe and North America (See Tabuna, this volume). The leaves of eru fetch very high prices and the high demand has increased pressure on this non timber forest product which is fast becoming locally extinct in many areas (See Shiembo, this volume). Cultivation trials have proved very successful. Eru, as a fast growing climber using the planted trees as support, provides another valuable component to the tree-planting programme.

### 4. Some Results

Target villages in SW Province: Activities and progress to date

Wovia	Lysoke	Munyenge	Banga-Bakundu
1995: 600 seedlings distributed but were lost in the nursery stage.	1996: Distribution of 600 <i>Cedrela odorata</i> seedlings for fuelwood. Planted between small-scale oil-palm and rubber farms. Height of plant on inspection 3 metres (average). All plantings presently in good state. 1998: Distribution 450 of <i>Prunus africana</i> seedlings. Still in nursery provided by villagers due to late arrival of rains. All in good state – will be planted soon following planting demonstration workshop.	1995: planting of 400 seedlings of <i>Terminalia superba</i> and <i>Cedrela odorata</i> in forest completely devastated by timber exploitation. 2nd visit in 1998. Trees in very good condition, 98% survival, fast growing at 1 metre annually; in a well managed state.	1995: 1st and 2nd distribution of 600 <i>Prunus africana</i> planted 5m apart in a 1 hectare land inside a valley bounded on each side by palm and rubber plantations. State of farm – 60% survival, weedy. Small family farm with insufficient labour force. Trees of varying sizes with a mean height of 85cm. Advised on the need for more labour, clearing and mulching with palm cones.

### 5. Conclusions

In many villages, women have difficulty owning land. The planting of trees on farmland is a traditional claim to ownership for many cultural groups and this programme, through encouraging women in planting trees, has also allowed them to own land for the first time.

In addition to problems of tenure, to improve the programme we need to:

- Encourage backyard/kitchen gardens and small tree plantations of NWFP;
- Encourage cultivation of marshes, riverbanks and fringes of villages;
- Use easily managed multipurpose tree-seedlings known to villagers for fuel and other uses rather than exotic species, beginning with fast growing species for quick financial returns.

# THE MANAGEMENT OF NON-WOOD FOREST PRODUCTS IN PROTECTED AREAS: LESSONS FROM A CASE STUDY OF MULTIPLE-USE IN BWINDI IMPENETRABLE NATIONAL PARK, UGANDA

A.B. Cunningham

## 1. Introduction

A primary goal of this CARPE meeting is to assess the potential role of non-wood forest product (NWFP) use in contributing to forest conservation. In this presentation, the example of the multiple-use programme at Bwindi Impenetrable National Park (BINP), Uganda, is used to illustrate the potential and pitfalls of processes leading to NWFP use within protected areas. As we all hope to conclude this meeting with a series of pragmatic "take home messages" that will help organisations and individuals interested in this issue move forward in policy and practice, I have structured this paper by stating a series of points (the "take home messages"), illustrating each one through examples from the BINP case-study or from other cases. In this process, I hope that this paper may sharpen the focus of the CARPE programme's goals of identifying the most promising forest products, the most promising conditions and exploitation systems which lead to forest conservation through NWFP use, rather than a situation where a policy of increased use of NWFPs leads to species-selective over-exploitation of the "most valued, most vulnerable" sub-set of NWFPs.

By taking Bwindi Impenetrable National Park and its Afromontane forest as a case-study, I am able to highlight the potential and many pitfalls of NWFPs which may not yet be evident in massive forested areas such as the Zaire basin or Amazonia where human population densities are 1-10 people/km<sup>2</sup>. Secondly, it is located near the border of Uganda, Rwanda and the Democratic Republic of Congo (former Zaire) in a region characterised by political instability as much as by endemic species.

## 2. Location and historical background to the case-study

Bwindi Impenetrable National Park, while large (330 km<sup>2</sup>) by comparison to most remaining Afromontane forests (generally <1-20 km<sup>2</sup> in size) is still relatively small compared to lowland tropical forests and is surrounded by 100-320 people/km<sup>2</sup>. As a result, due to high demand and lower stocks of some species, it provides a very useful case-study from which valuable lessons can be drawn so that NWFP policy is cautioned by practice. At the same time, it is important to recognise that the extensive and more sparsely populated lowland forests in the CARPE region of interest offer the greater opportunity for harvest due to large stocks and lower local (but not necessarily international) demand for NWFPs.

In 1990, a public inquiry around Bwindi Impenetrable Forest recorded strong local opposition to the creation of a national park, primarily because local people believed they would be deprived of the use of forest resources (Hamilton *et al.*, 1990) so that "white people can watch gorillas" (Wild and Mutebi, 1996). Nevertheless, in 1991, Bwindi Impenetrable forest changed its status from a forest reserve to a national park. With this proclamation came a rapid change from easy access to forest resources during a 15 year period of turmoil in Uganda (during the Amin/Obote period), to the situation where access to any forest resources was stopped. By 1990, following recommendations made by Butynski (1984), the destructive activities of agricultural clearing, pit-sawing and gold mining in Bwindi Forest Reserve were

stopped and in 1991 Bwindi Impenetrable forest was declared a national park. Consistent with national park legislation in many parts of the world, this change of legal status also precluded natural resource use within the boundaries of the national park. The result was an upsurge of public opinion against the new national park from the surrounding community. This was stimulated on one hand by loss of access to forest resources and on the other by some foresters being embittered by loss of revenue from illegal timber loggers and gold-miners in Bwindi forest. A consequence of this was increased fire damage through little or no community control of accidental fires or arson in the dry season of late-1991 and early 1992. Fire thus became a significant threat to parts of the national park. It was under these circumstances that networking and resource management planning at a local community level first began.

To some extent conflict is inherent in any protected area management programme due to the difference between the long-term goals of conservation and peoples shorter-term needs. These conflicts increase with higher human population densities, higher arable potential soils and with resource scarcity. Richard Bell (1987) points out with his characteristic clarity:

"Any programme that emphasises long-term communal benefits at the expense of short-term individual benefits will meet with resistance. The problems and costs of conservation are proportional to the extent of the conflict between these two sets of interests. For a conservationist programme to develop and survive without external enforcement, the benefits conferred must be real and they must not be long delayed" (Bell, 1987).

Multiple use, not just of NWFPs, but through other consumptive and non-consumptive uses plays an important part in this process. In 1992, a survey around BINP recommended a "middle-road" where use of high-value, low-impact resources (bee-keeping, medicinal plants and basketry fibre use) should be permitted within multiple-use zones (Cunningham, 1992). In theory, two approaches could be taken. First, not to allow any use of wild plants by local people until potential sustainable yields had been determined. However, this was not practical given the diversity of species and short time needed before decisions had to be made on the people/protected area conflict. The second option is to take an adaptive management approach, allowing harvesting and monitoring the response of harvested populations as described by Walters (1986). In the Bwindi Impenetrable National Park case, we took an approach mid-way between these two options. Neither the money, the time nor the manpower were available for determining productivity or sustainable yields of all harvested species. Equally, it would have been counterproductive to repeat over-exploitation problems experienced elsewhere in Africa with building poles (Hall and Rodgers, 1986; Muir, 1990), craftwork resource or medicinal plants (Cunningham and Milton, 1987; Cunningham, 1991) or fuelwood (Leach and Mearns, 1989). If harvesting is not sustainable, then it is a false solution providing brief respite from land-use conflict by putting off the real solutions to the problem.

For this reason, the CARE Development Through Conservation Programme (DTC), which supports the Uganda Wildlife Authority (UWA) in implementing this integrated conservation and development project (ICDP), has placed an emphasis on providing viable alternatives to high volume uses such as fuelwood, building materials and bean-stakes outside the national park through agroforestry and rural development programmes (Wild and Mutebi, 1996). The UWA and the Uganda Forest Department recognised that the needs of neighbouring communities have to be considered and met, if protected areas are to have a long term future. Methods developed to meet these needs include, the sharing of tourism revenues, development activities in park adjacent areas, conservation education and resource utilisation.

### 3. "Take home messages"

**Point 1:** When NWFP use forms part of a multiple-use (and conflict resolution) strategy between local communities and protected areas, we must seek a "middle-road" between the "fences and fines" preservationist approach and "conservation" programmes driven almost solely by short-term benefits through "people's participation" which take no account of the local peoples resource needs in the long-term. A short-term approach may provide a temporary "bonanza" of resources now scarce outside the protected area, but it will undermine the primary goal of any protected area, i.e. the maintenance of habitat and species diversity. The common ground is that if a valued but vulnerable resource is overexploited, local people and conservation both lose out.

Over the past few decades and particularly since the late 1980s, there has been a strong move away from a "fences and fines" preservationist approach to protected areas to one stressing sustainable use and community development. This broader approach is evident in the different IUCN categories of Protected Areas which were developed in the mid-1980s and recently modified at the IV World Congress on National Parks and Protected Areas in 1992. In part, this change in approach to conservation came through the recognition that conservation attempts to maintain the integrity of protected areas by excluding all types of local community interaction and use has largely been unsuccessful (Wells and Brandon, 1992). In some cases, the pendulum has swung so far towards the local community/rural development side that Katrina Brandon (1997) recently wrote that "the majority of conservation programmes are in fact large and complicated social programmes" and that "the attention to sustainable development and poverty alleviation, while important, does not address environmental issues. If anything, these concerns broaden the agenda and dilute the message". Oates' (1995) cautionary tale from a forest conservation programme in Nigeria is a good example of this.

We need to be able to look beyond the smokescreen of "bio-politics" and untangle the complex interplay of ecological, political, religious, economic and social undercurrents behind successful or failed examples of resource conservation. There has been too much generalisation on a range of very diverse and dynamic situations. For every claim that "rural people have sophisticated systems of natural resources management which have maintained biodiversity for thousands of years" and that "people living adjacent to protected areas have found themselves deprived of resources which for thousands of years they had a right to utilise" (IIED, 1994), there are cases where local people have destroyed high diversity habitats, or where the people living adjacent to protected areas are recent migrants.

The recent pendulum swing back to "preservationism" called for by several prominent expatriate biologists who have worked in the tropics (Kramer, van Schaik and Johnson, 1997) is unworkable anywhere in tropical Africa. Reasons for this are that protected areas need to be maintained under circumstances of political turmoil, lack of funds, changes of government and a "brain drain" of senior park staff - with expatriates often those who leave first and fastest. As Jonathan Kingdon (1990) points out:

"...the realities of power are exactly the opposite to those perceived by most of the participants of this struggle to conserve key areas of high endemism and biodiversity because the long-term future of Africa's Centres of Endemism lies with local peasantries rather more than with transient governments or enthusiastic conservationists, yet locals seldom receive the respect that is generally accorded to those that wield power. Meanwhile, both populations and resentments grow.....The conservationists' answers should not lie in propagandist campaigns, which are generally seen for what they are, but in a shared growth of knowledge and debate. The minimal demands of local communities will include sustained, not ephemeral programmes of action in which their own people can find meaningful, decisive and dignified roles".

Several forest conservation areas in the borderlands of western Uganda/eastern DR Congo (formerly Zaire) and north-west Rwanda, including BINP are prime examples of this. Despite the fact that three of these forested national parks form the stronghold of one of the "ultimate" flag-ship species for international conservationists (the Mountain Gorilla (*Gorilla gorilla berengei*) and BINP is the first African protected area to receive funding through an international Trust Fund, it only has 30 park staff for an area of 330 km<sup>2</sup> for a national park surrounded by 100,000 people living in immediately adjacent parishes. Under these circumstances, total protection is not possible.

A basic principle behind multiple-use (and NWFP use) is to help off-set some of these lost opportunity costs and better justify conservation as a form of land-use. In principle, benefits need to be directed to those living closest to the protected area. In most cases, these are the people who are most affected by crop raiding animals and loss of access to plant resources inside protected areas. This is well illustrated by the household surveys by the CARE-DTC project recording the number of respondents from communities adjacent to the Bwindi Impenetrable National Park collecting forest products, pit-sawing or affected by crop-raiding animals prior to park closure, compared to those away from the forest (Wild and Mutebi, 1996).

Benefit sharing, including that from eco-tourism revenue should take place through local community institutions set up for this purpose, which should be representative of the communities and of resource users. This is often easier said than done. Protected areas are often located in more remote areas where access to literacy skills is limited. In many cases, resource users are from a sector of the local community with the least economic or political power. For these reasons, local resource users are generally not well represented, even at the lowest level of formal local government, although they may be highly influential members of their own communities. In addition, the administrative boundaries that form the basis for local government within the nation state rarely conform to the territorial boundaries of local communities. This may further skew the relationship of who "represents" communities surrounding protected areas.

**Point 2:** We need to better use the predictive ecological, anthropological and economic tools we have to avoid situations where resource over-exploitation and conflict develop despite (or because of) good intentions which then lead to worsened circumstances for local communities and for conservation.

We have the advantage of hindsight from successes and failures in many conservation and development case studies, not only in forests, but also in savannah woodlands and grasslands. We also know that sustainable use of NWFPs depends as much on a predictive understanding of the biological component as it does on the social and economic aspects of NWFP use. We have many of those predictive tools based on key issues drawn from ecological, social and economic studies of tenure, trade and NWFP use or abuse. It is essential that we use these tools to avoid cases where good intentions catalyse resource depletion. While sustainable harvest of any NWFPs is possible in theory, it is often more complex than people think. What is often glossed over is that high conservation priority habitats, with a high species diversity and slow-growing, habitat specific species require a level of management of an intensity that is not possible with the economic constraints that are a feature of many conservation departments.

For all interest groups, whether resource users, rural development workers or national park managers, it is far better to have pro-active management and to stop or phase out destructive harvesting in favour of suitable alternatives before over-exploitation occurs, than to have the

"benefit" of hindsight in the midst of a devastated resource. Marilyn Hoskins (1990) puts this well in her paper on forestry and food security:

"All research and management by outsiders must remember that their activities come and go, but food security -- land and resources surety -- is a long-term, life and death issue for rural peoples".

**Point 3:** The complexities of implementation increase exponentially with increasing numbers of species coupled with a high number of resource users.

The culture/nature interface of Afromontane forests and surrounding farming communities is a very different and more complex situation to resolve. Firstly, resource sharing is focused on a wide range of non-wood forest products and on eco-tourism revenues from gorilla viewing rather than hunting. Secondly, because of their structural complexity and higher species diversity, forests provide a very different situation to harvesting of plant resources in several other African protected areas. Muir (1990), for example, working with local wood-cutters in Afromontane forest in southern Africa, has demonstrated that cultivating alternative sources of building material outside indigenous forest can be over ten times cheaper than the cost of an intensive monitoring programme for sustainable use of that resource.

In savannah parks in southern Africa, harvesting commonly focuses on plants from wetland or disturbed grassland situations. Examples are harvesting of *Phragmites australis* reeds and *Cymbopogon validus* thatch grass from wetlands or disturbed grasslands. Unlike forests, these vegetation types have a wide distribution, low species diversity and high biomass production of annual stems which are resilient to harvesting for hut-building purposes (Cunningham, 1985; Shackleton, 1990). Managed harvesting of reeds and thatch-grass is also facilitating late autumn and winter cutting when disturbance to nesting birds is minimised. Similarly, at a species level in African savannah, harvesting usually applies to common, fast-growing thatch or encroaching woody species such as *Acacia karroo*, *Acacia nilotica*, *Dichrostachys cinerea* (Fabaceae) and *Euclea divinorum* (Ebenaceae) which are harvested as an aid to management objectives for the savannah parks.

In contrast to reeds and thatch species, data on abundance, productivity and population biology of Afromontane forest trees, even those of major economic importance, are limited. This applies even more to the hundreds of species representing "minor forest products". Concern over loss of access to wild forest plant resources is an important local issue as wild plants provide craft and building materials, fuel, medicines, food supplements or are a source of honey to people around the forest. The question is, once resources have been identified, how does one decide whether uses are sustainable or not? In the Bwindi case-study, based on ethnobotanical surveys of the forest, local markets and households, wild plant resources were divided into three categories:

First, a **low impact, high value** category, where impact is low due to harvesting of small volumes of plant material by specialist users, particularly where leaves, fruits or flowers are used. This includes non-commercial harvesting of medicinal plants by traditional healers and midwives or for veterinary medicines, occasional felling of the secondary forest tree *Polyscias fulva* by traditional blacksmiths, harvesting basketry materials or bee-keeping. All of these uses have low biological impact but high social value through this harvesting to a large sector of the community.

Meetings with bee-keepers have led to mutually accepted regulations printed on Bee-keeping Society Membership cards requested by this forest user group. To date, nearly 500 bee-keepers in four parish bee-keeping societies are registered to keep an estimated 3 000 hives within multiple-use zones. In addition, the DTC project is assisting bee-keepers with processing and marketing of surplus honey. Initial ethnobotanical surveys with traditional

healers and basket-makers have been followed up with PRA work in three pilot-study parishes, leading to harvesting of selected species. Each of these activities falls within Joint Forest Management (JFM) agreements developed within each of these parishes and signed by the Forest Societies and Uganda National Parks (UNP), including access to certain footpaths through the forest and to a hot spring site considered to have spiritual healing qualities.

Second, a monitoring **adaptive management** category, where subsistence demand was high relative to supply or where species selective commercial harvesting was beginning to develop. This included seasonal and rotational management to specialist harvesters of the montane bamboo, *Synarundinaria alpina*, a slow growing forest climber *Loesneriella apocynoides* (Celastraceae), medicinal plant species such as *Hallea rubrostipulata* (Rubiaceae) whose bark is gathered on a small-scale commercial basis, and the secondary forest tree *Rapanea melanophloeos* (Myrsinaceae), which is used by woodcarvers.

Third, a **substitution category**, of continued closed access to resources where sustained use is not possible due to either complexity, high demand or slow growth rates where the emphasis needs to be placed on providing alternatives outside the national park.

This was considered to be the case for some wood uses (beer boats, bean stakes, building poles, fuelwood) due to the combination of past impacts, high demand and limited staff for monitoring or management of multiple-use species in an uneven-aged, high diversity forest. To foresters, whose objective is hardwood timber production, saplings of "reserved species" represent regenerating timber trees. To people from local rural communities they also represent an important source of beer boats (>50cm diameter at breast height (dbh), building material (5-15cm dbh) or bean poles (1.5-5cm dbh) with high density wood favoured due to greater resistance to borer attack or fungal infection. These species are not only an immediately useful resource to local people. However, they also represent the future forest canopy of the next century which needs to be conserved if the forest is to survive.

Provision of alternatives to harvesting of beer boats, bean stakes and building poles was recommended on the basis of their widespread use, the high volumes used, the focus on hardwood species and problems that have arisen in other Afromontane and coastal forests (Cunningham, 1992). It was also recognised that the success of forest conservation and community relations strongly depends on how effectively tree cultivation is implemented. Shortages of fuelwood, building poles and bean stakes are being experienced in the DTC area, and a shortage of large trees for beer boats can be expected in the future. Reasons for wood scarcity, and solutions to the problem are recognised by local people. Cultivation of trees is widely practised in the DTC area already. Elephant grass (*Pennisetum purpureum*) and trees (particularly *Eucalyptus*) are also planted for bean stakes, while *Ficus* cuttings are planted for beer boats. In at least one area, even hardwood timber trees have been planted, with *Entandrophragma* (Meliaceae) reaching a diameter of 90 cm within 40 years. Such local initiatives need to be recognised and encouraged.

In a recent survey conducted in the DTC area, for example, *Eucalyptus* (88% of respondents) and *Acacia mearnsii* (49%) were the species most preferred for building and had respectively been planted by 77% (92) and 36% (43) of respondents (Kanongo, 1990). From field observation, it is clear that many homes in the DTC area are built from these cultivated tree species (particularly *Eucalyptus*), with the use of exotic species increasing with distance away from the forest. Over 125 farmer-tree nurseries have now been developed. Guided by local farmer preferences, the focus has been on *Eucalyptus* woodlots and the agroforestry species *Sesbania sesban*, a nitrogen fixing species useful for bean stakes. In addition, two indigenous tree nurseries have been maintained, with 5 000 trees distributed in the past year. Local Conservation Extension Agents (CEA's) employed by CARE are also assisting local

farmers with climbing bean variety trials, banana plantation management, soil conservation and vegetable growing with the aim of sustainable agricultural production.

**Point 4:** It is crucial that any forest conservation/NWFP harvest programme takes the specific needs and roles of the pygmy peoples, who are the ancestral inhabitants of these forests (e.g. Baka, Mbuti, Batwa), into account.

There are several reasons for this. Firstly, it is crucial to work with them as an important forest user group. Many pygmy communities are not only heavily involved in the bush-meat trade, often in a "protein for starch exchange" with agriculturists, but they are also involved at the lower end of the commercial marketing chain for many timber loggers and for NWFPs such as commercial collection of *Pausinystalia johimbe* bark, *Gnetum* leaves and forest tubers (e.g. *Dioscorea* yams) and forest fruits (e.g. *Irvingia*, *Ricinodendron heudelotii* etc.). Secondly, throughout the region, they also place great cultural and religious value on some species which can exceed the barter or commercial value of those NWFP species (e.g. *Dioscorea*). Thirdly, this is an issue of cultural survival. In the Bwindi Impenetrable National Park base, the Batwa (or Abayanda people as they call themselves) have faced an historical situation where encroachment of Bantu agriculturists over many centuries (Taylor, 1993) has cleared the forest and built up to a situation today where there is strong social pressure against the Batwa having access to farmland. At the same time, the game resource that was a major barter source has been over-hunted, timber overexploited and access to large areas of the forest for harvesting purposes lost. Multiple-use has taken many of these needs into account such as use of stingless bees, yams and forest fruits. Although extensive research has been done in the lowland tropical forests of the CARPE region (e.g. by the University of Kyoto, Hart and Hart, 1986 and others), the conservation and NWFP harvesting programmes that consider the specific needs and roles of pygmy communities need to be taken into account to a greater extent.

**Point 5:** Most NWFPs with commercial value are already traded by local people who have access to markets - but some "wild cards", not recognised by local people as having commercial value, exist which have high potential for international trade with "green marketing" premium prices through more direct marketing. This can play an important role in raising living standards for communities in or adjacent to the forest, but it is crucial that strong tenure systems and simple, robust monitoring programmes are established prior to large-scale marketing.

Examples from the Bwindi Impenetrable National Park case which were identified in the initial 1992 survey we did were *Carapa grandiflora* and *Allanblackia stuhlmannii*, which are both sources of oils/vegetable fats. The same two genera occur in the CARPE region of interest. In the Amazon, *Carapa* seed oil is an important medicinal which is commercially harvested and in the Eastern Arc region of Tanzania, *Allanblackia* fruits have been commercially harvested for many years for soap making. However, both of these genera are classic cases of tropical trees which bear relatively few, yet very large fruits where recruitment into the "seedling bank" can be seriously disrupted by commercial harvesting (See, for example, Peters, 1994).

**Point 6:** Too many NWFP utilisation programmes assume that sustainable harvesting will take place and do not take the costs of monitoring into account. Monitoring the success of multiple-use programmes is essential but, for this to be sustainable, monitoring programmes must be robust, pragmatic and cheap. Before any monitoring starts, it is crucial to decide on what is to be monitored, at what scale (landscapes, populations, individuals), at what levels of detail and by whom. Once a few key species have been selected for population level monitoring, then it is important to set up permanent plots for long-term monitoring.

When Bwindi Impenetrable National Park was a forest reserve, the 1964 Ugandan Forest Act allowed controlled harvest of forest plant resources, including "minor forest products". This was based on a permit system intended to generate government revenue and facilitate monitoring. This system broke down due to political and economic upheaval. During the period of political turmoil in Uganda, the buying power of forestry staff salaries declined dramatically (Howard, 1991). As a result, control systems for hardwood and "minor forest product" harvesting broke down. By 1983, an estimated 140-280 people were involved in pit-sawing, and an estimated 100-200 were people involved in panning gold from river-valleys inside Bwindi forest (Butynski, 1984). As a result, an estimated 10% of the forest reserve remained intact, 61% had been heavily exploited by pit-sawyers and 29% "creamed" of the best hardwoods by selective pit-sawing (Howard, 1991). In addition, Butynski (1984) estimated that 10-20 people a day entered the forest daily for bee-keeping purposes or to hunt for wild bee-hives, whilst 25-50 people went to collect fuelwood, bamboo and building materials.

In many countries with high biological diversity, adequate control is too expensive for the State. Effective in situ conservation for black rhino, for example, would cost \$400 per km<sup>2</sup> (Martin, 1993). Based on his experience in East Africa, for example, John Hall suggests that patrolling of forest reserves generally requires two forest guards per 500ha (or four guards per 10km<sup>2</sup>) (Hall, 1983). In most cases, neither this level of funding nor staffing are available. Situated in rugged, forested terrain, for example, Bwindi Impenetrable National Park, 330km<sup>2</sup> in extent, has 30 patrol rangers, rather than the 130 guards deemed necessary by Hall (1983). Implementation of a sustainable logging programme requires even more staff. In Afromontane forest in South Africa, which has a relatively low species diversity and where only a single product (timber) and few species are involved, a marking team of one forester and only two staff selecting trees >30cm dbh is only able to cover 5ha per day (Seydack *et al*, 1995). For these reasons alone, it is necessary to design programmes for protected areas or the land around them that takes local institutions, tenure and resource management systems into account.

**Point 7:** A large component of "resource management" is actually about "people management", often dealing more with human behaviour than with resources. For good science to become good management requires wide social acceptance of management plans or regulations. Low tenure and high NWFP prices, coupled with potentially destructive harvest (bark, root, tuber) use can spell disaster. Low prices with secure tenure mean little incentive to conserve for the long term. The challenge is to design and develop a situation where there is both secure tenure and high price coupled with a practical resource management plan.

Secure tenure is an important ingredient for resource management and conservation. However, whether you are working in areas that are privately owned, in a national park belonging to the state or in a communal area, it is crucial not to fall into the trap of simplistic assumptions or simple classification of different types of tenure. This is particularly important in much of Africa (and in many other sub-tropical and tropical regions) where local people or indigenous communities have established complex rules controlling access to communal land, which in turn has been overlapped by State control (as in the case of many national parks or forest reserves). It is also important to recognise that land tenure and resource tenure may be very different.

At BINP, key steps to establishing a mind-set of more secure tenure amongst local resource users were the demarcation of multiple-use zones based on agreed and clearly recognisable boundaries (Scott, 1992); the identification and nomination of individuals to small, locally based user groups (basket-makers, bee-keepers, herbalists etc.) in a process of community

## **BOX 1. Setting priorities for harvested species based on ethnobotanical surveys**

**STEP 1. IDENTIFY ON SPECIES IN HIGHEST DEMAND:** An important focus would be species used in high volume locally (building poles, fuelwood) or in smaller volumes in highly species specific trade (crafts, medicines, edible plants). The identification of species in trade can be done at "both ends" : in source areas and in sites where they are used (or on sale). Correct identifications are best done in source areas. It is extremely important that this is done through collection and expert identification of good voucher specimens. If you are working from ethnobotanical studies of markets linked to informal trade networks, it is useful to survey the largest (regional and central) markets which carry the widest range of species, then work "up-stream" to source areas identified on the basis of discussions with commercial collectors and traders to collect fresh voucher specimens. In the case of the international export trade this could be through listings of exporting companies or from customs data and phytosanitary certificates.

**STEP 2. PREPARE A SHORT-LIST OF SPECIES WHICH ARE :**

- Destructively harvested (bark, roots, bulbs, stems, wood, whole plants);
- Slow growing (separation on the basis of life-form can be useful);
- Present in local markets and are (i) the most popular and/or most expensive and/or (ii) are sold in greatest number (small plants) and/or volume;
- considered to be scarce by market traders or commercial collectors.

**STEP 3. IDENTIFY SPECIES WHICH MAY REQUIRE SPECIAL CONSERVATION EFFORT:**

Conservation biologist Reed Noss has suggested five categories of species that may need special attention:

- Ecological indicator species: that signal the impact of events that will affect other species with similar habitat requirements. Afro-alpine plants such as giant lobelias and giant senecios, which will be affected by global warming are a good example;
- Keystone species that play a pivotal role in the community or ecosystem such as fig species whose fruits support many primate, bird and fig-wasp species, but are exploited on a large scale for making drums and beer brewing troughs in Uganda;
- Umbrella species which have large area requirements and, if given enough protection, will enable the conservation of many other species in the same area. The plant equivalents of eagles and large mammalian carnivores would be dioecious tropical tree species which occur at low densities and require large areas of forest to maintain viable populations;
- Flagship species; popular, charismatic species to the public which are symbolic of the need for conservation and stimulate conservation initiatives. Several medicinal plants, such as the Madagascan Rosy Periwinkle (*Catharanthus roseus*) have been used as "flagships". Culturally important species can also be "flagships";
- Vulnerable species : rare species with low reproductive ability and low genetic variation. This would include species that are prioritised by other Steps 4-6, which are particularly vulnerable to human impacts.

**STEP 4. SHORT-LIST THESE FURTHER ON THE BASIS OF COMMONNESS OR RARITY** on the basis of their characters of geographic distribution, habitat requirements and local population size. (For details of this see Rabinowitz *et al*, 1986.) From an international (and often local) perspective, the highest priority is given to a species with narrow geographical distribution, a restricted habitat and small population size.

**STEP 5. WITHIN THE RESULTING SHORT-LIST, SET PRIORITIES ON THE BASIS OF**

**PHYLOGENETIC DISTINCTIVENESS:** Aljos Farjon outlines this approach using a rating system (see "Species" 24:65, June 1995), with highest priority given in descending order to :

- Species in a monotypic families (highest priority); then
- Species in a monotypic genus; then
- Species in a segregate genus, subgenus or section of a medium to large genus;
- Species in a small genus (2-5 species);
- Species in a medium to large genus;
- Species which are part of a species-complex; with the lowest priority aligned to an
- Intraspecific taxon in a medium-size to large genus.

**STEP 6. PRIORITISE SPECIES ACCORDING TO IUCN CATEGORIES OF THREAT:** In common with Step 5 above, these priorities were developed for application on a global scale, such as judging the extinction risk of the whole species. In many cases, this will differ from the local perspective of resource users. It is important that local, national and international perspectives are taken into account.

participation, the provision of licenses to those individuals who were recognised by the national park authorities, and the signing of a written MoU between the communities and Uganda Wildlife Authority (UWA) which clearly spelt out the mutual obligations of the community and UWA (Wild and Mutebi, 1996). These principles are common ingredients for successful community based management as well (See Box 1).

Eight years ago, at a meeting of several hundred villagers, the chairman of Mpungu Parish presented a letter on behalf of the community expressing their opposition to the national park and asking why "innocent Ugandans should be made to suffer by creating a National Park" (Hamilton, *et al.*, 1990). In April 1994, the same parish chairman in a speech to the Director of Uganda National Parks, made during the signing of the memorandum of understanding, said: "Mr Director, allow me to express our sincere and greatest appreciation to the new concept of UNP. Allowing us an area of the park to collect ensuli (*Smilax kraussiana*) and [medicinal] herbs . . . We were strongly and bitterly opposed to the idea of Bwindi becoming a national park, but as I say, this attitude has completely changed. We have made a complete turn from negative to positive . . . We used to refer to the national park as 'their' forest; now we call it 'our' national park".

**Point 8:** Inventories are a very important first step to priority setting. They are also part of a networking process which is ideally conducted by a multidisciplinary team, or more often in practice by researcher and local research participants who are aware of ecological, economic and local cultural/institutional issues.

Lowland and montane forests are a dynamic and diverse mix of species and life-forms with a multiplicity of users, so too are rural communities with their complex mix of political and socio-economic hierarchies, user groups, jealousy and hidden agendas. The higher the species diversity, the higher the number of wild plant uses and users would be expected. The first step to unravelling this complexity is fieldwork with resource users in forests and the surrounding community, enabling identification of both species and resource users groups. This is as much a method as a process towards credibility and communication at a local level.

Inventory surveys of plant or animal species are often the first step in identifying unique biological components within protected areas. Conservation managers do not have the luxury of time. Facing the pressures on protected areas they have to make decisions. Skilled biologists and taxonomists are a scarce resource in most tropical countries. Uganda is no exception. Neither is most of the CARPE region. Under these circumstances, folk taxonomic knowledge can be invaluable in inventory work, followed up through identification of voucher specimens. In this case, inventory of plants or edible insects in the forest with knowledgeable local people was combined with discussion on ecological or social issues relating to these resources or to sites of cultural importance. Separate discussions were held with specialist users groups (such as bee-keepers, midwives, bamboo basket-makers) or Batwa people on species used, species most favoured and whether resources were available or not outside the national parks (Cunningham, 1992; Cunningham *et al.*, 1993; Scott, 1992).

Local communities often have good reason to be suspicious of conservation motives. In the past, conservation has often meant evictions, resource loss and harassment with few positive benefits to the community in general. Networking to develop credibility in the eyes of local leaders can be extremely important in this process, requiring time, transparency, patience and constancy. Community members are very good judges of human nature. In the minds of community members are questions such as : What attitudes do park managers have? How much do they understand of the resources themselves? In the Ugandan case-study, it took several sessions over nine months to establish that the communities of Mpungu Parish

adjacent to Bwindi Impenetrable National Park had most confidence in the Stretcher Societies as key organisations forming Forest Societies (Wild and Mutebi, 1996).

**Point 9:** Although predictive models (Point 2) enable us to attain a "first approximation" level of what is likely to succeed or fail, multiple-use (and NWFP use) programmes need to be developed on a case-by-case basis. They CANNOT be developed on a "recipe book" basis from other socio-economic or ecological circumstances.

Managed use of resources within national parks or in buffer zones around them has become a widespread strategy to defuse land-use conflicts. As early as the 1940s, resource sharing arrangements were started in Africa to address some of these lost-opportunity costs (Bell, 1987). Forty years later, these are now termed Integrated Conservation and Development Programmes (ICDPs) (Wells and Brandon, 1992). Although the concept is well established, Wells and Brandon (1992) found almost no examples of resource use within buffer zones on the edges of the protected areas in their survey of the 23 most promising ICDPs. Nevertheless, a few ICDPs have been well documented in Zimbabwe and Zambia (Martin, 1986; Lewis *et al.*, 1990). These examples are primarily from savannah regions with high game biomass, low densities of people, low arable potential and, in several cases, the occurrence of tsetse flies. In these savannah regions, the major focus has been on benefits derived from tourism, trophy hunting or venison from culling operations (Martin, 1986; Bell, 1987).

Innovative, decentralised approaches to conservation outside protected areas also have a way of catching on and spreading. Three examples are CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) in Zimbabwe (Martin, 1984; Child, 1996), the Luangwa valley in Zambia (Lewis, Kaweche and Mwenya, 1990) and Joint Forest Management (JFM) Programme projects spread across India and Nepal (Poffenberger *et al.*, 1992; Fischer, 1995). Although small, and started in isolation, these programmes have built up experience and common ground that has been more widely applied - sometimes in problematic socio-economic and ecological circumstances.



**Figure 1.** Sign protecting community agroforestry woodlot (Photo: T. Sunderland).

The Mount Kilum example in Cameroon is a local example of the blind application of the JFM recipe from Nepal to Afromontane Africa. Surrounded by high densities of local people and with very different ecological circumstances to the JFM areas of Nepal or India, the montane forests of Cameroon are home to 23 endemic bird species, making them a major African bird conservation priority site (Collar and Stuart, 1988). Several rare species of barbets, woodpeckers or hornbills are deadwood dependant species, with populations limited by nest-site availability. Claimed as a successful case of JFM (Fischer, 1995), the agreement reached at Mt. Kilum through participatory approaches with the local community for deadwood harvesting from this small and extremely important Afromontane forest reserve promises to be a conservation disaster. The JFM agreement has not only led to the collection of fallen deadwood, but also to the felling of very large trees such as *Nuxia congesta*, some in excess of 70cm diameter at breast height (dbh). This represents a major removal of an ecological niche providing nest sites or shelter for rare birds, small mammals and reptiles in a forest reserve. (Predictably on the basis of existing information, it would have been far better to put effort into identifying and supporting the provision of alternative sources of fuelwood sources on farm or from fuel efficient stoves). Once the "Pandora" of the JFM agreement with the local community is out of the box, it is very difficult to retract such agreements and get them back into the box again.

**Point 10:** Predicting the sustainability of harvesting requires an assessment both of the biological factors influencing resilience or vulnerability to harvesting and of the socio-economic factors that drive demand. Ethnobotanical surveys of local markets are a very useful step in this process.

From a resource management perspective, there are several reasons why the marketing and sale of wild plants should be the focus of ethnobotanical surveys. First, commercial trade or barter reflect demand. If demand for a species or resource category (such as fuel, basketry fibre, herbal medicine) is high, then these species or resource categories will be sold in many marketplaces. Conversely, a species or category of plant in low demand would be less common in marketplaces.

The most useful species will be frequently sold by more sellers in many more markets than species for which there is little demand. Systematic market surveys therefore provide a useful way not only of classifying the species on sale, but also of arranging them into hierarchical levels which reflect their relative popularity and usefulness. However, some of the most useful and popular species no longer feature in markets, due to over-exploitation. Second, price reflects resource supply in relation to demand. Locally common species are rarely sold in local marketplaces unless it is bulk-sale for processing or retail elsewhere.

When a popular species is scarce, whether due to geographical distribution or to over-exploitation, then trade occurs from resource-rich areas to the places where there is demand but little or no supply. As scarcity increases, so does the price. When alternatives are not available, the higher the price, the greater the incentive to go further and further afield for a scarce species. Improved roads and cheaper transport reduce this cost. As a result, internal marketing systems change in two ways, each shortening the marketing chain. First, cheaper transport enables rural people to get to larger centres to sell their products. Second, better roads improve the access that outsiders have to more remote plant resources. Outsiders frequently have more buying power than local people in remote, resource-rich areas. If this takes place and resource tenure starts to break down, then this hastens the scramble for resources in high demand.

Ethnobotanical surveys of local markets provide a means through which we can filter out international or local priority species in the series of steps listed below:

## **BOX 2. Influences on successful community-based natural resources management: (CBNRM)**

### **1. LAND-USE CONTEXT**

**Land-form and land-use options :** evaluation and comparison of benefits that could be expected from the same land under different forms of land-use, and of the possibly gap between benefits from conservation and other forms of land-use. Where this gap (the "opportunity costs") is non-existent or small, there is a good chance that CBNRM will succeed. Where it is large, then special conservation zones may have to be established where local "lost opportunity costs" are bridged through international and national support.

### **2. LAND AND RESOURCE BOUNDARIES AND TENURE**

**Clear, accepted, controllable boundaries :** boundaries around the common property resource area need to be clearly defined and small enough to be controllable

**Secure tenure :** successful resource management and conservation depends on long-term tenure, whether the land or the resources themselves are privately or communally owned.

### **3. RESOURCE PREDICABILITY AND MOBILITY**

**Predicability and low/no mobility :** the greater the resource predicability in space or time, the greater the incentive for establishing property rights or managed use. Examples are the strong rights attached to long-lived perennial resources that provide a predictable resource in unpredictable environments such as wild tree species that are sources of productive, favoured fruits or provide browse in arid/semi-arid environments (eg: *Boscia* trees in East and Southern Africa) or the widespread private rights to beehives or trees with wild hives. The converse applies to mobile resources such as game animals or fish. In such cases private or common property rights apply to traps and trapping sites, rather than to the resource itself.

### **4. RELATIONSHIP BETWEEN RESOURCES AND THE USER GROUP**

**Resource value and scarcity :** the resource must be important to the group. It must also be seen as scarce and vulnerable to human impact. If the resource users belief system does not link human impact (such as overhunting) with resource depletion then this poses a problem that may even exacerbate overexploitation.

**Size of user group :** a smaller number of users is better than a larger group, but the group should not be so small that it has no social influence.

**Group identity :** the more clearly defined the user group, the greater the chance of success (eg: local beekeepers, herbalists, midwives, basketmakers).

**Location of resource users :** ideally the resource users need to live near to the resource, or amongst mobile or semi-nomadic communities, or frequent the resource area regularly. In either case, this simplifies monitoring who is using the resource or resource area and helps keep outsiders out. **Community homogeneity :** social control over resource use is more likely to occur in homogenous than heterogenous communities.

**Multiple-use lands, resources and multiples of users :** the more uses and users there are of a particular landscape or resource, the more complex and potentially conflicting management becomes. CBNRM is favoured in sites and for resources with fewer, rather than more uses.

### **5. LOCAL INSTITUTIONS**

**Religious/ritual belief systems widely accepted :** These maintain group pressure for actions that encourage short-term individual sacrifice in favour of longer-term group benefit. This is an important way in which group pressure is maintained in small-scale societies where hierarchical political control is weak.

**Long-term or hereditary leadership rather than temporary "big men" :** hereditary leadership, often backed by ritual power and continuity with ancestors provides more effective resource control than populist leadership maintained through "display and distribution" of resources. In both cases, control of access to resources is one means of maintaining political power. The difference is in time scale : long term hereditary leadership vs. short-term control where there is less incentive to leave valued resources unharvested.

### **6. SETTING AND MAINTAINING LIMITS**

**Users knowledge :** best built on existing local knowledge of sustainable yields, resource status.

**Rules for resource use :** need to be developed through a process of local participation, mutually agreed simple, practical, enforceable and appropriate.

**Maintaining obligations :** mutual agreements reached on resource use need to be kept and there need to be disincentives against individuals exploiting resources at the expense of the group.

**"Free riders" should be detectible :** people trying to abuse the system, need to be easy to detect. This largely depends on having small, clearly defined boundaries around the resource, a small and a identifiable group of resource users who live near the resource.

**Conflict resolution :** well developed mechanisms for conflict resolution should be established. These may be internal mechanisms, such as resolution of conflicts which are expressed through witchcraft accusations resolved through cleansing rituals and therapy.

**Punishments against rule breaking :** consensus needs to be reached on punishments for breaking agreed rules. There should be a sliding scale of punishments but punishments for serious offences need "bite" in social or material terms.

#### 7. RESOURCE MANAGEMENT GROUPS AND THE STATE

**The state should support and encourage, and be careful not to undermine decentralised control :** where resource groups are effective in preventing an open-access situation and are managing resource use on a sustainable basis, State control should be minimised.

**Point 11:** When we look at ecological impacts, we must see beyond the individual plant level and understand impacts and conduct monitoring at the plant population and forest dynamics/forest system level. We also need to be very selective in choosing which plant populations are monitored.

In diverse and dynamic habitats, with many hundreds of species harvested, yet with limited funding and time, we have to carefully choose where to focus detailed studies at a plant population level. The first steps in this process are to short-list the species which are most valued and used in greatest quantity or enter commercial trade. In terms of resource management and monitoring, the plant resource categories of greatest concern are cases where destructive harvesting is taking place, particularly where species are scarce, slow growing, habitat specific and where roots, bark, stems or the whole plant are harvested. Conversely, this process also highlights species which are likely to be most tolerant of continued harvest and those which are unpopular, rarely used and would be less of a priority for quantitative work at a species population level.

Although the response of individual plants to harvesting impacts provides useful information, it is crucial to avoid getting side-tracked when we see destructive harvest at the individual plant level. Harvesting impacts need to be seen from the perspective of the population dynamics of that particular species. Harvested plant populations in turn need to be viewed in terms of how they are influenced by disturbance and succession.

**Point 12:** Multiple-use programmes in protected areas need to take ecological impacts into account.

This issue is most evident in Afromontane and coastal forest protected areas, which are small and are surrounded by high numbers of rural farmers. High volumes of hunting or deadwood removal both have complex ecological impacts. In the Bwindi Impenetrable National Park case, fuelwood use was not allowed within the multiple-use zones, but was a candidate for development of alternatives (on-farm agroforestry production, fuel-efficient stoves) outside the protected area. The ecological impact of dead tree felling at Mt. Kilum in Cameroon is a good example of a case where this has been ignored (See Point 10 above).

**Point 13:** Training and employment of people from communities around the park area are very important, providing a real benefit from the existence of the park and a resilience in terms of staffing in times of political turmoil.

This has not been sufficiently catered for in many African protected areas, including Uganda. This point is best made by the following quote :

"...that vehicles, buildings, and short-term consultants supported by large multi-nationals do not make a conservation project. Instead, conservation is achieved by people with commitment. Project personnel recruited from the local population who demonstrate qualities

of leadership and commitment, who receive regular hands-on training that empowers them to take responsibility for the management of their natural resources, are the formula proven to sustain long-term conservation efforts under difficult conditions. The combination of a few dedicated individuals, together with the support of a non-governmental organisation (independent of political constraints) with a long-term commitment to conservation, is the best recipe for achieving lasting success in countries where political stability is in question, or perhaps anywhere" (Hart and Hart, 1997).

Two Central African examples highlight the need for training hand-picked local people in protected area management. One of the strongest tests of conservation strategies is how resilient they are to the chaos of civil conflicts. Recent tests of this stem from conservation areas in Rwanda and Zaire (now Democratic Republic of the Congo) engulfed by conflict (Hart and Hart, 1997; Fimbel and Fimbel, 1997). These Central African examples highlight the crucial need for appropriate training for hand-picked local people at various levels (rangers, technical staff, research professionals and managers) to take responsibility for conservation programmes. International non-governmental organisations have a key role in this process, and one of these is to support this training process. In both cases, international funding was disrupted and ex-patriate staff left or were evacuated due to conflicts in or around the Nyungwe Forest Conservation Project in Rwanda and four World Heritage Sites in Zaire. What maintained these conservation areas during these conflicts were local people connected to these projects. The important lesson from both cases is summed up from the Rwandan case, where Nyungwe forest, an Integrated Conservation and Development Project (ICDP) and a priority area for conservation was held together in the face of lawlessness and land-grabs. Four local people with exceptional leadership qualities continued to collect and safeguard project records and liaise with people neighbouring the park and local government representatives. Of 45 local staff, all from villages bordering the conservation area, 40 remained, continuing to undertake forest patrols without salaries or communications from former supervisors or senior staff who had fled.

#### **4. Conclusion**

The CARPE programme is working in a large region with many challenges. This region is also one which really requires practical support to a region of great importance for forest conservation. One of the advantages that a relatively new initiative like CARPE has is that it can learn from the research, conservation and development lessons learned from other African forest conservation programmes as well as from tropical forest research by ecologists, anthropologists and economists in other parts of the tropics. I sincerely hope that the programme will succeed and lead to long-term support for forest conservation in this region.

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## References

- Bell, R.H.V. 1987. Conservation with a human face: Conflict and reconciliation in African land-use planning. pp. 79 – 101. In D. Anderson & R. Grove (eds) *Conservation in Africa: People, Politics and Practice*. Cambridge University Press.
- Butynski, T M. 1984. Ecological survey of the Impenetrable (Bwindi) forest, Uganda, and recommendations for its conservation and management. Unpublished report to the Ugandan Government.
- Child, B. 1996. The practice and principles of community-based wildlife management in Zimbabwe: The CAMPFIRE programme. *Biodiversity and Conservation* 5 : 369-398.
- Collar, N.J. & S.N. Stuart. 1988. *Key forests for threatened birds in Africa*. International Council for Bird preservation Monograph no. 3, Cambridge, IUCN/ICBP.
- Cunningham, A.B. 1985. *The resource value of indigenous plants to rural people in a low agricultural potential area*. PhD thesis, Faculty of Science, University of Cape Town.
- 1991. Development of a conservation policy on commercially exploited medicinal plants: A case study from southern Africa. pp. 337 – 358. In *Conservation of medicinal plants*, edited by V. Heywood, H. Synge & O. Akerele. Cambridge University Press.
- 1992. Park, people and plant use: recommendations regarding multiple-use zones and development alternatives around Bwindi Impenetrable National Park, Western Uganda. Report for CARE-International, Kampala, Uganda.
- FAO. 1990. *The community's toolbox : the idea, methods and tools for participatory assessment, monitoring and evaluation in community forestry*. Food and Agriculture Organisation (FAO), Rome.
- Fimbel, C & R. Fimbel. 1997. Conservation and civil strife. Rwanda: the role of local participation. *Conservation Biology* 11 : 309-310.
- Fischer, R. 1995. Co-management of forests. IUCN, Gland, Switzerland
- Hall, J.B. & A. Rodgers. 1986. Pole cutting pressure on Tanzanian forest. *Forest Ecology and Management*. 7: 57-66.
- Hamilton, A, J. Baranga & J. Tindigarukayo. 1990. Proposed Bwindi (Impenetrable) Forest National Park: Results of a public enquiry and recommendations for establishment. Unpublished report.
- Hart, T.B. & J.A. Hart. 1986. The ecological basis of hunter-gatherer subsistence in African rainforests: The Mbuti of Eastern Zaire. *Human Ecology*. 14(1): 29-53.
- 1997. Conservation and civil strife. Zaire : new models for an emerging state. *Conservation Biology* 11 : 308-309.
- Howard, P C. 1991. Nature Conservation in Uganda's Tropical Forest Reserves. IUCN, Gland, Switzerland.
- IIED. 1994. Whose Eden? An overview of community approaches to wildlife management. International Institute for Environment and Development (IIED), London.
- Kanongo, M. 1990. Draft report of baseline data, report for Development through Conservation project. Phase 1. Dec. 1989 - Feb. 1990. Development through Conservation project, Ikumba, Uganda.
- Kramer, R, C. Van Schaik & J. Johnson (eds). 1997. *Last stands: Protected areas and the defense of tropical biodiversity*. Oxford University Press, New York.
- Leach, G & R. Mearns. 1988. *Beyond the fuelwood crisis: People, land and trees in Africa*. Earthscan Publications, London.
- Lewis, D., G.B. Kaweche, & A. Mwenya. 1990. Wildlife conservation areas outside protected areas - lessons from an experiment in Zambia. *Conservation Biology* 4 : 171 - 180.
- Martin, R.B. 1986. *Communal areas management programme for indigenous resources (CAMPFIRE)*. CAMPFIRE Working Document No. 1/86, Department of National Parks and Wildlife Management, Zimbabwe.

- Milton, S.J. 1987. Effects of the basket weaving industry on the mokola palm (*Hyphaene petersiana*) and on dye plants in NW Botswana. *Economic Botany* 42 : 386-402
- Muir, D.P. 1990. *Indigenous forest utilisation in KwaZulu: a case study of the Hlatikulu forest, Maputaland*. MSc thesis, University of Natal, Pietermaritzburg.
- Oates, J F. 1995. The dangers of conservation by rural development - a case study from the forests of Nigeria. *Oryx* 29 : 115-122.
- Peters, C M. 1994. *Sustainable harvest of non-timber plant resources in tropical moist forest: An ecological primer*. Corporate press Inc., Landover MD.
- Poffenberger, M., B. McGean, A. Khare, & J. Campbell. 1992. *Field methods manuals in joint forest management*, vols 1 and 2. Society for Promotion of Wastelands Development, New Dehli.
- Scott, P. 1992. *Fringe benefits : National Park boundaries as areas for local community utilisation : the case of the Impenetrable (Bwindi) forest*. MSc thesis, Agricultural University of Norway.
- Shackleton, S.E. 1990. Socio-economic importance of *Cymbopogon validus* in Mkambati Game Reserve, Transkei. *South African Journal of Botany*. 56: 675-332.
- Taylor, D.M. 1993. Environmental change in montane southwest Uganda: A pollen record for the Holocene from Ahakagyesi swamp. *The Holocene*. 3: 324-332.
- Walters, C. 1986. *Adaptive management of renewable resources*. Macmillan Publishers. London.
- Wade, R. The management of common property resources: Collective action as an alternative to privatisation or state regulation. *Cambridge Journal of Economics*. 11: 95-106.
- Wells, M. & K. Brandon. 1992. *People and parks: Linking protected area management with local communities*. World Bank, Washington.

# THE DOMESTICATION OF INDIGENOUS AGROFORESTRY TREES: ICRAF'S STRATEGY IN THE HUMID TROPICS OF WEST AND CENTRAL AFRICA

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## Abstract

The tropical rain forests of West and Central Africa are endowed with abundant high value indigenous fruit and medicinal tree species. Many rural households of the region heavily depend on these resources for their fruit, medicinal, food, and construction needs. Moreover, some of these products, particularly medicinal plants, are traded internationally, significantly contributing to the economy of the countries of the region. Currently, the majority of these products are exploited exclusively from the wild. The accelerated rate of destruction of the forest of the Central Africa region is currently estimated at 60% per year (FAO, 1997). The clearance of forest for agriculture, increased urbanisation and other economic developments makes the need to domesticate many high value forest resources an imperative. It is hoped that this will enable small-scale farmers to cultivate these species in an environmentally-sustainable and economically-profitable system. In order to enhance the potential adoption of cultivation, the importance of identifying greater market opportunities through transformation to value added goods and developing a sound policy environment is also advocated. This paper presents ICRAF's tree domestication approach and preliminary results obtained so far in West and Central Africa.

**Key words:** Domestication, vegetative propagation, seed, marcotting

## 1. Introduction

Throughout the humid tropics there are numerous perennial woody species that have provided indigenous people with many of their needs for millennia (Leakey, 1998; Okafor and Lamb, 1994; Abbiw, 1990). With the rapid population growth, these resources are being depleted owing to the increasing demand for productive land for agriculture, which is met by clearing more forest. Deforestation reduces species diversity and erodes the genetic base of tropical trees, including those vital for the very survival of the population of the region.

The rain forest environment, as rich and diverse as it is, is also known to be extremely fragile. As a result, the region's forest land cleared for crop cultivation (based on the traditional shifting cultivation) remains productive for less than three years. It requires a fallow or resting period of over 20 years before land can again be brought under cultivation. The practice of shifting cultivation destroys the vegetation and exposes the soil to harsh climatic factors (intense solar radiation and heavy raindrops). This, in turn, leads to disruption of the closed nutrient recycle and severe degradation of the natural resource base with its attendant consequences on the global environment (Ahn, 1974; Lal, *et al.*, 1975; Jha *et al.*, 1979). The practice of shifting cultivation is reported to account for 60% of forest losses each year (FAO, 1997).

In response to both environmental concerns and the need to ensure the sustenance of the livelihood of the population of the region, agroforestry is advocated as a potential solution (Leakey, 1998). The aim is to develop a more sustainable form of land use that will improve

farm productivity while at same time improving the welfare of the community. Traditional agroforestry systems are part and parcel of the cropping systems of the humid tropics of Africa. Simple indigenous multi-strata systems such as the cacao (*Theobroma cacao*) cultivation system and compound gardens composed of several medicinal and fruit tree species already exist in the region (Okafor and Fernandes, 1987).

Elsewhere in the world, similar tree-based home gardens have been found to be capable of providing 44% of people's carbohydrate needs and 32% of their protein intake, while using only 7% of their time (Cooper *et al.*, 1996). In addition to their economic and nutritional importance, these systems are also biologically diverse and environmentally resilient.

In West and Central Africa, the production objective of some of these simple agroforests, such as the cacao or coffee systems, are often targeted to a single commodity, such as cocoa or coffee. This exposes farmers to high risk at times of price fluctuation, policy changes or natural disasters such as prolonged and debilitating disease outbreaks. For example, when the world cocoa price fell drastically and remained depressed from the late 1980s through the early 1990s, both producers and nations suffered immense economic setbacks. Many farmers responded by either abandoning the farm or clearing the cacao field completely and replacing it with other crops (Duguma *et al.*, 1998).

As indicated above, farmers grow different types of indigenous fruit and medicinal plants in almost all of the simple agroforests. However, none of these species have been systematically selected and bred for quality or quantity. The inter-cropping system informally developed by farmers has never benefited from modern science in order to optimise resource use efficiency for environmental quality as well as increased return on investment. Although different types of species are known to be inter-cropped, the simple agroforests of West and Central Africa are reported to be less diverse and under utilised compared to the highly complex agroforestry systems of Southeast Asia (ICRAF, 1987, Duguma *et al.*, 1990; Duguma, 1994). This suggests there is considerable potential for the development of these systems in the West and Central African region.

In recent years however, there has been a growing interest in optimising the value and role of high value indigenous species in the tree-based cropping system of West and Central Africa. The International Centre for Research in Agroforestry (ICRAF) began such an initiative in 1994. The aim is to first identify priority (from the farmers' perspective) high value species, with a view to improving their genetic base and, secondly, to integrate these species through domestication into improved multi-strata systems developed through the application of agroforestry science and indigenous knowledge. The strategy of the initiative and preliminary results obtained are provided below.

## **2. Species prioritisation**

With only rare exceptions, the tree germplasm used or available for immediate use in agroforestry is wild and unimproved. The number of species in existing agroforestry technologies is enormous: 100–2 500 (Simons, 1996). Of course, a domestication programme cannot effectively handle so many species, nor would all species even warrant domestication at any one time.

For this reason, ICRAF has developed a decision-making framework to determine whether domestication of a particular species should proceed, and if so at what level of intensity and in what direction (Jaenicke *et al.*, 1995; Franzel *et al.*, 1996). This priority setting is important, as it identifies the 'top' species as farmers view them and which can best contribute to achieving research objectives, while focusing on key factors that minimise costs while

increasing benefits. In the priority-setting exercise, farmers indicate which trees are most important for them and in what ways they would like them improved.

These guidelines for setting priority species constitute a great advance in procedural methodology. The process involves seven stages:

- Building a multi-disciplinary team (economists, foresters, agronomists, social scientists) and planning;
- Assessing client (farmers and users) needs;
- Assessing species currently used by clients;
- Ranking importance of tree products according to several criteria (food and nutritional security, market value and potential value);
- Identifying priority species;
- Evaluating and ranking priority species;
- The production of a final list of priority species for domestication.

The researchers then target their collections of germplasm to individual trees that farmers deem superior. This priority-setting methodology has now been used in a number of eco-regions: the semi-arid lowlands of West Africa, the humid lowlands of West Africa, the lowlands of the Peruvian Amazon, the Yucatan Peninsula in Mexico and the Miombo woodlands ecozone of Southern Africa (ICRAF, 1994).

The priority-setting exercise in the humid lowlands of West Africa (HULWA) identified the following species for domestication work (listed in order of importance):

- *Irvingia gabonensis*,
- *Dacryodes edulis*,
- *Chrysophyllum albidum*,
- *Ricinodendron heudelotii*,
- *Garcinia kola*.

In addition, on the basis of their value in existing and future international markets and as a potential source of income in the region, and because both trees are currently being over-exploited and harvested unsustainably in natural stands two medicinal trees, *Prunus africana* and *Pausinystalia johimbe*, were also added to ICRAF's domestication programme (Cunningham and Mbenkum, 1993; Dawson, 1997; Ndibi and Kay, 1997; Leakey, 1997; Sunderland *et al.*, 1997).

### **3. Genebank establishment**

Establishment of a genebank of priority species is a crucial first step in the process of tree domestication after the species prioritisation. First of all, it serves as a "bank" for continuous supply of diverse genetic material of the priority species for further selection. Of course this is possible only if the initial germplasm collection is undertaken in as wide and diverse a geographical spread as possible throughout the native range of the species. This enables researchers to obtain preliminary field information on growth performance, tree architecture, susceptibility or resistance to pests and diseases etc., which are crucial in the selection process. ICRAF's experience with *Irvingia gabonensis*, *Irvingia wombolu*, *Prunus africana* and *Pausinystalia johimbe* is reported below.

#### **3.1. *Irvingia gabonensis***

Farmer preference surveys in HULWA identified *Irvingia gabonensis* (bush mango) as a top priority species for the eco-region. The bush mango is marketed widely throughout the region

(Ndoye, 1995), people eat the nutritious fruit and from the cotyledons, or kernels, they derive a thickening agent for stews. There is tremendous potential for improvement as there is great variation in the quality, taste and size of the fruit, the size of the kernel, the timing of fruit production and in the maturation process. Farmers cultivate the tree widely and tend to collect wildlings from the forest and plant these in their home gardens.

To launch the domestication programme, seeds were collected from tree farmers viewed as their 'best' or superior individuals in Gabon, Cameroon and Nigeria. This seed was used to establish three live genebanks: in Mbalmayo (Cameroon) and Ibadan and Onne in Nigeria. Preliminary results from these multi-site genebank trials revealed great variation between and among accessions. For the Nigerian genebanks, the difference in height development was significant.

There was also a statistically significant difference in the collar diameter between provenance in the Nigerian genebanks. The number of branches was another parameter recorded. In genebanks in Mbalmayo, there was also significant variation among and between accessions for height, stem diameter and number of branches. Twelve months after planting (MAP), one accession from Gabon (G1) and two from Nigeria performed well both in terms of diameter and height.

In general, genebanks in Nigeria were in better shape than the one in Cameroon. Variation in height, stem diameter and phenological development between and within populations of *I. gabonensis* was highly significant at this stage of development (12 and 24 MAP for Cameroon and Nigeria respectively). Should the same trends be observed when the plants are mature enough to display traits that farmers view as desirable (size of the fruit, kernels, sell cracking property for *I. wombulu*) then the research focus will be on identifying appropriate propagation techniques, cloning, mass propagation and on-farm evaluation of superior lines.

### **3.2. Marcotting *Irvingia gabonensis***

Marcotting is a vegetative propagation technique undertaken on intact branches. It involves bark girdling and wrapping the girdled area in a damp medium to induce rooting. It is an approach that has been widely used in horticulture to multiply traditional fruit trees in temperate regions. Its application to indigenous tropical species is very recent and preliminary results are extremely encouraging indeed.

For marcotting or air layering of *I. gabonensis*, national teams went out to interview farmers and to set marcotts on trees farmers viewed as superior. In all, 1 200 farmers were involved in setting 2 000 marcotts in Ibadan, Onne (Nigeria), Ebolowa and Mamfe (Cameroon).

While the technique produced propagules, the success rate was low (30%) and the survival rate was even lower (10%). The rooting rate can probably be improved by the use of rooting hormones, and better management of the fragile rooted propagules should increase the survival rate. It is also assumed that the weaning of rooted propagules under non-mist propagators (described by Leakey *et al.*, 1990), as for rooted leafy cuttings, could considerably improve the survival rate.

Despite the low success rate, marcotting is still preferable to rooting of cuttings, as it is notoriously difficult to get cuttings from mature trees to root. The only alternative is to fell the tree and to root cuttings from juvenile coppice shoots that develop subsequently on the stump. While this is feasible, it would result in a long delay before the propagules would again become sexually mature. Once selected phenotypes have been captured, techniques must be developed to root cuttings from the rooted marcotts, so they can be rapidly

multiplied. Of particular interest in the selection for desirable traits, another species, *I. wombulu*, has individuals with nuts that are self-cracking, exposing the kernel and making it much easier to extract. Such a trait could have enormous economic and social spin-offs by saving considerably on the labour needed to crack open the hard seed coat with a machete to extract kernels from the nuts of unimproved trees.

### 3.3. *Prunus africana*

*Prunus africana* (formerly *Pygeum africanum*) is an indigenous timber tree of tropical montane areas of West, Central, East Africa and Madagascar. The bark extracts are used in the treatment of benign prostatic hyperplasia and prostrate gland hypertrophy, ailments suffered by 60% of men in Europe and USA. The complexity of the extract apparently precludes the likely synthesis of this drug (Waterman, 1994). The compound is extracted almost exclusively from the raw bark of this tree, the trade of which is worth some \$220 million a year (Cunningham *et al.*, 1997). However, unsustainable methods of exploiting the bark have seriously eroded natural populations of this montane species in both Madagascar and Cameroon (Cunningham and Mbenkum, 1993). The international trade of *Prunus africana* is now controlled, in theory, by the placing of the species on Appendix II of the Convention for International Trade in Endangered Species (CITES).

ICRAF, in collaboration with UNESCO (United Nations Educational, Scientific and Cultural Organization), Limbe Botanic Garden, CDC (Cameroon Development Corporation) and IRAD (Institut de Recherches Agricole pour le Developpement), has developed a programme to investigate the possibility of domesticating the species. This programme is concerned with the selection of populations that produce the greatest quantity of bark, or alternatively, the best quality and quantity bark extracts for medicinal use. This work was initiated with a survey of the genetic variation of *P. africana* in the wild, followed by seed collection and the establishment of live genebanks.

Seeds for the genebanks were collected in three areas in Cameroon (Mendankwe, Kilum Mountain and Mount Cameroon). Seed collected from 80 trees were set in a genebank at Tole near Limbe, while leaf samples from 31 trees were also harvested for molecular genetic analysis. The genetic analysis is still underway and results are pending.

The preliminary results from genebanks in Limbe analysed by the Mount Cameroon Project showed that the survival rate of all provenance's varied from 60% to 100%. There was statistically significant variation in early plant growth among the various accessions. There was a variation in mean height of 5-month-old plants of less than 40 cm, to over 100cm. The variation observed in survival rate and early height development does not seem to relate directly to the provenance of the seeds. Regardless of the source of the seed, however, the existence of such variation is a good indication that there is great potential for genetic improvement of this species through careful selection.

## 4. Genetic improvement through vegetative propagation

Vegetative propagation techniques are the quickest and most efficient means to select, capture and multiply traits that farmers have stated are desirable in these priority species in anticipation of their incorporation into different agroforestry systems.

Vegetative propagation offers the tree geneticist the ability to replicate traits of particular interest and also to overcome the problem of lack of seeds. The latter is important because most of the rain forest species are irregular in their fruiting pattern. Vegetative propagation is also a relatively straightforward technique to multiply, test, select and utilise the full range of

genetic diversity present in most tree species that can easily be practised by farmers. In this way, selected and highly productive but unrelated clones can be used commercially, for reforestation and different agroforestry technologies. ICRAF's programme uses vegetative propagation techniques such as rooting, grafting and air layering to capture desirable traits for high-value species.

#### **4.1. Rooting of leafy stems: *Prunus africana***

Rooting of juvenile cuttings has been shown to be an effective tool in vegetative propagation (Tchoundjeu and Leakey, 1996; Tchigio and Duguma, 1998). Advances in the development of low cost non-mist propagators are a key to the success of this technique (Tchoundjeu, 1997; Leaky *et al.*, 1990).

The objective of the vegetative propagation research programme of ICRAF in HULWA is to determine the main factors that affect the rooting of juvenile leafy cuttings of *P. africana*. For this reason, we tested a variety of factors, including type of substrate and leaf area effects.

Substrates tested included sawdust, sand and a mixture of the two. Rooting of cuttings was significantly better in sawdust and the sand-sawdust mixture than it was in sand alone. A similar trend was noted regarding the highly significant difference between percentages of dead cuttings in each treatment. The greatest number of dead cuttings was observed in the sand-sawdust mixture, followed by sawdust and sand substrates, respectively. Despite the low rate of rooting success in sand, paradoxically this medium also produced a low rate of mortality of cuttings. Sand seems to be an appropriate rooting substrate for conserving fragile cuttings. This is valid in the humid environment of a tropical forest. Similar results would be unlikely in the Sahel where atmospheric humidity is lower.

Leaf area was also an important factor and accounted for significantly different rooting rates of *P. africana*. As observed in many similar experiments with tropical trees, the first cuttings rooted only two weeks after the trial was set up. The presence of a leaf is crucial to the rooting process; no leafless cuttings rooted in this experiment. Furthermore, rooting success appeared to improve with increased leaf size. Cuttings with leaves of 20 and 25 cm<sup>2</sup> rooted significantly better than those with areas of only 5 and 10 cm<sup>2</sup>. Although previous experience with other tropical species such as *Lovoa trichilioides* has shown that larger leaf areas can in fact impede rooting (Tchoundjeu, 1998), this was not the case in this trial with *P. africana* where 80% of the cuttings with leaf areas of 20–25 cm<sup>2</sup> rooted. Follow-up experiments to test a range of larger leaf areas should help clarify this issue.

When dead cuttings were examined, it appeared that the mortality rate was inversely proportional to the leaf areas. No leafless cutting survived at the end of the experiment, and leaves and leaf area are both requisites to successful rooting of *P. africana*.

Contrary to the inverse relation between the mortality rate and the size of the leaf area, the mean number of roots per rooted cutting was proportional to the leaf areas. Cuttings with leaf areas of 20 and 25 cm<sup>2</sup> produced the highest mean number of roots, although the difference was not significant.

These two experiments with *P. africana* clearly indicated that this species can be multiplied by rooting. However, more studies on the effects of different types and concentrations of hormones are needed to shed more light on the process of rooting of this important species. This could help pave the way for domestication of *P. africana*, a species that produces recalcitrant seeds which lose their ability to germinate only a few days after collection. This

has proved to be a particular constraint to cultivating the tree in Madagascar where farmers have a long tradition of tree propagation and planting.

The work to develop vegetative propagation techniques for this species will enable researchers and their farmer partners to produce a stable domesticated population of the species. This will serve to guarantee income to the rural population using this improved germplasm, while decreasing pressure on a valuable natural resource that is currently harvested unsustainably throughout its natural range.

#### **4.3. Rooting of leafy stems: *Pausinystalia johimbe***

*P. johimbe* is a late secondary forest tree species, the bark of which is commercially exploited. It forms the main ingredient in many pharmaceutical and herbal remedies to alleviate the symptoms of organic impotence (Sunderland *et al.*, 1997). On a local level, the bark is used as an aphrodisiac and as a mild stimulant to prevent drowsiness. This species is thus important for the supply of raw material for well-developed local and international markets.

Because of its many uses, its value on the international market and the destructive methods used to harvest the bark, *P. johimbe* is now seriously threatened, especially in South Cameroon. Entire trees are felled and then cut into logs, from which bark is stripped. To date, bark has been taken entirely from trees in natural stands and there has been no effort made to develop strategies of sustainable exploitation of the wild resource nor, until recently, had any attempts been made to domesticate the species (see Sunderland *et al.*, this volume).

ICRAF together with Boehringer Ingelheim have initiated a programme to assess the domestication potential of this species, using vegetative propagation techniques. The ICRAF collaborative team have tested the effectiveness of different types of substrates for rooting leafy stem cuttings under non-mist propagators in the nursery at Mbalmayo, Cameroon. Material used for rooting in this experiment was harvested from the stumps where exploiters have carried out destructive felling. These trials clearly indicate that the rooting success of *P. johimbe* differs significantly depending on the substrate used. Cuttings set in sawdust alone and in a sand/sawdust mixture rooted significantly better than did cuttings in a medium of pure sand. Although the percentage of cuttings that rooted in the sawdust in the first six weeks was quite low, the rooting rate increased rapidly from week seven, to attain a maximum rooting rate of 74% by week nine, when the experiment ended.

Observations of the mortality rates of the cuttings in the various media showed that no cuttings died in the sand substrate. The number of dead cuttings in the sand/sawdust medium was significantly higher than in sawdust alone. Sand is a porous medium, where cuttings could easily absorb humidity from the water table of non-mist propagator by capillarity. This could explain the fact that non-rooted cuttings were still alive after six weeks in the propagator. Moreover it is also a good indication of the resilience of *P. johimbe* cuttings. Therefore the collection of cuttings under appropriate conditions could be extended over many days. This points to the possibility of collecting germplasm from this threatened species from neighbouring countries, such as Equatorial Guinea, where extensive natural stands still exist.

The mean number of roots per rooted cutting also varied according to the rooting medium. Sand produced cuttings with the highest mean number of roots, compared with fewer roots in the sand/sawdust mixture and in sawdust alone. The evidence from this trial suggests that rooting *P. johimbe* cuttings using non-mist propagators is entirely feasible.

Further research is being carried out on the germination of seeds of this important species. The seeds are extremely small and so far attempts to germinate this species has proven difficult, with extremely high mortality of the young seedlings.

## 5. Conclusion

The domestication research programme in the humid lowlands of West Africa is still in its very early stages. So far, work has begun on only a few priority species (*Irvingia gabonensis*, *Prunus africana*, *Pausinystalia johimbe*, *Dacryodes edulis*, *Ricinodendron heudelotii*, *Garcinia cola* and *Cola nitida*). As the programme advances and improved germplasm for species that farmers view as potentially lucrative or vital to their household welfare is made available, these agroforestry trees will be incorporated into the planting culture in farming systems throughout the region. Once incorporated and developed to complex agroforests, they have the potential to become major income producers in themselves because of the range of highly marketable products produced in such systems. Such agroforestry strategies also reduce risks; should any one product lose its market value, the diversity of trees that farmers will be cultivating will reduce the impact of this potential loss of revenue. Not only are such systems economically viable, they are also biologically diverse, creating a veritable marriage between environmentally sustainable production and profitability; the ultimate aim of all ICRAF's research programs.

## 5. References

- Abbiw, D. 1990. *Useful plants of Ghana: West African uses of wild and cultivated plants*. Intermediate Technology Publications, Royal Botanic Gardens, Kew.
- Ahn, P.M. 1974. Some observations on basic and applied research in shifting cultivation. *FAO Soils Bulletin* (24) 123-154.
- Cooper, P.J.M., R.R.B. Leakey, M.R. Rao & L. Reynolds. 1996. Agroforestry and the mitigation of land degradation in the humid and sub-humid tropics of Africa, *Experimental Agriculture*. 32: 235-290.
- Cunningham, A.B. & F.T. Mbenkum. 1993. *Sustainability of harvesting Prunus africana bark in Cameroon: A medicinal plant in international trade*. People and Plants Working Paper No. 2, UNESCO, Paris.
- Dawson, I. 1997. *Prunus africana*: How agroforestry can help save an endangered medicinal tree. *Agroforestry Today*. Vol. 9 (2): 15-17.
- Duguma, B. 1994. Environmental characteristics and land use systems of the humid lowlands of west and central Africa. In Adeola, I.O.O and D. Ladipo (eds). *Proceedings of the regional workshop on multipurpose tree prioritisation*. 24-26 June 1993, IITA, Ibadan, Nigeria.
- Duguma B., J. Gockowski, & J. Bakala. 1998. Smallholder cocoa (*Theobroma cacao*) cultivation in agroforestry systems of West and Central Africa: Challenges and opportunities. A paper presented at international workshop on sustainable cocoa, organised by Smithsonian Tropical Research Institute, Panama City, Panama, 29 March to 3 April 1998.
- Duguma B., Tonye J. & D. Depommier. 1990. *Diagnostic survey on local multipurpose tree/shrubs fallow systems, and livestock in southern Cameroon*. ICRAF working paper No 60. ICRAF, Nairobi, Kenya.
- FAO, 1997. *State of the World's forest*. Worlds End Publication, Oxford, UK.
- Franzel, S., H. Jaenicke & W. Janssen. 1996. *Choosing the right trees: Setting priorities for multipurpose tree improvement*. ISNAR Research Report No. 8. The Hague: International Service for National Agricultural Research.
- ICRAF, 1987. *Annual Report 1987*. International Centre for Research in Agroforestry, Nairobi, Kenya.

- ICRAF, 1994. *Annual Report 1994*. International Centre for Research in Agroforestry, Nairobi, Kenya.
- Jaenicke, H., S. Franzel & D.J. Boland. 1995. Towards a method to set priorities amongst species for tree improvement research – a case study from West Africa. *Journal of Tropical Forestry Science* 7: 490-506.
- Jha, M.N., P. Pande & T.C. Pathak. 1979. Studies on the changes in the physico-chemical properties of tripura soils as a result of jhuming. *Indian Forester*, 105: 436-441.
- Lal, R., B.T. Kang, F.R. Moormau, A.S.R. Juo & J.C. Moomaw. 1975. Soil management problems and possible solutions in western Nigeria. In Bornemisza, E. and A. Alvarado (eds): *Soil management in tropical America*, pp. 372-408. Raleigh: North Carolina State University. (quoted in Nair, P.K.R., 1984).
- Leakey, R.R.B., J.F. Mesen, Z. Tchoundjeu, K.A. Longman, J. McP. Dick, A. Newton, A. Matin, J. Grace, R.C. Munro & P.N. Muthoka. 1990. Low-technology techniques for the vegetative propagation of tropical trees. *Commonwealth Forestry Review* 69: 247-257.
- Leakey, R.R.B. & A. Newtown. 1994. Domestication of "Cinderella" species as the start of a woody-plant revolution. In Leakey, R.R.B & A. Newton, (Eds.) *Tropical trees: Potential for domestication, rebuilding genetic resources*. HMSO, London.
- Leakey, R.R.B. 1997. Domestication potential of *Prunus africana* (Pygeum) in Sub-Sahara Africa. In Kinyua, A.M., W.M. Kofi-Tsekpo & L.B. Dangana (eds). *Conservation and utilization of indigenous medicinal plants and wild relatives of food crops*.
- Leakey, R.R.B. 1998. Agroforestry in the humid lowlands of West Africa. Some reflections on future directions in research. In Duguma, B. (ed). *Agroforestry Systems* (Special Issue) 40(3).
- Ndibi, B.P. & E.J. Kay. 1997. The regulatory framework for the exploitation of medicinal plants in Cameroon: the case of *Prunus africana* on Mount Cameroon. *Biodiversity and Conservation* 6, 1409-1412.
- Ndoye, O. 1995. *The markets for non-timber forest products in the humid forest zone of Cameroon and its borders structure, conduct, performance and policy implications*. Report to CIFOR. Bogor, Indonesia. 86 p.
- Okafor, J.C. & E.C.M. Fernandes. 1987. Compound farms of south eastern Nigeria: A predominant agroforestry homegarden system with crops and small livestock, *Agroforestry Systems*, 5: 153-168.
- Okafor, J.C. & A. Lamb. 1994. Fruit trees: Diversity and conservation strategies. In Leakey, R.R.B & A. Newton, (Eds.) *Tropical trees: potential for domestication, rebuilding genetic resources*. HMSO, London.
- Sunderland, T.C.H., A. Njiamnshi, A. Koufani, M.L. Ngo- Mpeck & C. Obama. 1997. The ethnobotany ecology and natural distribution of yohimbe (*Pausinystalia johimbe* K. Schum.) and evaluation of the sustainability of current bark harvesting practices and recommendations for domestication and management. A report prepared for ICRAF.
- Tchoundjeu, Z. Vegetative propagation of African mahogany: effects of provenance, substrates, auxins and leaf areas. (in press).
- Waterman, P.G. 1994. Trees for drugs and other extractives: future prospects. In Leakey, R.R.B & A. Newton. (Eds.) *Tropical trees: potential for domestication, rebuilding genetic resources*. HMSO, London

# **A FARMING SYSTEMS PERSPECTIVE TO NWFP EXPLOITATION IN THE SUPPORT ZONE OF THE KORUP NATIONAL PARK OF CAMEROON: DETERMINING THE CONNECTIONS BETWEEN THE HOUSEHOLD AND THE FOREST**

Michael B. Vabi and Nicodème Tchamou

## **1. Introduction**

Forests have always been exploited by people living in and around them for millennia. In addition to their socio-cultural value, the use of natural resources by forest dwelling/dependent people has been confirmed by many studies describing the relationship between people and the forest. Results of studies highlighting the relationship between people and the forest show that NWFPs constitute complementary sources of food security and medicine for households, and are increasingly important sources of cash income. Against this background, NWFPs have become one of the focal themes in discussions about forest-people relationships. Similarly, campaigns focussing on the promotion of sustainable forest exploitation techniques, including that of NWFPs, have been high on the agenda of many conservation and development agencies.

Using household cash income sources, income-generating activities and household activity calendars, this paper introduces the concept of farming systems into the exploitation of NWFPs and outlines the pattern of adaptive response by forest dependent/forest dwelling households in four villages of the support zone of the Korup National Park. The household is used here as a sociological concept representing a collection of different socio-economic units, with overlapping functions or roles. The household represents a mix of production, consumption, and food-sharing units. Similarly, a farming system as described in this paper comprises the household, farm, forest (including any surface water) and livestock. Within this broad framework, key elements of the rural setting are manipulated by members of the household to ensure their food security.

One virtue of introducing the farming systems perspective to an examination of NWFP exploitation is that it highlights the dynamic interactions between households and their components. We argue that it is not the farm, it is not wage labour, it is not livestock, it is not remittances, but all of these components, in sometimes minuscule amounts, that ensure household food security. Furthermore, the contribution of NWFPs to ensure household survival and food security is also an important component. In terms of actors involved, the entire household participates in the exploitation, consumption and marketing of NWFPs.

## **2. Selection of study villages, data collection procedures and analysis**

The Korup National Park, situated in SW Province, Cameroon, was created in October 1986 and covers an area of about 1 259 km<sup>2</sup>. In addition to the core-protected area, three forest reserves surround the park: the Ejagham, Nta-Ali and the Rumpi Hills Forest Reserves. These reserves, together with the 172 villages situated within and around the park, constitute the Korup Project Support Zone. The park itself and the Support Zone make up the Korup Project Area covering an area of about 3 500 km<sup>2</sup>. To date, the major donors of the Korup National Park Project have been the European Union, WWF-UK, DFID and GTZ .

According to Thomas *et al.*, (1989), and Mutuba & Balinga (1996) the local population of the project area can be grouped into five major linguistic groups. These are the Ejagham, the Balong, the Korup, the Isangele and the Oroko. As a result of slight language variations, these ethnic groups could be broken down into more than ten tribal groups including Njamaya, Ngunaya, Obang, Keru, Korup, Bakoko, Batanga, Bima, Bakundu and Ngolo.

Based on this socio-cultural background, a household survey was conducted in the North and Northeast of the Korup Project area, which lies within the intervention zone of GTZ. This area has a full representation of the ethnic/tribal groups described above.

Using ethnic/tribal affiliation as the initial stratification factor, the study villages were selected using stratified sampling procedures. However, because selected villages had to satisfy both the sampling procedure and concern for the development of people centred conservation within the support zone, the villages of Abat, Bakebe, Banyo and Otu were selected for study. These case study villages maintain important trade relations with many feeder villages within the Korup Project area (see Table 1). Indeed, the four villages serve as gateways out of the enclave project area for the surrounding villages. Furthermore, Otu is an important cross-border trade centre and shares the same socio-cultural history with the other Ejagham villages in the Cross River State of Nigeria. Banyo is on the border with the park, immediately adjacent to one of the villages located within the park boundary which has been proposed for resettlement.

**Table 1:** Villages having trade relations with survey villages.

<b>ABAT</b>	<b>BAKEBE</b>	<b>BANYO</b>	<b>OTU</b>
Bayib-Ossing	Fortabe	Barika-Batanga	Ayaoke
Mgbegati	Tinto-Kore	Babianbanga	Ekoneman
Osselle	Tinto-Wirye	Ijoye	Ekang (Nigeria)
Bakut	Tinto-bu	Mofako	Nfamiyen (Nigeria)
Ekogati	Ashum	Lobe	Kamen (Nigeria)
Basu	Nfaitock	Ndoyle	Bebang (Nigeria)
Bajoh	Eyang	Dibonda-Mosina	Ojock (Nigeria)
	Nchamba 1	Itali	Debiji (Nigeria)
	Mbiyo	Ipongi	Owom (Nigeria)
	Nfaichang	Bobange	Nyaje (Nigeria)
	Mbinjong	Masaka	
		Baromba	
		Dienge-Mwangale	
		Mokwalibe	
		Sikan	
		Ayong	

### 3. Collection procedures and analysis

Selected Participatory Rural Appraisal (PRA) tools and techniques were used to collect both qualitative and quantitative information. In each village activities of socio-economic importance, including NWFPs collection, were determined through a Direct Matrix Ranking. The criteria used in this ranking included cash income, household consumption/utilisation, and the estimated number of people within the village carrying out the activities.

### 3.1. Community interviews

The socio-economic rankings were followed by topic-focused interviews with different exploiters of NWFPs: men, women, youths, children and hunters. During these interviews, identified socio-economic activities were classified using the pair-wise ranking technique. The first six income-generating activities were retained for subsequent in-depth discussions with the different groups of NWFP exploiters. In all, four community interviews were conducted (one for each village) and several focus group interviews (at least two in each village) with men, women, youths and children, separately. Discussions were also held with village chiefs, traditional councillors and village socio-cultural and farming groups. A number of income-generating activities (subsistence farms, palm-wine tapping, and garri processing) were also visited to appraise their development potential and problems.

Similarly, individual interviews were conducted to collect quantitative information on cash income generated over the last twelve months from a total of 57 individual village people chosen on the basis of availability and willingness to cooperate. Thirty-six percent of those interviewed were women and the rest were men.

The quantitative information collected was analysed using simple mean standard deviation and direct frequency counts.

## 4. Results and discussions

### 4.1. Patterns of income-generating activities by gender

Table 2 shows that farm, forest, rivers and livestock constitute equally important sources of household incomes to both men and women. The NWFPs that are included in women's income-generating activities are eru (*Gnetum* spp.), bush mango (*Irvingia* spp.) and njansang (*Ricinodendron heudelotii*), while male activities included hunting and trapping along with bush-mango and bush-onion (*Afrostryax* spp.) collection. It is evident that NWFPs play an important role in supplementing conventional food supplies, the main household food supply being the farm. NWFPs supplement seasonal shortages in food within these villages, which regularly occur between June and July. Bush-mango, njansang, egusi (pumpkin seeds), bush-onion and bush-pepper (*Piper guineensis*) are generally added to sauces and soups that accompany staple foods such as plantains, bananas and yam and cassava flour. The fleshy mesocarp of sweet bush-mango (*Irvingia gabonensis*), is reported to be eaten as a snack by children and women.

A paired-wise ranking of the income-generating sources reported that cocoa is the most important cash-generating activity for men, comparing very closely with hunting and trapping. This qualitative assessment was confirmed by quantitative information obtained from a sample of 37 men. In both cases, fruits (essentially oranges, pineapples and bananas), food-crops and palm wine tapping are insignificant cash-generating activities for men. A substantial proportion of the food produced by both men and women is consumed within the household. NWFPs only accounted for about 6% of male annual cash incomes.

Using the paired-wise ranking technique, the most important cash-generating activity for women was cassava, either transformed (into water-fufu or garri) before sale, or sold directly. This qualitative assessment was again confirmed by data collected from a sample of 20 women selected for individual interviews.

**Table 2: Pattern of Income-generating Sources by Gender within some Villages of the Korup Park**

ABAT		BAKEBE		BANYO		OTU	
Men	Women	Men	Women	Men	Women	Men	Women
<b>FARM</b>	<b>FARM</b>	<b>FARM</b>	<b>FARM</b>	<b>FARM</b>	<b>FARM</b>	<b>FARM</b>	<b>FARM</b>
Cocoa	Cassava	Cocoa	Cassava	Cocoa	Cassava	Cocoa	Cassava
Coffee	Cocoyams	Coffee	Cocoyams	Coffee	Cocoyams	Plantains	Cocoyams
Plantain	Pepper	Plantain	Egusi	Plantains	Egusi	Bananas	Egusi
Oranges	Vegetables		Yams	Bananas	Yams	Palm-oil	Yams
	Beans	<b>FOREST</b>	Bananas		Pepper		Plantains
<b>FOREST</b>	Maize	Tapping		<b>FOREST</b>	Vegetables	<b>FOREST</b>	Beans
Hunting	Groundnuts	Hunting	<b>FOREST</b>	Tapping	Beans	Tapping	Maize
Trapping	Egusi	Trapping	Njansan	Hunting	Maize	Hunting	Vegetables
Tapping	Yams	Fishing	Eru	Trapping	Groundnuts	Trapping	Groundnuts
Fishing		Bush-mango	Fishing	Fishing	Potatoes	Fishing	Pepper
Palm-oil	<b>FOREST</b>	Bush-onions	Bush-mango		Plantains	Bush-mango	Okra
	Bush-mango			<b>LIVESTOCK</b>		Timber	
<b>OFF-FARM</b>	Njansan	<b>LIVESTOCK</b>	<b>LIVESTOCK</b>	Chickens	<b>FOREST</b>	Kola-nuts	<b>FOREST</b>
Petty trading	Eru	Goats	Chickens		Njansang		Bush-mango
					Eru	<b>LIVESTOCK</b>	Njansan
	<b>OFF-FARM</b>	<b>OFF-FARM</b>	<b>OFF-FARM</b>		Bush-mango	Sheep	Eru
	Petty trading	Petty trading	Petty trading		Agkwana	Goats	<b>LIVESTOCK</b>
							Goats
					<b>OFF-FARM</b>	<b>OFF-FARM</b>	<b>OFF-FARM</b>
					Petty trading	Petty Trading	Petty trading

It should be noted that women sell an important proportion of cassava when it is converted into water-fufu and garri. This is sold in combination with vegetables including eru (*Gnetum africanum*). Also, much of the bush pepper cultivated by women is used in preparing pepper-soup dishes with wild-game meat and plantains. This makes the sale of food crops and petty trading by women mutually dependent income-earning activities throughout the villages surveyed. As shown in Table 2, NWFPs accounted for about 20% of the annual cash incomes reported by women. The relative positions of the income sources for women were consistent across the villages surveyed.

#### **4.2. Relative importance of household income-generating activities**

Table 3 shows that the cash crop, cocoa, is the most popular income-generating activity for about 81% of the men, with a mean annual cash income of CFA 176 859. Hunting and trapping was reported to be an important supplementary income-generating activity to 51% of the men. NWFPs were reported to be popular income-generating activities to 46% of the men, procuring a mean annual cash income of CFA 23 459. Only 32% of the men included in the individual interviews reported earning cash incomes from palm wine tapping, petty trading and coffee.

The sale of food-crops was reported to be a popular income-generating activity to 90% of the women included in the case study sample. Women reported a mean annual cash income of CFA 40 366 from the sale of food crops. This was closely followed by petty trading and NWFPs, from which 70% of the women reported earning annual cash incomes of CFA 34 269. Fifty percent of women's annual cash incomes were reported to come from the sale of vegetables. However, most of the vegetables and food-crops, especially cassava and plantains, are cooked and sold in road-side restaurants. Also, a substantial amount of the food crops cultivated are consumed within households and/or given out as gifts to visitors, less able friends and relatives within and outside the village.

The data presented in Table 3 shows the relative competitiveness of hunting (including trapping) and cocoa production as cash income-generating activities for men. While hunting and trapping were reported to be popular income-generating activities with a mean annual cash income of CFA 163 269, cocoa compares very closely with these activities. It accounts for a mean annual cash income of CFA 176 859 for 8% of the men included in the case study sample. Similarly, the sale of agricultural crops compares very closely with NWFPs and petty trading for women. Considering that wild-game meat constitutes a major trade item in women's income-generating activities, they indirectly tend to encourage the hunting expeditions of men. The variation reported in annual cash earnings from petty trading and NWFPs compared to the variation in cash income from NWFPs suggests that NWFPs (see standard deviations) represent a regular cash income generating activity to the women included in the case study sample.

Across the villages surveyed, no consistent pattern of income generating activities between villages emerged. However, for Abat and Bakebe, hunting and trapping accounted for the highest annual cash income for men. In Banyo and Otu, cocoa production accounted for 39% and 50% of mean annual cash incomes, respectively. The second annual cash income source reported for Banyo was coffee, while hunting and trapping were reported to be the second most important cash income earning source in Otu. Across the villages studied, the least income was earned from fishing, tapping, fruits and the sale of sheep, goats and chickens. It is important to note that most of the palm-wine harvested is not sold, but consumed.

**Table 3: Relative importance of income sources**

Income Source	Number of Farmers Reporting Incomes				Totals		Mean (FCFA)	Standard deviation
	ABAT	BAKEBE	BANYO	OTU	N	%		
<b>ALL MEN</b>	<b>10</b>	<b>7</b>	<b>9</b>	<b>11</b>	<b>37</b>	<b>100</b>	-	-
Cocoa	6	5	8	11	30	81	176 860	104 727
Coffee	4	3	5	N/A	12	32	54 925	10 328
Petty trading	4	2	4	2	12	32	129 125	88 066
NWFPs	3	2	4	8	17	46	38 797	23 459
Food-Crops	3	5	6	8	22	59	26 897	7 248
Hunting	4	3	7	5	19	51	163 279	81 439
Trapping	N/A	4	6	2	12	32	25 392	14 197
Fruits	2	3	3	5	13	35	17 763	4 449
<b>ALL WOMEN</b>	<b>3</b>	<b>5</b>	<b>6</b>	<b>6</b>	<b>20</b>	<b>100</b>	-	-
Food-crops	3	5	6	5	18	90	57 542	40 366
Vegetables	3	3	N/A	4	10	50	5 903	3 333
Petty trading	1	5	5	3	14	70	60 750	34 270
NWFPs	3	4	2	5	14	70	33 138	7 123

### 4.3. Household activity calendars

Except for eru and cassava, the peak period for the harvesting of most crops grown by women was reported to be between June and August (Tables 4 and 5). This period corresponds to the peak hunting and trapping period for men. While trapping, some men in Bakebe and Otu reported joining their wives in the collection of bush-mango (*Irvingia spp.*). Most of these activities are dictated by their seasonal availability, rather than by drops in labour demand for other activities. For example, in the rainy season, men are more preoccupied with trapping because the increased vegetation growth on the forest floor makes it easier to identify regular paths used by animals. Therefore, trapping becomes more profitable at this period of the year, and attracts the attention of many more hunters. Similarly, bush-mango fruits (*Irvingia spp.*) are more abundant in the rainy season, making collection easier. Also, many women take advantage of this period in order to prevent the fruits from germinating.

There was no clear pattern for the marketing of most women's agricultural produce. However, bush-mango (*Irvingia spp.*) and njansang (*Ricinodendron heudelottii*) were marketed generally between October and November. This corresponds to the period when the roads leading into the suburban centres of the support zone are almost impassable. This has a negative effect on the marketing of bush-mango and other NWFPs collected, and therefore on the prices paid to collectors.

The prices of all products sold by women were reported to have been increasing over the past five years. Men reported that coffee and cocoa prices, though fluctuating, have been on the decline. Most, if not all the cocoa, NWFPs and other agricultural products from Otu are either sold in Nigeria or bought by Nigerian traders in the village. The marketing of most NWFPs and agricultural products reflects their seasonal nature. Prices are low at harvesting and tend to increase as supply diminishes. In general, the period between November and January corresponds to a period of boom in the villages included in the survey. This is the period when cocoa, coffee, oranges, bush pepper, njansang and smoked bush-mango (*Irvingia spp.*) are sold.

These data show that there is virtually no period when a given activity is carried out by inhabitants of the support zone. Rather, men and women carry out a range of activities at different periods of the year and take up other activities when they see that they can make reasonable social or financial gains.

### 5. Conclusion and implications

Results of these studies indicate a need to shift the goal of increasing farm income to improving overall household food security. Household food security is ensured from a variety of sources, of which NWFPs are a single component. It is major preoccupation of many households that are located near to protected areas in the forest region of Cameroon. It would be reasonable to adopt food security as an operational goal for conservation and development projects. The basic indicator of success for these projects should not be limited to species or ecosystem protection and increasing the forest's conservation value, but should also include household food security.

Within this framework, a farming systems approach, in which the farm and the household are regarded as interacting social units, is more representative of the reality than the traditional commodity and farmer focus in research and extension intervention. Improvements in NWFP production and marketing are more important strategies in improving overall household livelihood, rather than concentrating on food-specific technologies. Interventions must be

broadly based, and aimed at increasing a range of technical options available to forest dwelling/dependent people.

For most households in the forest zone of Cameroon, the links between the different components of a rural environment are not only biological but also social and economic. Thus, when designing interventions for addressing rural communities' technical and social constraints, NWFP's biological, social, and economic roles should all be considered. Adopting a farming system approach to NWFP exploitation enables development agencies to recognise that village-based resources represent different types of social actions and interests that are behind NWFP exploitation.

The implications for policy are that uni-sectoral approaches to household food security for communities around protected areas are insufficient. Households within protected areas ensure food self-sufficiency by generating cash and non-cash incomes from all components of the farming system, including the protected areas. These relationships need to be seriously considered when designing intervention strategies for forest dependent/dwelling households.

### **References**

- Mutuba, T. & V.S. Balinga. 1996. *A decade of the Korup National Park*. Korup National Park, Mundemba.
- Thomas, D.W., J.M. Thomas, W.A. Bromley T.F. & Mbenkum. 1989. *Korup Ethnobotanical Survey*. Final report to WWF - UK.

**Table 4: Calendar of Men's Major Income-generating Activities**

<b>Activities</b>	<b>Peak Period</b>	<b>Peak Marketing Period</b>	<b>Common Market Outlets</b>	<b>Price Movements Over the Past Five Years</b>
Cocoa Production	September-November	October-December	Home	Decreasing
Coffee Production	December-February	January-March	Home	Decreasing
Oranges and Pineapples	October-November	October-November	Home	Stable
Plantains/Bananas Production	July-September	July-September	Home Village Market	Increasing
Palm-Wine Tapping	November-December	November-December	Home Village Market	Increasing
Palm-oil Production	September-October	September-October	Home Village Market	Increasing
Bush-mango Collection	February-March, June-October	March-May, July-October	Home Village Market	Increasing
Fishing	November-March	November-March	Home	Increasing
Hunting and Trapping	July-September	July-September	Home Forest Village Market	Increasing

# NON-WOOD FOREST PRODUCTS MARKETS AND POTENTIAL DEGRADATION OF THE FOREST RESOURCE IN CENTRAL AFRICA:

## The role of research in providing a balance between welfare improvement and forest conservation

Ousseynou Ndoye, Manuel Ruiz-Perez, Antoine Eyebe

### Abstract

This paper investigates the importance of income generated from marketing selected NWFP in Central Africa. The focus is mainly on local markets in the Humid Forest Zone of Cameroon and markets at the borders with the Central African Republic (CAR), Equatorial Guinea and Gabon.

The main NWFP species considered are *Irvingia* spp. (bush mango nut), *Cola acuminata* (kola nut), *Garcinia lucida* (essock) and *Garcinia kola* (onie). Emphasis is on the marketing of the kernel and fruit of *Irvingia* spp. and *Cola acuminata*, and the bark for *Garcinia lucida* and *Garcinia kola*.

The study found that the value of the NWFP marketed was US\$ 753 000 in the first half of 1995 and US\$ 499 000 in the same period of 1996. Of these amounts, the value of barks marketed (for both *Garcinia lucida* and *Garcinia kola*) represented US\$ 30 000 and US\$ 23 500 in 1995 and 1996, respectively. The decline in the significance of NWFP marketed, as a result of lower supply, shows the thinness of NWFP markets resulting from their dynamic and unpredictable nature, which changes the role of markets in assembling and distribution of NWFP from year to year.

The study also found that traders' weekly marketing margins from barks are comparable to and may even be higher than those from kernels (*Irvingia* spp.) and fruits (*Cola acuminata*). The harvesting of barks is not always carried out in a sustainable manner. However, their markets provide revenues for both traders and rural dwellers. This reveals the potential role of NWFP markets in forest resource degradation and underlines the difficulty in achieving a balance between improving the livelihoods of forest-dependent people and conserving the forest resource.

Future research should focus on determining the rate of bark harvest that would enable forest dwellers to sustainably derive part of their livelihoods from *Garcinia lucida* and *Garcinia kola* while preserving these trees.

### 1. Introduction

Many studies have shown the importance of Non-Wood Forest Products (NWFP) in the livelihood of forest dwellers (Chambers and Leach, 1987; de Beer and McDermott, 1989; Falconer, 1990; Scoones *et al.*, 1992; Townson, 1995; Ndoye *et al.*, 1997). Furthermore, NWFP are often cited as alternatives for sustainably managing and preserving the forests (Ndoye, 1994; Guedje, 1996). Despite their importance, NWFP are not always gathered or harvested in a sustainable way that will preserve the resource (see Hall and Bawa, 1993;

Sayer, 1993; Peters, 1994; Laird, 1995; Freese, 1996). Ndoye (1995) found that 58 per cent of the palm trees (*Elaeis guineensis*) tapped by a sample of farmers in the Mbalmayo area, in the Humid Forest Zone of Cameroon, were killed. Furthermore, costs of resource degradation to society, as a result of killing each palm tree, varied between 70 000 to 129 000 CFA Francs (Ndoye, 1995). Champaud (1973) reported that the technique used by farmers in Mom, a village in the Centre province of Cameroon, to tap palm wine was to kill the palm tree (*Elaeis guineensis*). Oyono (1997) found that 1 000 palm trees (*Raphia hookeri*) were killed after tapping in Ekom, southeast Cameroon.

In the Southwest province of Cameroon (M'mouck village), farmers have embarked on planting *Prunus africana* because they had almost disappeared from some areas of the village, and farmers had to go deeper into the forest to harvest the bark (BDCPC, 1997). The market value of the bark of *Prunus africana* used for the treatment of Prostrate Gland Hypertrophy is estimated at US\$150 million per year (Cunningham and Mbenkum, 1993, p. 7). *Prunus africana* bark is collected by 14 per cent of households around Mount Cameroon (BDCPC, 1997). Between 1986 and 1991, an average of 1 923 tons of *Prunus africana* bark were processed in Cameroon. This represented an average of 35 000 trees debarked per year, affecting at least 6 300 hectares of Afromontane forest each year (Cunningham and Mbenkum, 1993).

Due to the increased need for opportunities to generate cash income for people living in and around the forests, the potential role of NWFP markets in forest resource degradation and conservation should be studied on a continuous basis. The information generated could help researchers identify NWFP trees for domestication, to design improved and more sustainable harvesting methods (technologies) and to train forest gatherers to use these techniques. The data will also expand the range of appropriate decisions available to policy makers to improve the livelihood of forest-dependent people while preserving forest resources.

This paper attempts to clarify the potential role of NWFP markets in forest resource degradation and conservation by comparing the markets of two broad categories of NWFP: kernels/fruits and barks. In general, the gathering and marketing of kernels/fruits place less pressure on the resource than the harvesting of barks. Kernels and/or fruits are gathered and sold but the tree is preserved, whereas the harvesting and the marketing of barks may endanger the sustainability of forest resources because the survival of the tree could be at risk. Two particularly important NWFP in Central Africa included in the first category are the kernels of *Irvingia* spp. and the fruit of *Cola acuminata*. The barks of *Garcinia lucida* and *Garcinia kola* are part of the second category.

The demand of *Irvingia gabonensis* in southern Nigeria has been estimated at 80 000 tons per year (Leakey and Maghembe, undated). Nigerian traders import the fruit and the kernel from Cameroon (Scoones *et al.*, 1992). In Cameroon, Nkongmeneck (1985) estimated the size of the market for kola nut (*Cola acuminata*) at 20 400 tons. In 1983, the income from kola nut in some rural households in southwest Cameroon was higher than that for coffee, contributing between 5 and 37 per cent of household cash revenues (Laird *et al.*, 1996). Kola nut exports from Ghana were estimated at 6 million tons and 7.5 million tons in 1988 and 1989, with a value of US\$1.03 million and US\$1.48 million respectively (Laird *et al.*, 1996).

In southern Cameroon, Ntamag (1997) reported that *Garcinia lucida* is found in little disturbed forests, normally common access areas. Diaw (1997) also found *Garcinia lucida* in these near virgin forests and that it is governed by an open access regime limited to the members of the community, i.e., the village. For *Garcinia kola*, the most important niches are cocoa plantations, virgin forests and fallow land (Ntamag, 1997). Van Dijk (1995) found

*Garcinia kola* occurred only in forest lands at distance from human settlements. She also noted that the species might be endangered by over-exploitation due to the use of the bark in production of palm wine. In an inventory of 11 complete transects in southern Cameroon, Van Dijk (1995) did not find a single *Garcinia lucida* tree and suggested that this could be due to high harvesting levels. Guedje (1996) also found that *Garcinia lucida* grows in dense populations with a preference for undisturbed forest habitats. This species cannot recover and will eventually die if the bark is removed over a large surface around the stem (Guedje 1996). She identified sites with more than 50 per cent of dead trees.

In January 1994, the devaluation of the CFA Franc severely affected Cameroon and other countries in Central Africa which are part of the CFA zone.<sup>1</sup> The devaluation increased the price of beer and whisky and made palm wine more attractive in rural and urban areas (Ndoye, 1994). As already noted, the barks of *Garcinia lucida* and *Garcinia kola* are used in the production of palm wine. *Garcinia lucida* is also considered to be a social good because of its medicinal value and anti-poison properties (Diaw 1997). For these reasons pressure on both species may increase. Furthermore, because *Garcinia lucida* is governed by an open access regime, the trees could become more vulnerable to externalities created by the opportunistic behaviour of a few forest dwellers resulting from higher market demands for the bark. Opportunistic behaviour, as defined by Williamson (1985), is a way of acting in self-interest with guile. It brings immediate rewards to the individual and imposes high costs on society (Shaffer *et al.*, 1987).

The authors believe that research on *Garcinia lucida* and *Garcinia kola* is wanting many key areas.

- There is no information on the sustainable rate of bark harvest that would preserve *Garcinia lucida* and *Garcinia kola* trees.
- Sustainable harvesting techniques that would guarantee the survival of *Garcinia lucida* and *Garcinia kola* trees have yet to be designed by researchers. This could help mitigate future pressure on these resources.
- Research on domestication of *Garcinia lucida* and *Garcinia kola*, and their subsequent cultivation by forest dwellers, is not currently included in the agenda for NWFP research in Central Africa.

This paper argues that while NWFP provide valuable alternative income-generating opportunities for rural dwellers, which increases the need to develop these markets, the harvesting practices are not always sustainable. This emphasises the difficult trade-offs between improving the livelihood of forest dependent people and forest conservation. For the four NWFP studied, the harvesting practices for *Irvingia* spp. and *Cola acuminata* are more sustainable than those used for *Garcinia lucida* and *Garcinia kola* bark. For the first group, the tree is preserved, whereas when harvesting barks, the survival of the tree is not always guaranteed. It is worth noting, however, that collection of fruits and kernels for consumption and sales may have a negative impact on the future population structure of the trees (Peters, 1994).

The second section of the paper is a brief description of the methodology of the study. Section three describes the distribution and utilisation of the four NWFP species analysed in this paper: *Irvingia* spp., *Cola acuminata*, *Garcinia lucida* and *Garcinia kola*. Next, the

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<sup>1</sup> CFA=Communauté Financière Africaine. Cameroon, Gabon, Equatorial Guinea, Central African Republic, Congo (Brazzaville), Chad are the countries in Central Africa that are part of the CFA zone.

quantity of NWFP marketed and traders' marketing margins are discussed. Section five analyses the welfare effects of marketing *Irvingia* spp. and *Cola acuminata* compared to *Garcinia lucida* and *Garcinia kola*, while section six discusses the type of research needed to deal with the thinness of NWFP markets and (potential) forest resource degradation. The final section presents the conclusions and implications of the study.

## 2. Methodology of the study

Twenty-eight markets in the Humid Forest Zone (HFZ) of Cameroon were surveyed in 1995 and 1996. The HFZ comprises five (Centre, South, Littoral, East, South West) of the 10 provinces in Cameroon. Data from the 1987 census indicate that 45 per cent of the total population of Cameroon live in the HFZ. The zone is bordered on the south by the Republic of Gabon, Equatorial Guinea and Congo Brazzaville, on the east by the Central African Republic, and on the northwest by the Republic of Nigeria. The HFZ covers 270 162 square kilometres representing 58 per cent of the territory of Cameroon.

*Irvingia* spp. (wild mango nut), *Cola acuminata* (kola nut), *Garcinia lucida* and *Garcinia kola* were the NWFP selected for study in this paper. The marketed quantities of the kernels and the fruits are used for *Irvingia* spp and *Cola acuminata*, while the marketed quantities of the bark are considered for *Garcinia lucida* and *Garcinia kola*. The data reported for all these NWFP are based on 29 weeks of activity from January to July in both 1995 and 1996. Two hundred and sixty-seven (267) traders were interviewed in 1995 and 347 in 1996, representing 24 per cent and 27 per cent of the estimated total number of traders operating in the selected markets studied each year.

## 3. Distribution and utilisation of NWFP in Central Africa

### *Irvingia gabonensis*

Harris (1993) identified two species of *Irvingia* used for food in Cameroon: *Irvingia gabonensis* and *Irvingia wombolu*. This section will only discuss the distribution and utilisation of the first. The *Irvingia gabonensis* tree is found throughout the whole Humid Forest Zone of Cameroon (i.e., evergreen, semi-deciduous and transition forests). The species is distributed from the south of Senegal to Zaire (Vivien and Faure 1985) in the low land warm humid forest of West and Central Africa. In West Africa, *Irvingia gabonensis* is found in Senegal, Guinea Conakry, Liberia, Sierra Leone, Côte d'Ivoire, Ghana, Togo, Benin and Nigeria. In Central Africa, it grows in Cameroon, Gabon, Central African Republic and Congo (Brazzaville).

*Irvingia gabonensis* commonly called "dika nut", belongs to the family of *Irvingiaceae*. The fruit is similar to a small "domesticated" mango, and is green when raw and yellow when ripe. The ripe fruit contains a lot of fibres. The pulp of the fresh fruit is eaten and the nut is cracked to obtain the *Irvingia gabonensis* kernel. This kernel can easily be separated into two parts.

The kernel is the most valued part of the *Irvingia gabonensis* tree. It is a delicious condiment for soup and an important source of cash income for farmers in the Humid Forest Zone of Cameroon. The kernel can be pounded and used as a substitute or complement for groundnut in the diet of forest dwellers in the Humid Forest Zone of Cameroon. The sauce made with *Irvingia gabonensis* kernel can be stored for three to four days without being refrigerated. The paste obtained from the crushed kernel is called "dika bread" in Gabon and "etima" in the Centre province of Cameroon and can be stored for more than a year after it is dried in the sun. The *Irvingia gabonensis* kernel can be stored for up to a year if completely dry.

### *Cola acuminata* (kola nut)

*Cola acuminata* commonly called "abata cola", belongs to the family of *Sterculiaceae* and is found in the green forests of Cameroon. It is distributed from Nigeria to Congo (Vivien and Faure, 1985). The tree produces fruits that are consumed and sold because of the stimulant properties of the nut. *Cola acuminata* is the basis of an important trade within Cameroon and between Cameroon and neighbouring countries.

### *Garcinia kola*

*Garcinia kola* belongs to the family of *Clusiaceae* (*Gutiferae*) and is found in the Humid Forest Zone of Cameroon. The tree is distributed from Sierra Leone to Gabon and Zaire (Democratic Republic of Congo) (Vivien and Faure, 1985). This encompasses part of the lowland warm humid tropic of West and Central Africa. In West Africa, *Garcinia kola* grows in Sierra Leone, Côte d'Ivoire, Ghana, Togo, Benin and Nigeria. In Central Africa, it is found in Cameroon, Gabon, Central African Republic and Equatorial Guinea. *Garcinia kola* is commonly called "bitter kola" by local people, which is the name of the aphrodisiac fruit that the tree produces. It is an important product in the Humid Forest Zone of West and Central Africa because it is eaten and also contributes to the revenues of rural households.

The bark of the *Garcinia kola* tree is used in palm wine to give the wine a bitter taste and to make it stronger. This practice is common in the Centre province of Cameroon and also in Gabon. The bark when soaked into water can be used as a treatment for intestinal worms and to cure stomach pain. Mixed with kola nut, the fruit of *Garcinia kola* aids digestion.

### *Garcinia lucida*

*Garcinia lucida* belongs to the family of *Clusiaceae* (*Gutiferae*) and in Cameroon is found in the Humid Forest Zone. The bark is an anti-venom. It is mostly used by farmers who tap palm wine after harvesting the tree. According to farmers, the bark of *Garcinia lucida* gives a stronger taste to the palm wine.

## 4. NWFP markets and margins of traders

### Volume and value of NWFP marketed

The total quantity of sales recorded in the sample for *Irvingia* spp., *Cola acuminata*, *Garcinia kola* and *Garcinia lucida* amounted to 138 tons in 1995 and 85 tons in 1996, with a value of 84 072 000 CFA Francs and 77 262 100 CFA Francs respectively (Table 1). A projection of the total number of traders operating in the 28 markets would yield an aggregate quantity of 677 tons in 1995 and 272 tons in 1996 with a total value of 361 558 000 CFA F in 1995 and 254 402 000 CFA F in 1996 (Table 2). (This aggregate figure is obtained by assuming that the same percentage of traders in the sample handling a particular NWFP in a given market can be generalised for the total number of traders operating in that market.) This is equivalent to US\$ 753 000 in 1995 (480 CFA F= US\$1) and US\$ 499 000 in 1996 (510 CFA F= US\$1). The projected sales of *Garcinia kola* and *Garcinia lucida* barks represented 57 tons in 1995 and 37 tons in 1996 with a total value of 14 331 000 CFA F (US\$ 30 000) in 1995 and 11 977 000 CFA F (US\$ 23 5000) in 1996.

*Irvingia* spp. is the NWFP which is marketed by the highest percentage of traders, followed by *Cola acuminata*, *Garcinia lucida* bark and *Garcinia kola* bark. In 1995, *Cola acuminata* was the most important NWFP in terms of amount traded, followed by *Irvingia* spp., *Garcinia lucida* and *Garcinia kola* barks. In 1996, the order of the importance of quantity

marketed changed slightly, with *Irvingia* spp. being the most important NWFP, then *Cola acuminata* and the two *Garcinia*. Value of the NWFP marketed displayed a different order of significance than the one related to volume. In both 1995 and 1996, the value of sales was greatest for *Irvingia* spp., followed by *Cola acuminata*, *Garcinia lucida* and *Garcinia kola* barks. The quantity and value of NWFP marketed reflect the typical characteristics of thin markets caused by a combination of environmental and economic factors. This will be discussed further in the next section

**Table 1:** Selected NWFP markets in the Humid Forest Zone, 1995 and 1996\*

NWFP	% of Traders		Sales by Sample Interviewed			
	Selling NWFP		Quantity (kg)		Value (CFA Francs)	
	1995 (n=267)	1996 (n=347)	1995	1996	1995	1996
<i>Irvingia</i> spp.	45	47	36 390	34 400	43 000 000	47 534 600
<i>Cola acuminata</i>	19	24	80 960	31 650	35 884 000	23 660 300
<i>Garcinia lucida</i> (bark)	2	4	14 600	13 500	3 726 000	4 882 500
<i>Garcinia kola</i> (bark)	1	1.5	5 970	5 560	1 462 000	1 184 700
<b>Total</b>	<b>67</b>	<b>76.5</b>	<b>137 920</b>	<b>85 110</b>	<b>84 072 000</b>	<b>77 262 100</b>

\* 29 weeks for all NWFP in 1995 and in 1996

**Table 2:** Sales projected over all NWFP markets in the Humid Forest Zone, 1995 and 1996\*

NWFP	Projection of sales for all NWFP Markets			
	Quantity (Kg)		Value CFA	
	1995	1996	1995	1996
<i>Irvingia</i> spp.	111 000	107 100	125 237 000	147 769 000
<i>Cola acuminata</i>	509 000	127 400	221 990 000	94 656 000
<i>Garcinia lucida</i> (bark)	40 600	27 300	10 360 000	9 867 000
<i>Garcinia kola</i> (bark)	16 200	9 900	3 971 000	2 110 000
<b>Total</b>	<b>676 800</b>	<b>271 700</b>	<b>361 558 000</b>	<b>254 402 000</b>

\* 29 weeks for all NWFP in 1995 and in 1996

From 1995 to 1996, the combined quantity of both *Garcinia lucida* and *Garcinia kola* bark marketed decreased by 7 per cent, while the actual value of sales increased relatively by 17 per cent (Table 1).

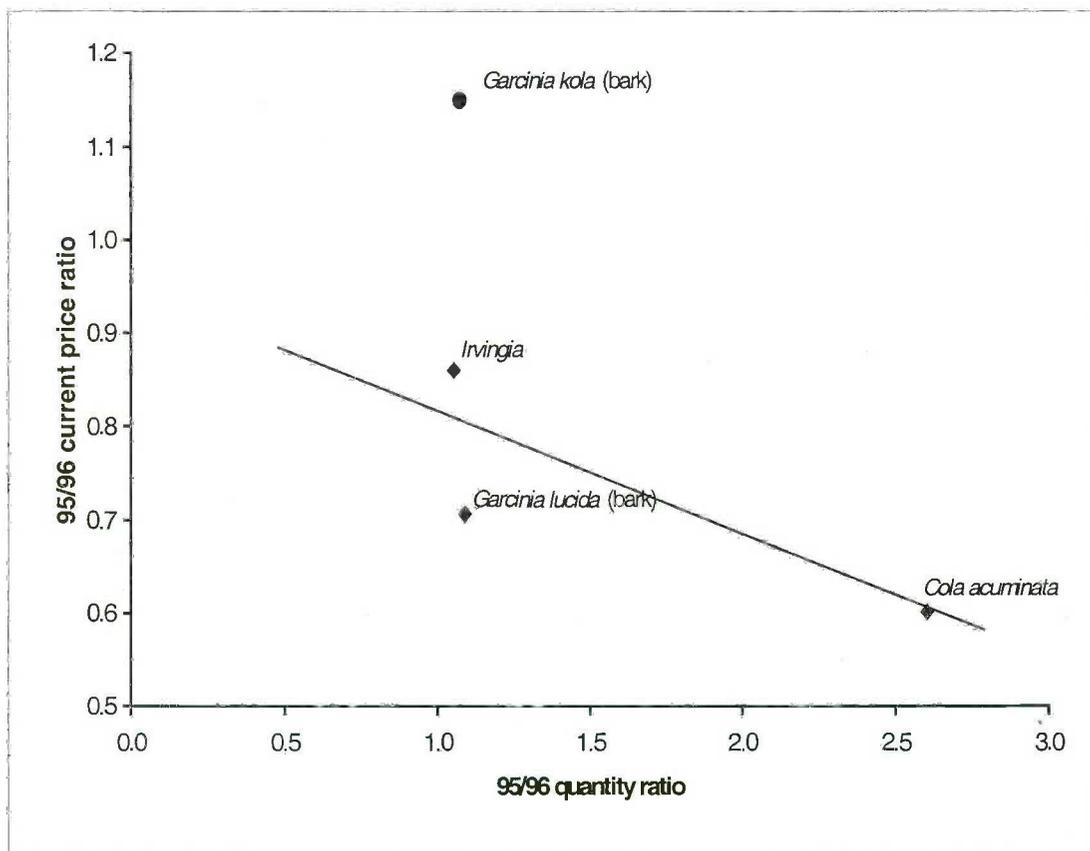
### Thinness of NWFP markets

The quantity and value of the NWFP studied varied significantly between 1995 and 1996, especially for *Cola acuminata* (Table 1). This is characteristic of thin markets. Markets are defined as thin if a small change in production has a large effect on the quantity marketed. This changes the role of markets in assembling and distribution of NWFP from year to year. There are various ways to deal with thin markets, which will be discussed further in the conclusions.

From 1995 to 1996, the actual quantity marketed of *Irvingia* spp. declined by 5 per cent while the value of sales increased by 11 per cent (Table 1). In 1995, the markets of Ebolowa, Abang Minko (border between Cameroon and Gabon) and Kye-Ossi (border between Cameroon and Equatorial Guinea) accounted for 59 per cent of the total quantity of *Irvingia* spp. marketed; in 1996, these markets traded 41 per cent of total quantity marketed. The Mfoundi market (Yaounde) became more important, accounting for 17 per cent of quantity marketed in 1996 against 7 per cent in 1995.

The decline in the quantity of *Irvingia* spp. marketed can be explained by the fact that the production of *Irvingia wombolu* was less important in 1996 than in 1995. As noted by Ndoye *et al.*, (1997) there are two species of *Irvingia* that are traded in the Humid Forest Zone of Cameroon and its borders: *Irvingia gabonensis*, which fruits from June to August; and *Irvingia wombolu*, which fruits from January to March. This significantly affected the quantity traded at Ebolowa (Table 3). Although the quantity of *Irvingia* spp. marketed increased in several markets, this was not sufficient to offset the decline in other markets, especially Ebolowa, one of the key regional markets for this product.

Figure 1 Response of price to quantity of main products



**Table 3:** Changes in the trade of *Cola acuminata*, *Irvingia* spp., *Garcinia kola* and *Garcinia lucida* barks in selected markets of the Humid Forest Zone and its borders

Markets	<i>Cola acuminata</i>		<i>Irvingia</i> spp.		<i>Garcinia kola</i> (Bark)		<i>Garcinia lucida</i> (Bark)	
	Difference 96-95 (bags)	Relative Change %	Difference 96-95 (bags)	Relative Change %	Difference 96-95 (bags)	Relative Change %	Difference 96-95 (bags)	Relative Change %
Mbalmayo	+20	+147	+36	+259	-	-	+76	+40
Edea	+15	+157	-	-	-	-	-	-
Mfoundi (Yde)	-81	-58	+55	+117	-	-	-	-
Sangmelima	+6	+182	-42	-62	-	-	-	-
Mokolo (Yde)	-43	-60	-24	-72	-	-	-	-
Ebolowa	+32	+124	-137	-59	-	-	-324	-66
Abang Minko	+3	+35	-6	-4	-10	-7	+51	+69
Kribi	-	-	+28	+148	-	-	-	-
Bertoua	-2	-95	-8	-81	-	-	-	-
Abong Mbang	-	-	-10	-75	-	-	-	-
Bafia	-673	-99	+7	+612	-	-	-	-
Monatele	-	-	+0.4	+17	-	-	-	-
Zoatele	+5	+407	+1.2	+46	-	-	+80	+138
Akonolinga	-40	-92	-17	-84	-	-	-	-
Batouri	-	-	-2	-24	-	-	-	-
Kenzou	+27	+170	-	-	-	-	-	-
New-Bell	+83	+290	+15	+226	-	-	-	-
Kumba	-0.8	-12	+2.3	+72	-	-	-	-
Limbe	-	-	-12	-76	-	-	-	-
Saa	-	-	-1.1	-68	-	-	-	-
Ombessa	-209	-90	-	-	-	-	-	-
Kye-Ossi	-	-	+10	+98	-	-	-	-

The quantity marketed and the value of sales of *Cola acuminata* decreased from 1995 to 1996 by 61 per cent and 34 per cent respectively. In 1995, the markets of Mfoundi (Yaounde), Bafia and Ombessa accounted for 82 per cent of the total quantity of *Cola acuminata*, but only 18 per cent in 1996. The New Bell market (Douala) became more important, handling 22 per cent of quantity marketed in 1996 compared to 2 per cent in 1995. The most important markets for *Cola acuminata* in 1995 were Bafia and Ombessa, located further north of Yaounde. The following year, markets further south of Yaounde (Mbalmayo, Ebolowa), markets in the Littoral province (Edea, New-Bell) and the frontier market with Central African Republic (Kenzou) became more important in assembling and distribution of *Cola acuminata* (Table 3).

The decline in the quantity traded from Bafia and Ombessa can be explained by a drastic reduction in production, resulting from physical, biological and/or ecological factors. Further investigation is necessary, because of the NWFP studied, *Cola acuminata* is the most frequently planted by forest dwellers, especially in their cocoa plantations. Despite its widespread cultivation, it has had the greatest decline in the quantity marketed.

Between 1995 and 1996, the quantity of *Garcinia lucida* bark marketed declined by 8 per cent while the actual value of sales increased by 31 per cent. In 1995, the markets of Mbalmayo, Ebolowa, Abang Minko (border between Cameroon and Gabon) accounted for 93 per cent of the total quantity of *Garcinia lucida* bark marketed and 74 per cent in 1996. The market of Zoatele became more important and handled 18 per cent of quantity marketed in 1996 compared with 7 per cent in 1995. The trade of *Garcinia lucida* bark is dominated by markets south of Yaounde (Mbalmayo, Zoatele) and the frontier market with Gabon (Abang Minko) (Table 3). The overall decline in the quantity of bark marketed was due to the drastic decrease in amount traded at Ebolowa, which could not be offset by increases at Mbalmayo, Abang Minko and Zoatele. Furthermore, the reduction may be due to excessive pressure on the resource in the areas supplying the Ebolowa market.

For *Garcinia kola* bark, the quantity marketed and the value of sales decreased by 7 per cent and 19 per cent respectively from 1995 to 1996. All trade in both years was undertaken at Abang Minko. This bark is very important for Gabonese consumers who use it to improve the taste (bitter) of palm wine and to increase the level of alcohol.

The foregoing discussion demonstrates that NWFP markets are quite complex, highlighting the difficulties and the challenges associated with their study. The relationship between quantity marketed and prices received for the four products is related to the decline in volume of trade (see Figure 1). There were two different reasons for this decline in the amount of product changing hands in the markets.

1. For *Irvingia* spp., *Cola acuminata* and *Garcinia lucida* bark, reduced production of the product led to a decline in the quantity marketed, especially for *Cola acuminata*. This may have been caused by one of the following conditions or a combination:
  - a reduction in both production and demand from traders and consumers for the NWFP;
  - a linear relationship between production and quantity marketed by forest dwellers, meaning that a reduction in production translates to a reduction in quantity marketed due to poor long-term storage facilities in a year of a good harvest; and/or
  - a reduction in production leading to a decline in quantity marketed by forest dwellers due to a fixed amount (threshold) being held by the household for home consumption.

**Table 4:** The three most important origins of *Irvingia* spp. traded in 1995 and 1996

MARKETS	1995			1996		
	Origin 1	Origin 2	Origin 3	Origin 1	Origin 2	Origin 3
Mbalmayo	Mbalmayo	-	-	Mbalmayo	-	-
Edea	Mfoundi (Yde)	-	-	Edea	-	-
Mfoundi (Yde)	Mfoundi (Yde)	Mokolo (Yde)	Ebolowa	Mfoundi (Yde)	Mbalmayo	Ngomedzap
Sangmelima	Sangmelima	Ebolowa	Ezezung	Sangmelima	Elom	Ebolowa
Mokolo (Yde)	Mokolo (Yde)	Mfoundi	Mbalmayo	Mokolo (Yde)	-	-
Ebolowa	Ebolowa	Route Kribi	Nkok-Ekie	Ebolowa	Kribi	Mbalmayo
Abang Minko	Ebolowa	Essos (Yde)	Ngozip	Ebolowa	Kribi	Ambam
Kribi	Ebolowa	Biwong	Kribi	Kribi	Ebolowa	Likoube
Bertoua	Mfoundi (Yde)	Bertoua	-	Bertoua	-	-
Abong Mbang	Abong Mbang	-	-	Abong Mbang	Medjo	-
Bafia	Bafia	-	-	Bilig-Bidig	-	-
Monatele	Monatele	-	-	Monatele	-	-
Zoatele	Mfoundi (Yde)	Ebolowa	-	Ebolowa	Mfoundi (Yde)	-
Akonolinga	Akonolinga	Ebolowa	Mfoundi	Akonolinga	Mfoundi (Yde)	-
Batouri	Batouri	Kadey	Mfoundi	Batouri	Kadey	Mfoundi
Kenzou	-	-	-	-	-	-
New-Bell (Dla)	New-Bell	Saa	-	New-Bell	Saa	Mfoundi
Kumba	Kumba	-	-	Kumba	-	-
Limbe	Limbe	Muyuka	Mamfe	Limbe	Mamfe	-
Saa	Saa	-	-	Saa	-	-
Ombessa	-	-	-	-	-	-
Kye-Ossi	Ebolowa	-	-	Ebolowa	-	-

**Table 5:** The three most important origins of *Cola acuminata* traded in 1995 and 1996

MARKETS	1995			1996		
	Origin 1	Origin 2	Origin 3	Origin 1	Origin 2	Origin 3
Mbalmayo	Mbalmayo	-	-	Mbalmayo	Mvog-Mbi	Mengueme
Edea	Edea	-	-	Edea	-	-
Mfoundi (Yde)	Mfoundi	Bokito	Mbangassina	Mfoundi	Bafia	Monatele
Sangmelima	Mfoundi	-	-	Sangmelima	Mbalmayo	Mfoundi
Mokolo (Yde)	Mokolo	Bokito	Ndom	Mokolo	Ndom	-
Ebolowa	Ebolowa	-	-	Ebolowa	Route Mvangan	Biboulman
Abang Minko	Mfoundi	Abang Minko	-	Mfoundi	-	-
Kribi	-	-	-	-	-	-
Bertoua	Obala	-	-	Bertoua	-	-
Abong Mbang	-	-	-	-	-	-
Bafia	Bafia	Bokito	Yabeng	Tiko (Bafia)	Banda	-
Monatele	-	-	-	-	-	-
Zoatele	Ebolowa	-	-	Ebolowa	Mfoundi	-
Akonolinga	Akonolinga	-	-	Akonolinga	-	-
Batouri	-	-	-	-	-	-
Kenzou	Mbanga	Loum	-	Mbanga	Batouri	-
New-Bell	Loum	-	-	Saa	New-Bell	Mbangassina
Kumba	Kumba	-	-	Kumba	-	-
Limbe	-	-	-	-	-	-
Saa	-	-	-	-	-	-
Ombessa	Bouraka	-	-	Melen	-	-
Kye-Ossi	-	-	-	-	-	-

**Table 6:** The three most important origins for *Garcinia lucida* bark traded in 1995 and 1996

MARKETS	1995			1996		
	Origin 1	Origin 2	Origin 3	Origin 1	Origin 2	Origin 3
Mbalmayo	Mvog-Mbi	Ebolowa	-	Mbalmayo	Mvog-Mbi	-
Edea	-	-	-	-	-	-
Mfoundi (Yde)	-	-	-	-	-	-
Sangmelima	-	-	-	-	-	-
Mokolo (Yde)	-	-	-	-	-	-
Ebolowa	Ebolowa	Ngoul Essama	-	Ebolowa	Ebolowa-Assi	-
Abang Minko	Ebolowa	-	-	Ebolowa	-	-
Kribi	-	-	-	-		
Bertoua	-	-	-	-		
Abong Mbang	-	-	-	-		
Bafia	-	-	-	-		
Monatele	-	-	-	-		
Zoatele	Ebolowa	-	-	Ebolowa	Mvog-Mbi	Lolodorf
Akonolinga	-	-	-	-	-	-
Batouri	-	-	-	-	-	-
Kenzou	-	-	-	-	-	-
New-Bell	-	-	-	-	-	-
Kumba	-	-	-	-		
Limbe	-	-	-	-		
Saa	-	-	-	-		
Ombessa	-	-	-	-		
Kye-Ossi	-	-	-	-		

**Table 7:** The three most important origins for *Garcinia kola* bark traded in 1995 and 1996

MARKETS	1995			1996		
	Origin 1	Origin 2	Origin 3	Origin 1	Origin 2	Origin 3
Mbalmayo	-	-	-	-	-	-
Edea	-	-	-	-	-	-
Mfoundi (Yde)	-	-	-	-	-	-
Sangmelima	-	-	-	-	-	-
Mokolo (Yde)	-	-	-	-	-	-
Ebolowa	-	-	-	-	-	-
Abang Minko	Ebolowa	-	-	Ebolowa	Melanga	Akom
Kribi	-	-	-	-	-	-
Bertoua	-	-	-	-	-	-
Abong Mbang	-	-	-	-	-	-
Bafia	-	-	-	-	-	-
Monatele	-	-	-	-	-	-
Zoatele	-	-	-	-	-	-
Akonolinga	-	-	-	-	-	-
Batouri	-	-	-	-	-	-
Kenzou	-	-	-	-	-	-
New-Bell	-	-	-	-	-	-
Kumba	-	-	-	-	-	-
Limbe	-	-	-	-	-	-
Saa	-	-	-	-	-	-
Ombessa	-	-	-	-	-	-
Kye-Ossi	-	-	-	-	-	-

**Table 8:** Net margins (in CFA) for the marketing of NWFP in 1995 and 1996

NWFP	Total net margin (x 1000 CFA)		weekly margin per trader		margin as % of sales value	
	1995	1996	1995	1996	1995	1996
<i>Irvingia</i> spp.	12 988	11 292	3 800	2 400	30%	24%
<i>Cola acuminata</i>	6 362	6 205	4 400	2 600	18%	26%
<i>Garcinia lucida</i> (bark)	972	1 627	5 600	4 000	26%	33%
<i>Garcinia kola</i> (bark)	544	289	6 200	2 000	37%	24%

**Table 9:** Traders' marketing margins in selected markets (CFA Francs)

Market	1995	1996
<i>Cola acuminata</i>		
Mfoundi (Yde)	5 800	2 200
Bafia	13 900	2 600
Ombessa	8 000	1 500
New Bell (Dla)	3 100	6 800
Kenzou	3 700	5 800
<i>Irvingia</i> spp.		
Mfoundi (Yde)	2 000	2 900
Ebolowa	5 500	1 800
Abang Minko	13 700	7 800
New Bell (Dla)	1 500	3 700
Limbe	1 800	900
Kye-Ossi	2 800	8 600
<i>Garcinia lucida</i>		
Mbalmayo	6 000	4 800
Ebolowa	10 200	7 800
Abang Minko	1 600	2 300
Zoatele	4 000	5 000
<i>Garcinia kola</i>		
Abang Minko	6 200	2 000

2. For *Garcinia kola* bark, demand was reduced because the distribution market for this product, Abang Minko, was performing poorly due to the breakdown of the ferry that affected the number of Gabonese crossing the border. This led to an overstocked market translating to lower prices. This further affected the quality of the bark, which was not the case for *Irvingia* spp. because of better storage potential in the short term.

*Irvingia* spp., *Cola acuminata* and *Garcinia lucida* all behaved as would be expected, displaying a similar price elasticity of supply. Prices increased as quantity marketed declined, and the greater the reduction in quantity marketed the higher the increase in price (Figure 1). The fourth NWFP, *Garcinia kola* bark, responded in a contrary fashion. The reduction in the quantity marketed was not the result of a decreased supply (as with the other three products) but because of a market glut in Abang Minko due to the ferry problem. When traders arrived to sell in the market, they found fewer buyers generating a lower demand and a consequent price reduction.

The role in assembling and distribution of several of the markets studied changed from 1995 to 1996. For *Irvingia* spp., *Cola acuminata* and *Garcinia lucida* bark, the increase in the quantity marketed in a few markets was not enough to offset the decline in other markets. This translated to an overall decline in the quantity marketed. Declining production of these NWFP may have been due to environmental factors like drought, excessive pressure on the resource resulting in reduced availability, and changes in weather patterns altering the period of flowering and fructification of the NWFP.

In 1995, there appeared generally to be stable relationships between selling markets and their immediate surrounding areas (as portrayed when the selling market is the same as the origin of the NWFP) as a source of supply for the four NWFP studied (Tables 4 to 7). For most of the selling markets, the origins of the NWFP changed from 1995 to 1996, which reinforces the argument of unstable or erratic supplies affecting (positively or negatively) the role individual markets play in assembling and distribution between the two years. Peters (1994) points out that "very few tropical forest species produce reliable fruits during a well-defined, predictable season each year". This implies the need for long-term monitoring of NWFP markets to better characterise them by linking the ecology of the NWFP (i.e., life cycle, type of output produced, abundance in the forest and the size-class distribution of natural population) (Peters, 1994), climatic factors, and other related environmental variables, as well as socio-economic and cultural factors.

### **Marketing margins of traders**

In 1995 the average weekly net margins per trader were higher for *Garcinia lucida* and *Garcinia kola* barks than for *Irvingia* spp. and *Cola acuminata* (Table 8). The following year, the net margins were highest for *Garcinia lucida* bark and were comparable for *Irvingia* spp. and *Cola acuminata*. This is also reflected in the total marketing margins as a percentage of the value of sales, which is higher for barks. Clearly, traders will continue to demand these NWFP (barks), especially for their use in palm wine production.

The reasons for the differences in the marketing margins between fruits/kernels and barks are complex, and relate to different storage periods, different levels of perishability and to the fact that the quantity of fruits/kernels traded is significantly higher than the quantity of barks traded. As a result, the larger markets (*Cola acuminata* and *Irvingia* spp.) are subject to lower weekly net margins. From 1995 to 1996, the average weekly net marketing margins for each trader who sold *Irvingia* spp., *Cola acuminata*, *Garcinia lucida* bark and *Garcinia kola* bark declined by 37 per cent, 41 per cent, 29 per cent and 68 per cent respectively (Table 8).

*Garcinia kola* bark, which is traded exclusively at Abang Minko, showed the greatest decline in margins.

In 1995, the markets of Abang Minko (border between Cameroon and Gabon) and Ebolowa had the highest weekly net marketing margins per trader for *Irvingia* spp., amounting to CFA F 13 700 and CFA F 5 500 respectively (Table 9). The next year, Kye-Ossi (border between Cameroon and Equatorial Guinea) and Abang Minko (border between Cameroon and Gabon) produced the highest margins of 8 600 CFA F and 7 800 CFA F respectively. The lower weekly marketing margins in 1996 at Abang Minko was caused by the breakdown of the ferry, which forced traders to sell at reduced margins. Although the average weekly marketing margins declined at Abang Minko in 1996, it remains the case that sales of *Irvingia* spp. are more lucrative at markets at the borders (Table 9).

Bafia and Ombessa had the highest weekly net marketing margins per trader for *Cola acuminata* in 1995 with 13 900 CFA F and 8 000 CFA F respectively. In 1996, the markets of New Bell (Douala) and Kenzou (border between Cameroon and Central African Republic) had the highest weekly net marketing margins totalling 6 800 CFA F and 5 800 CFA F. The increases over the two years were 119 percent at New Bell and 57 percent at Kenzou (Table 8).

For *Garcinia lucida* bark, the markets of Ebolowa and Mbalmayo had the highest weekly net marketing margins per trader in 1995, of 10 200 CFA F and 6 000 CFA F. In 1996, Ebolowa and Zoatele margins were highest weekly with 7 800 CFA F and 5 000 CFA F. The average weekly marketing margins per trader decreased by 24 per cent for Ebolowa and increased by 25 per cent for Zoatele from 1995 to 1996 (Table 8).

In both 1995 and 1996, Abang Minko was the only market where *Garcinia kola* bark was marketed. The weekly net marketing margins per trader declined from 6 200 CFA F in 1995 to 2 000 CFA F in 1996. This drastic decline was due to the drop in the average sale prices of the bark over the two years (Table 1), and the additional transport and storage costs created by the non-functioning of the market. Traders were forced to return home without selling after incurring some costs of bringing their product to the market. The ferry of Abang Minko broke down in May-June 1995 and was still not repaired during the time of the survey in 1996. Furthermore, there were some problems on the border between Cameroon and Gabon, which made the market non-operational in several instances. Traders were not informed of these prior to their arrival at the market, which could have helped them to avoid the costs of needlessly transporting their product. This also lowered the quality of the bark.

## **5. Welfare effects of marketing different NWFP**

This section investigates the welfare effects of selling *Irvingia* spp. and *Cola acuminata* compared to selling the barks of *Garcinia lucida* and *Garcinia kola*. Basic questions need to be asked:

- Are forest dwellers better off when they sell *Irvingia* spp. and *Cola acuminata* than when they sell *Garcinia lucida* and *Garcinia kola* barks?
- What is a possible solution to the trade-offs that are likely to occur?

### **Welfare effects for forest dwellers**

Forest dwellers receive a certain percentage of the wholesale and retail prices when they sell their NWFP. Gatherers received a higher percentage of the retail prices when they sell *Irvingia* spp. than when they sell *Garcinia lucida* and *Garcinia kola* barks (Table 10). The

difference in the percentage of the retail prices received by forest dwellers for sales within Cameroon is not significant. The differences when the NWFP is sold at the border with Gabon may be due to factors such as transportation costs and generally better margins for traders in frontier markets, especially for *Irvingia* spp. This implies that forest dwellers should be spending more time in the collection and sales of *Irvingia* spp. than the harvesting and sales of barks. Since forest dwellers are searching for income-generating enterprises, the above knowledge may not be an important factor in changing their behaviour.

### **Welfare effects for traders**

As previously discussed, the weekly net marketing margins achieved by traders selling *Garcinia lucida* and *Garcinia kola* barks were higher or comparable to those of *Irvingia* spp. and *Cola acuminata*. This suggests that traders will continue to demand the barks of *Garcinia lucida* and *Garcinia kola* because of their importance in palm wine production, of which consumption has increased significantly since the devaluation of the CFA Franc.

Trade-offs are likely to be necessary when trying to maximise returns to forest dwellers and traders, as well as conserve the resource. This situation is discussed below as part of the need for research.

## **6. Future research needs**

### **Reducing the thinness of NWFP markets**

To reduce the thinness of NWFP markets, several conditions must be met. The most important is to increase aggregate production. This could be done through conservation or domestication.

- *Conservation* can be achieved by determining the harvesting rate that will preserve the NWFP tree, using sustainable harvesting techniques for bark extraction and educating forest dwellers to use these methods efficiently.
- *Domestication* and cultivation by forest dwellers will reduce the length of the production cycle of the NWFP while preserving the characteristics that are important to consumers.

Domestication may require longer-term research and more financial resources than conservation, which is of a shorter-term strategy. The current economic crisis, structural adjustment policies and the devaluation of the CFA F, have all increased poverty in rural and urban areas (World Bank, 1995), and resulted in return migration from urban to rural areas (Bela, 1994; Pokam, 1997). These pressures seem to reduce the possibility that conservation is a viable option. The domestication of NWFP and their cultivation in multi-strata agroforestry systems (like the current cocoa and coffee-based systems in Cameroon) could be a more viable alternative in reducing the pressure from the forests under present circumstances.

However, increasing the aggregate supply of NWFP is a necessary but not sufficient condition for reducing the thinness of NWFP markets. Other conditions that need to be met are improved access to market information and infrastructure, reduced transaction costs (information, contracting and enforcement costs), and improved institutional support (credit) for forest dwellers and traders. Without these, efforts to domesticate and plant particular NWFP may fail.

## Potential resource degradation

### *Potential resource degradation from debarking*

There are debatable figures in the various inventories carried out in the forest zone with regard to the available stock of *Garcinia lucida* from the forest. These discrepancies can be explained by the relative abundance of each species in natural conditions. These in turn could explain why the variation in the abundance and the distribution of certain NWFP can be high, even over a relatively small area (van Dijk, 1998).

In her inventory in southern Cameroon, van Dijk (1995) did not find any *Garcinia lucida* trees. Ntamag's (1997) survey showed *Garcinia lucida* only in virgin forests at an average rate of 4 trees per hectare. Guedje (1997) recorded 58 live stems of *Garcinia lucida* trees per hectare in an inventory, which covered 8.45 hectares. She also found those trees with diameters equal to or greater than 10 centimetres were exploited (debarked) most – 32 live stems per hectare were noted in that category. All the above studies were carried out in the Tropenbos site, a relatively small area of 200 000 hectares.

The density of trees per hectare of *Garcinia kola* also appears to vary widely, according to the literature. Tchatchou (1997 cited by Doucet and Koufani 1997) found a density of 0.01 tree per hectare in eastern Cameroon. Doucet and Koufani (1997) themselves did not discover any *Garcinia kola* trees in their inventory carried out in eastern Cameroon. In southern Cameroon, van Dijk (1995) found a density of 0.4 tree per hectare for *Garcinia kola*.

There are three shortcomings in the current research of *Garcinia lucida* and *Garcinia kola*. There is presently no information about the sustainable rate of bark harvest per tree that would preserve it perennially. The literature reveals a high variability in the data about available stocks of *Garcinia lucida* and *Garcinia kola*. This may indicate that the potential (stocks) of the resource are not known precisely, and/or that there are problems in the methods used in the inventories to assess the availability of the resource. Peters (1994) cautioned that inventories should be carried out in different forest types. In addition to these problems, there is no information on average yield per tree.

The first two issues are important to reconcile livelihood and conservation objectives. Data on density and average yield per tree would allow calculation of the potential area of forest affected by debarking both *Garcinia lucida* and *Garcinia kola*.

Cunningham and Mbenkum (1993) assumed that the average yield of *Prunus africana* to be 55 kg per tree. We assumed similar yields for *Garcinia lucida* and *Garcinia kola*, because of the lack of information in the current research on those products. One factor that could justify this assumption is the similar height of the species; 25 and 30 metres for *Prunus africana* (BDCPC, 1997), 25 metres for *Garcinia lucida* (Guedje, 1996), and 35 metres for *Garcinia kola* (Vivien and Faure, 1996).

**Table 10:** Proportion of prices received by forest dwellers in 1996

NWFP	% of wholesale price (Cameroon)	% of retail price (Cameroon)	% of price to Gabonese	% of price to Equato-Guineans
<i>Irvingia</i> spp.	68	64	61	54
<i>Cola acuminata</i>	63	60	-	-
<i>Garcinia lucida</i> bark	-	63	47	-
<i>Garcinia kola</i> bark	-	-	50	-

**Table 11:** Potential number of trees debarked in 1995 and 1996\*

	<i>Garcinia lucida</i>	<i>Garcinia kola</i>
1995	738 trees	295 trees
1996	496 trees	180 trees

\*Based on an average yield of 55 kg per tree and the projection from Table 1.

**Table 12:** Potential number of hectares of forest affected (hectares)

	<i>Garcinia lucida</i>			<i>Garcinia kola</i>	
	4 trees/ha $\alpha$	32 trees/ha (dbh $\geq$ 10 cm) $\beta$	58 trees/ha $\beta$	0.01 trees/ha $\delta$	0.4 trees/ha $\epsilon$
<b>1995</b>	185	23	13	29 500	738
<b>1996</b>	124	16	9	18 000	450

$\alpha$  - Based on Ntamag (1997)

$\beta$  - Based on Guedje (1996)

$\delta$  - Based on Tchatchou (1997) cited in Doucet and Koufani (1997)

$\epsilon$  - Based on van Dijk (1995)

Based on the above assumption about the average yields of the trees (55 kg per tree), the potential number of *Garcinia lucida* trees debarked was 738 in 1995 and 496 in 1996. For *Garcinia kola* trees, the number debarked would be 295 in 1995 and 180 in 1996. These figures represent a reduction in the number of *Garcinia lucida* trees debarked of 33 per cent and 39 per cent for *Garcinia kola* between 1995 and 1996 (Table 11). The possible area of forest affected by bark extraction (Table 12) can be calculated by using the different estimates of the density per hectare for *Garcinia lucida* and *Garcinia kola* from Ntamag (1997), Guedje (1996), Doucet and Koufani (1997) and van Dijk (1995). In 1995, the potential number of hectares of forest affected by the extraction of *Garcinia lucida* bark marketed varied between 13 and 185 hectares, with that of *Garcinia kola* varying between 738 and 29 500 hectares. In 1996, the estimates of area affected by *Garcinia lucida* bark extraction ranged between 9 and 124 hectares, while that of *Garcinia kola* was from 450 to 18 000 hectares (Table 12).

Fewer *Garcinia lucida* and *Garcinia kola* trees were debarked in 1996 than in 1995. This could have occurred because of a reduction in the number of mature trees resulting from the scarcity of tree resources. Demand for the products in markets at the borders, especially for *Garcinia kola* bark, may also have been lower. A combination of these factors may also have contributed to the reduction in trees debarked.

#### *Role of research in finding a balance between welfare improvement and forest conservation*

Improving welfare from forests and forest conservation is always a difficult challenge for researchers, policy makers and the international community. As the study showed, NWFP contribute to the livelihoods of forest-dependent people. For *Garcinia lucida* and *Garcinia kola*, it is to the advantage of traders to continue to provide market outlets for forest dwellers to sell NWFP, since weekly net marketing margins from barks were higher or comparable to those of fruits/kernels (Table 3). Furthermore, traders will seek these products because of international demand from Gabon and other neighbouring countries.

*Garcinia lucida* and *Garcinia kola* have been used for many decades by forest dwellers in a sustainable way. Beside their medicinal properties, these products have traditionally been used by forest dwellers to improve the taste of palm wine. *Garcinia lucida* has other social attributes because it is an antidote for poison that is highly valued in rural areas.<sup>2</sup> However, when other factors contribute to the general economic situation, trade-offs are necessary between welfare and forest conservation. The decline in international markets for cocoa and coffee in the 1980s, the economic crisis that has affected Cameroon since 1986, structural adjustment programs which are accompanied by the lay-off of people, and the devaluation of the CFA F in January 1994, are all likely to increase pressure on the forests to provide alternative income-generating opportunities. In particular, the devaluation of the CFA Franc increased the price of beer and whisky, and these were substituted by palm wine and local whisky (odontol), which is made after distilling the fermented palm wine. The resulting boost in palm wine production will necessarily increase the pressure on palm trees (*Elaeis guineensis*, *Raphia hookeri*) and on *Garcinia lucida* and *Garcinia kola*. In eastern Cameroon, Oyono (1997) reported that young *Raphia* trees are now exploited, which was not the case ten years ago. In southern Cameroon, Guedje (1996) found sites where more than 50 per cent of *Garcinia lucida* trees were dead. According to information from the market interviews carried out, *Garcinia kola* trees that still bear fruit are sold by forest dwellers to traders who extract the bark. This practice was not common in the past. Before the devaluation of the CFA F, the price of an adult *Garcinia kola* tree varied between 10 000 and 15 000 CFA F; after devaluation the price of a tree was between 20 000 and 25 000 CFA F.

<sup>2</sup> According to Diaw (1997), "*Garcinia lucida* is vital to social interaction in societies where the sharing of drinks and the fear of poisoning are both widespread".

There could be a danger of a conflict between the social value of *Garcinia lucida* (and *Garcinia kola*) and the financial profitability of these NWFP as a result of emerging local and international markets. In a situation of economic crisis and an active search for alternative income-generating opportunities, private gains can override the hitherto sustainable social benefits that were derived from these NWFP, especially *Garcinia lucida* because it is governed by an open access regime. The displacement of social benefits by private gains from individual opportunistic behaviour can deplete forest resources and place a heavy cost on the larger community of forest dwellers who depend on these products.

Inventories show that there is a wide variation in the stocks available of *Garcinia lucida* and *Garcinia kola*, and there is no information on the sustainable harvest rate that would preserve these species. Furthermore, these NWFP are not on the research agenda of priority species to domesticate. Should researchers wait until the resources are depleted to be to effective action?

Reconciling improvement in welfare and forest conservation requires that researchers undertake both leading edge or strategic as well as problem-solving research. That is, scientists need to develop solutions to problems which may arise in the future, rather than merely responding after it is widely known that a given resource, important to forest dwellers, is depleted or under threat of disappearing.

Improved technologies are needed to enable forest-dependent people to continue to derive part of their livelihoods from NWFP while at the same time preserving the forest. Other required conditions are the access of forest dwellers to those technologies. This could be very important in reducing any future pressure on forests resulting from growing poverty and the search for alternative income-generating opportunities, as well as increased return migration from urban to rural areas. The best way to achieve the desired impact of meeting both livelihood and forest conservation goals is through multidisciplinary research where biological and social scientists work in partnership.

## **7. Conclusions and implications**

NWFP are very important to the well-being of forest dwellers and for that reason they need to be produced on a sustained basis. This paper has shown the importance of NWFP markets by comparing the marketing of *Irvingia* spp. and *Cola acuminata* on the one hand, and *Garcinia lucida* bark and *Garcinia kola* bark on the other.

The estimated value of the four NWFP in the markets surveyed during the first half of 1995 and 1996 amounted to USD 753 000 and USD 499 000 respectively. Markets appear to be thin and thus change their role in assembling and distribution of NWFP from one year to the next. Related to this changing function, the aggregated quantities marketed of the four NWFP declined from 1995 to 1996. Over the two years, the quantity marketed increased in few markets, but this was not sufficient to offset the decline in other markets.

The decrease in the quantity of NWFP marketed resulted from a reduction in aggregate production, caused by several factors, including drought, excessive pressure on the resource, and changes in weather patterns affecting the period of flowering and fructification of NWFP. This highlights the complexity of NWFP markets and the challenges facing their study, and the need for long-term monitoring in order to better characterise them.

In general, markets in major urban centres, Yaounde, Douala and border markets are more profitable than the other markets.

Although the exploitation of NWFP always have an ecological impact, the gathering and the marketing of *Irvingia* spp. and *Cola acuminata* are more sustainable because the tree is preserved after gathering the fruit or the kernels. The collection of *Garcinia lucida* and *Garcinia kola* barks usually kills or weakens the tree that is exploited.

With the devaluation of the CFA Franc and the continuous search for alternative income-generating opportunities by forest dwellers, the barks of *Garcinia lucida* and *Garcinia kola* will continue to be demanded by traders and consumers of palm wine, thereby generating revenues for forest dwellers and traders. In particular, *Garcinia lucida*, which is governed by an open access regime is more vulnerable to individual opportunistic behaviour with a danger of increased pressure on the resource. This shows the difficult trade-offs between improving the livelihoods of forest-dependent people and forest conservation. There is a high level of variability among different inventories of *Garcinia lucida* and *Garcinia kola* that could be due to their relative abundance in natural conditions. Research has much to contribute in finding an appropriate balance for achieving livelihood improvement through NWFP and forest conservation goals.

Research could make a significant contribution by:

- providing information on the sustainable rate of harvest that would preserve *Garcinia lucida* and *Garcinia kola* trees;
- designing sustainable harvesting techniques that could guarantee the survival of *Garcinia lucida* and *Garcinia kola* trees, thereby reducing future pressure on these resources;
- domesticating *Garcinia lucida* and *Garcinia kola* and promoting their cultivation by forest dwellers;
- enabling forest dwellers to access to improved technologies; and
- evaluating the impact of these technologies on the livelihoods of forest dwellers and forest conservation.

Single-disciplinary research alone is unlikely to solve the problem. We believe that only multidisciplinary studies, or at least improved communication between biological and social scientists, can help solve the livelihood and forest conservation dilemma. The welfare of hundreds of millions of people is at stake, as well as the maintenance of environmental services from the forests

## References

- BDCPC (Bioresources Development and Conservation Programme Cameroon) (1997) Newsletter, October/November.
- Bela, Laurent Manga (1997). “*Migrants de Retour et Développement Rural: Le Cas de Yémesoa.*” Les Cahiers d’Oscisca, No. 10, Septembre. ORSTOM, MINREST.
- Chambers, R. & Leach, M. (1987). *Trees to meet contingencies: saving and security for the rural poor.* Discussion Paper 228, Institute of Development Studies, University of Sussex, Brighton.
- Champaud, Jacques (1973) “*MOM, Terroir Bassa (Cameroun).*” Atlas des Structures Agraires au Sud du Sahara, no. 9, ORSTOM, Paris.

- Cunningham, A. B. & F.T. Mbenkum (1993). "Sustainability of Harvesting *Prunus africana* Bark in Cameroon. A Medicinal Plant in International Trade." *People and Plants Working Paper*, May
- de Beer, J. & McDermott, M. 1989. *The economic value of non-timber forest products in Southeast Asia*. Netherlands Committee for IUCN, Amsterdam.
- Diaw, Mariteuw Chimère (1997). "Si, Nda Bot and Ayong: Shifting Cultivation, Land Use and Property Rights in Southern Cameroon." *Rural Development Forestry Network*, Network Paper 21e, ODI, London.
- Doucet, J.L. & Koufani A. (1997). "Etudes des Produits Secondaires Végétaux de la Forêt de Kompia (Cameroun). Utilisation, Inventaires, Régénération, Commercialisation et Gestion Durable. Unité de Sylviculture, Faculté Universitaire des Sciences Agronomiques de Gembloux (Belgique)/ Herbarium National du Cameroun.
- Falconer, J. (1990) *The major significance of minor forest products*. FAO Community Forestry Note, 6. FAO, Rome.
- Freese, C. 1996. *The commercial, consumptive use of wild species: managing it for the benefit of biodiversity*. WWF Discussion Paper. WWF, Washington.
- Guedje, Nicole Marie (1996). "Evaluation Ecologique de Quelques Produits Forestiers Non-Ligneux de la Région de Bipindi-Akom II: Abondance, Distribution et Impact des Récoltes sur les Peuplements. Programme Tropenbos Cameroun.
- Hall, Pamela & Kamaljit Bawa (1993). "Methods to Assess the Impact of Extraction of Non-Timber Tropical Forest Products on Plant Populations. *Economic Botany*, Vol. 47 (3): 234-247.
- Harris, D. J. (1993). "A Taxonomic Revision and an Ethnobotanical Survey of the *Irvingiaceae* in Africa." PhD dissertation, University of Oxford, Oxford.
- Laird, Sarah (1995). *The Natural Management of Tropical Forests for Timber and Non-Timber Products*. OFI Occasional Paper No. 49, Oxford Forestry Institute, Department of Plant Sciences, University of Oxford, Oxford.
- Laird, Sarah & 17 others (1996). *Medicinal Plants of the Limbe Botanic Garden*. Mount Cameroon Project. Edited by Sylvia Howe.
- Leakey, R. R. B. & J. A. Maghembe (undated). "Domestication of High Value Trees for Agroforestry: An Alternative to Slash and Burn Agriculture." ICRAF Position Paper 1.
- Ndoye, Ousseynou (1994). "Research on Non-Timber Forest Products Utilization and Marketing at the International Institute of Tropical Agriculture." Paper Presented at the Workshop on Extractivism and Multiple Use Forest Reserves in Africa, Naro Moro (Kenya), 8-13 May.
- Ndoye, Ousseynou (1995). "Commercialization and Diversification Opportunities for Farmers in the Humid Forest Zone of Cameroon: The Case of Non-Timber Forest Products." Consultancy Report for the Alternatives to Slash and Burn (ASB) Project, March.
- Ndoye, Ousseynou, Manuel Ruiz-Perez & Antoine Eyebe (1997). "The Markets of Non-Timber Forest Products in the Humid Forest Zone of Cameroon." *Rural Development Forestry Network*, Network Paper 22c, ODI, London.
- Nkongmeneck, B. (1985). "Le Genre Cola au Cameroun." *Revue Sciences et Techniques* (Série de la Science Agronomique, Yaoundé, Cameroun), 1 (3):57-70.
- Ntamag, Cécile Ndjebet (1997). "Spatial Distribution of Non-Timber Forest Product Collection. A Case Study of South Cameroon." Unpublished MSC Tropical Forestry Thesis, Wageningen Agricultural University, Department of Forestry.
- Oyono, Phil René (1997). "Ruptures Socio-Economiques et Surexploitation du Palmier *Raphia* par les Populations Forestières de Lomié (Sud-Est Cameroun). *Bulletin Arbres, Forêts et Communautés Rurales* n. 11: 27-33, Septembre.
- Peters, Charles M. (1994). *Sustainable Harvest of Non-Timber Plant Resources in Tropical Moist Forest: An Ecological Primer*. Biodiversity Support Program, Washington, DC.

- Pokam Wadja Kemajou Jacques (1997). “*Les Migrations dans la Zone de Forêt Humide du Cameroun.*” Document de Travail No. 2. CIFOR Cameroun, Septembre.
- Sayer, Jeffrey A. (1993). “Using Non-Timber Products to Support Forest Conservation Programmes.” Status and Potential of Non-Timber Products in the Sustainable Development of Tropical Forests. *ITTO Technical Series* No. 11.
- Scoones, Ian, Mary Melnyk & Jules N. Pretty (1992). “*The Hidden Harvest: Wild Foods and Agricultural Systems. A Literature Review and Annotated Bibliography.*” International Institute for Environment and Development, London.
- Shaffer, James D., with Michael Weber, Harold Riley & John Staatz. (1987). “Influencing the Design of Marketing Systems to Promote Development in Third World Countries.” *MSU International Development Papers*, Reprint no. 2. Department of Agricultural Economics, Michigan State University.
- Townson, I.M. (1995) *Forest products and household incomes*. A review and annotated bibliography. OFI, Oxford, CIFOR, Bogor.
- Van Dijk, Han (1995) “Assessment of the Abundance and Distribution of Non-Timber Forest Product Species. Intermediate report of the project ‘The Economic and Ecological Assessment of Non -timber Forest Products in the Bipindi-Akom II region, South Cameroon’”. The Tropenbos Cameroon Programme.
- Van Dijk J.F.W. (1998). “Assessment of Non -timber Forest Products Resources in View of the Development of Sustainable Commercial Extraction.” Paper Presented at the International Expert Workshop on Non-Wood Forest Products (NWFP) for Central Africa, Limbe Botanic Garden, 10-15 May.
- Vivien, J. & J.J. Faure (1985). *Arbres des Forêts Denses d’Afrique Centrale. Espèces du Cameroun*. République Française, Ministère des Relations Extérieures Coopération et Développement. Agence de Coopération Culturelle et Technique.
- Vivien, J. & J.J. Faure (1996). *Fruitiers Sauvages d’Afrique. Espèces du Cameroun*. Ministère Français de la Coopération. Centre Technique de Coopération Agricole et Rurale (CTA).
- Williamson, Oliver E. (1985). *The Economic Institutions of Capitalism*. Free Press, New York.
- The World Bank (1995). “Cameroon: Diversity, Growth, and Poverty Reduction.” Africa Regional Office.

# A REGIONAL MARKET SURVEY OF THE NON-WOOD FOREST PRODUCTS TRADED IN CENTRAL AFRICA

Laurie Clark and Terry Sunderland

## 1. Introduction

CARPE is a multi-partner project that seeks to identify and begin to implement strategies to reduce deforestation and loss of biodiversity in the Congo River Basin. The United States Forest Service serves as team leader for the sub-component dealing with non-wood forest products (NWFPs). Under this component, we are seeking to determine the possible contribution of the NWFP sector to mitigating deforestation and loss of biodiversity.

Forests across Central Africa are being converted through logging, agriculture and other human-based activities. Many of the reasons for conversion are pragmatic. Proposed alternatives to the conversion of forests must also be pragmatic, and address some of the reasons leading to conversion activities. Additionally, in conservation and sustainable development initiatives alike, suggested solutions to forest based problems must be made with a sound understanding of the social, economic and ecological systems.

Little is known about the science and ecology of most NWFP species. Often they are species of little economic interest to governments, as they do not contribute significantly, nor often conspicuously, to the national economy. In a time of scarce financial resources, available funds are often focused on species or parts of an ecosystem perceived to be either in greater ecological danger (e.g. megafauna) or, more commonly, of greater and often more immediate economic return (e.g. most valued timber species).

None of this obviates the importance of NWFPs through all levels and scales of forest based, agricultural and urban societies across the region. In order for policy makers and land managers to make intelligent and informed decisions about forest ecosystems (including their human populations), they need to know as much as possible. A number of means of obtaining information is available: inventories, participatory rural appraisals and market surveys are methods often used. To that end, CARPE has developed a methodology analyzing markets in target Central African countries.

## 2. Market surveys and data harmonization

A goal of the NWFP component is to identify which marketed NWFPs have a high value and are widely traded, contributing significantly to household incomes. This will permit an assessment of the economic importance of NWFPs *vis-à-vis* other forms of forest utilization such as logging. Market surveys are one method to obtain this information.

Completing market surveys over time and space provides data that reflect seasonality and changes in product availability and price, and permit inferences about harvest levels and local abundance. For these reasons, CARPE is undertaking a year-long series of surveys to be completed in markets across the Central African region.



**Figure 1.** The plethora of NWFPs found in urban markets (Photo: T. Sunderland).

### **3. CARPE NWFP market survey objectives**

We hope to address the following objectives in part through this study:

1. Assess the capacity of the NWFP sector to contribute to the conservation of biodiversity and the reduction of the rate of deforestation in the Congo River Basin;
2. Establish a precedent for the harmonization of data via a standardized methodology;
3. Contribute to the quantitative, scientifically sound collection of baseline botanical, social and economic data on NWFPs for the Central African region.

### **4. Methodology**

A number of methodologies have been developed and implemented for the study of NWFPs in both rural and urban markets (Padoch, 1987; Falconer, 1994; Martin, 1995; Alexiades 1996; Ndoye *et al.*, 1997). For this study, a synthesis of these existing methodologies was made and, taking into account the known variables in Central Africa as well as the objectives of the study, a suitable methodology was finalised and developed (see Appendix).

For the purposes of the CARPE regional study, the market surveys are comprised of three phases of activity:

- **Phase One** involved the development of a concise, clear methodology and survey questionnaire; identification and training of survey teams (an intensive week-long training course was held in Libreville, Gabon, in February 1998) followed by preliminary surveys. The preliminary surveys are intended to provide a social and political context for the ongoing surveys, and to begin to establish the top few NWFPs, for each of the countries surveyed. (See Sunderland and Obama; Kimpouni; Yembi and Liengola, this volume.) The results of these studies will help refine the methodology as the next phase is implemented.

- **Phase two** will ensure the recording teams reiterate the surveys in markets across their particular region. Given financial and logistical constraints, at this stage it will not be possible to fully sample all the markets in each country. Instead, emphasis will be given to sampling urban, rural and border markets in an attempt to capture different products, volumes

and origins of products for these somewhat distinct market types. The data will be compiled, edited and organized, and the database eventually made available for public access.

• **Phase three** will concentrate on encouraging continued collaboration and communication of data, study designs and implementation among actors in the NWFP sector. Areas to be pursued might include the following: chains of production for key NWFPs; studies of the ecology and life cycles of certain species; assessment of potential for domestication of identified threatened species.

This study will establish a base of quantitative, scientifically sound data, from which informed decisions can be made about the NWFP sector. It will provide:

- A summary of the species traded, the quantities traded, their origin and relative value;
- An indication of the user groups for these species;
- A resume of the traders and sellers by country of origin and gender;
- Information on the relative pricing, availability, quantities sold and availability of products;
- A listing of what part of the plant is harvested, how products are used and how they are prepared.

## 5. Conclusion

With the possible exception of Cameroon, little is known about the NWFP sector throughout the Central African region. Administering a standardized methodology across the region over the course of a year will provide information that is currently unavailable to the people of the region, their governments and the international community. Though not exhaustive, the data will provide a base of data that is sound, comparable and drawn from across the ecological region of the Congo River Basin.

As is demonstrated by the preliminary market surveys completed in Equatorial Guinea, Republic of Congo, Democratic Republic of Congo, and Gabon, and reported in this volume, the trade of NWFPs in markets is rich in botanical, dietary and social importance. It is not difficult to see that multiplying this brief survey several times over and throughout the seasons of a year will give a tremendous amount of information and insight into the nature of the sector.

Decisions made about the management of the Central African region's natural resources must be made on the basis of factual information as well as national and regional objectives. This regional market survey will provide valuable support to the development of a sound regional natural management planning agenda.

## References

- Alexiades, M.N. 1996. *Selected guidelines for ethnobotanical research: A field manual*. New York Botanical Garden.
- Martin, G.J. 1995. *Ethnobotany - A methods manual*. Chapman and Hall.
- Falconer, J.E. 1994. *Non-timber forest products in Southern Ghana - Main Report*. Natural Resources Institute, UK.
- Ndoye, O., M. Ruiz-Pérez & A. Eyebe, 1997. The markets of non-timber forest products in the humid forest zone of Cameroon. *ODI-Network Paper 22c*.
- Padoch, C. 1987. The economic importance and marketing of forest and fallow products in the Iquitos Region. In W.M. Denevan & C. Padoch. *Swidden-fallow agroforestry in the Peruvian Amazon. Advances in Economic Botany*, Vol. 5.

## APPENDIX

### MARKET SURVEY OF NWFPs (Questionnaire modified from Martin, 1995)

1. Location of market.....
2. Collector/recorder.....
3. Date of visit.....

#### The vendor

4. Type of vendor: permanent stall      temporary stall      ambulatory
5. Gender: male      female
6. Approximate age.....
7. Origin: Nationality.....Village.....Ethnic group.....
8. How often do they sell here?.....
9. Other markets?.....

#### The collection

10. Botanical name.....
11. Local name (and language).....
12. Used as.....
13. Preparation.....
14. Collected in: forest farm fallow      cultivated      don't know
15. Plant part gathered: bark roots leaves seed flowers other (specific)
16. Country of origin for this plant.....
17. Gathered by the vendor: yesno
18. Condition of plants: fresh dried preserved in/as.....
19. Price/unit (e.g..... 100CFA for ten seeds).....
20. Brought to market: daily      weekly on occasion
21. Transport costs/ other related expenditures.....
22. Estimated quantity: vendor.....whole market.....
23. Availability:  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec all year around
24. How much sold compared to in the past: more      same      less
25. If changed, why?.....
26. Who buys this product?.....

Notes/ additional information:.....

In addition to the NWFP information, please also collect the following data. This will enable us to compare the relative costs of NWFPs across the different countries of the Congo River Basin.

Get prices for a standard basket of goods - here are examples

- 1kg cassava flour (garri)
- 1hand plantain
- 1kg sugar
- 1 litre palm oil
- 1 litre kerosene
- 1 egg
- 1 baguette bread

Also get: the present informal exchange rate in the market for US\$

- the formal exchange rate for US\$ in your country.

# A PRELIMINARY MARKET SURVEY OF THE NON-WOOD FOREST PRODUCTS OF EQUATORIAL GUINEA

Terry C.H. Sunderland and Crisantos Obama

## Abstract

Knowledge of the forestry and natural resource sectors in Equatorial Guinea, aside from faunal studies, is generally poor. This is despite the prolific activity in neighbouring and biologically similar countries such as Cameroon, Gabon and Congo-Brazzaville. This paper provides an introduction to the marketed NWFP sector in the continental region of Rio Muni, and the island of Bioko, where the sector operates under far different conditions experienced elsewhere in Central Africa as a result of a tumultuous colonial past and damaging post-independence era. Although there is some level of commercial exploitation and international trade of high value commodities such as *Prunus africana* and *Piper guineensis*, the reliance on non-Guineans for the NWFP trade is extremely strong with many of the commonly-traded NWFPs originating from outside the country despite actually occurring in the national forests.

**Key words:** Equatorial Guinea, non-wood forest products, market surveys, trade.

## 1. Introduction

Since independence from Spain in 1968, Equatorial Guinea has been largely inaccessible to researchers concerned with biological resources and therefore often remains an excluded entity, albeit an enigmatic one, when discourse on the state of the natural resources of the Central African region takes place (Morat and Lowry, 1997).

In addition, the rather exceptional colonial circumstances have also contributed to the paucity of available information on the biological resources of the country. The Spanish colonists did indeed undertake studies on forestry and agriculture-related subjects. However, much of the results generated, aside from the work of Lopez (1946), were rarely published and disseminated and, if they were, are available only in Madrid. The majority of the locally-held documents remaining in the country after the Spanish exodus was destroyed during the transition to independence and the period immediately afterwards. Specifically referring to non-wood forest products, Fa (1991) stated that although "certain products were used by the forest dwelling peoples in Equatorial Guinea, there is little or no recent data on preferred species or their uses".

In contrast to neighbouring countries, at independence Equatorial Guinea did not inherit a vast infrastructure, either physical or intellectual, able to continue with the study and management of its own natural resources, a situation compounded by the tumultuous early years of self rule. The latter in particular will not be discussed in this paper but are summarised best by Liniger-Goumaz (1986).

## 2. The country

Equatorial Guinea is composed of three highly diverse and disparate territories:

## **2.1. The island of Bioko**

The rectangular-shaped island of Bioko, formerly Fernando Pó, lies 32 km from the coast of Cameroon. It is oriented north-south and measures roughly 75 by 25 km, with a total area of 2 020 km<sup>2</sup>. The island is part of the volcanic chain which includes Mount Cameroon, São Tomé and Príncipe and Annobon and is dominated by two volcanic peaks: Pico de Basilé (3 010m) in the north and Pico Biao (2 010m) and Gran Caldera de Luba (2 261m) in the south. The majority of the lowland forest skirting the highlands, with the exception of the south of the island, has been converted to cocoa plantations but in many areas the majority of the original forest canopy trees have been maintained to provide shade. The montane forest has experienced little disturbance.

## **2.2. The Rio Muni region**

The continental territory of Equatorial Guinea is a rectangular-shaped piece of land of 26 000 km<sup>2</sup>, bordered on the west by the Atlantic Ocean, on the east and south by Gabon and on the north by Cameroon. It lies between 1°01' and 2°21'N with its eastern border following the meridian of 11°20'E. The territory has 222 km. of coastline between the estuaries of the Rio Muni at the southern end and the Rio Campo (or Ntem) at the northern end. It is from the former that it derived its name. The forested zone has been much affected in recent times by extensive logging. Timber exploitation was first undertaken in the coastal regions then, as techniques improved, the practice spread even further into the interior. Today, much of the mainland territory has been logged or is currently under concession (Stenmanns pers. comm.) despite a proposed network of protected areas (Garcia and Eneme, 1997).

## **2.3. The island of Annobon**

Annobon, formerly Pagalú, lies 1°25' south of the Equator some 335 km from Gabon and 160 km south of São Tomé. The island has a land area of only 1 700 ha. with a small population of 9 000. It is essentially isolated from the other territories and is very little studied. It is anticipated that CUREF will undertake some biological surveys there at some point in the future.

## **2.4. People**

The country has a combined population of around 400 000 made up of a number of tribal groups, distributed mostly along geographical lines. The Fang dominate the Rio Muni region and the Bubi, the island of Bioko. Other Africans are also present in significant numbers in Equatorial Guinea. These include Cameroonians (mostly Hausa traders), Nigerians and Ghanaians, as well as small numbers of people from Chad and Mali. The majority of these people are engaged in small-scale trading and business.

## **3. The market study**

### **3.1. Methodology**

The findings summarised below represent the results of a preliminary market survey in markets in both the Rio Muni region and Malabo on the island of Bioko, and provide a general overview of which NWFPs are marketed and traded. This summary work will form the basis of a year-long market study that will be undertaken by CUREF staff using the expanded methodology described by Clark and Sunderland (this volume). This subsequent study will, through a standardised method of data collection and regular market visits,

determine the influence of seasonality and provide a far clearer and more comprehensive picture of the formal NWFP sector in Equatorial Guinea.

For the purposes of this preliminary study and due to time constraints, no formalised approach to data gathering was adopted. Instead, informal and persistent (i.e. a number of visits over a short space of time) observations and interviews were undertaken regarding the presence of NWFPs in the market. Vendors were asked what items were, what the local names are, what particular products are used for and who buys them. The origin of many products was also recorded. Each new product encountered was purchased and collected, labelled and cross-referred to the notes taken using the methodology outlined in Clark and Sunderland (this volume). The collection of each product ensures that subsequent authoritative identifications can take place, despite many products being directly identified by the data collection team during the data collection sessions.

An additional output of this work was the identification of a number of forest products more commonly sold than others and could be considered more important in terms of both value and quantity. Normally, these products would be identified through counting how many vendors sold each product (and how much of each) as recommended by Falconer (1994). However, because of time constraints this was estimated, providing the list presented in Table 1. Subsequent studies regarding the quantifying of particular products will concentrate on these most-traded NWFPs in particular.

### 3.2. Summary of findings

**Table 1:** List of most commonly-sold NWFPs in the markets of Rio Muni and Bioko (not ranked in order of importance).

Scientific name	Vernacular name (& language)**	Use	Rio Muni	Bioko
<i>Aframomum spp.</i>	<u>essun</u> , <u>ndong</u> (Fang)	Medicine / condiment (seed)	X	X
<i>Afrostryax spp.</i>	<u>essun</u> (Fang)	Condiment (seed & bark)	X	X
<i>Cola acuminata / nitida</i>	<u>abe-cola</u> (Fang)	Stimulant (seed)	X	X
<i>Dacryodes edulis</i>	<u>asia</u> (Fang)	Edible fruits	X	X
<i>Enantia chlorantha</i>	<u>nfoo</u> (Fang)	Medicine (bark)	X	X
<i>Garcinia kola</i>	<u>akuin</u> (Fang)	Stimulant / medicine (seed)	X	X
<i>Garcinia lucida</i>	<u>essok</u> (Fang)	Chewstick	X	
<i>Gnetum africanum</i>	<u>okok</u> (Fang)	Leaf vegetable		X
<i>Irvingia gabonensis</i>	<u>andok</u> (Fang)	Condiment (kernel)	X	X
<i>Monodora myristica</i>	<u>fep</u> (Fang)	Condiment (seed)	X	X
* <i>Piper guineensis</i>	<u>ondodo andjik</u> (Bubi); <u>bush-pepper</u> (Pidgin)		X	X
* <i>Prunus africana</i>	<u>bihasa</u> (Bubi)			X
<i>Ricinodendron heudelottii</i>	<u>essesang</u> (Fang)	Condiment (seed)	X	X
<i>Tetrapleura tetraptera</i>	<u>enziese</u> (Fang)	Condiment (fruit)	X	X
<i>Xylophia aethiopica</i>	<u>oyang</u> (Fang)	Condiment (seed)	X	X

\* Despite being subject to export (see Box 2) these products are also widely found in the markets of Equatorial Guinea, Bioko in particular.

\*\* All vernacular names in this report are of Fang origin, unless where indicated.

### 3.2.1. Traditional medicine and medicinal plants

Visits to a number of medicinal plant vendors in a number of markets in the Rio Muni region provided the information for the completion of the following table. However, the list is far from complete as, often when studying traditional medicine use, there was a certain reticence in the provision of information on the part of the vendors. The following recorded species and their use could best be described as general knowledge and distinctly well-known remedies.

**Table 2:** Medicinal plants recorded in the Bata and Mbini markets and their uses (no data as yet from the Bioko markets)

Scientific name	Fang name	Part used	Use
<i>Aframomum c.f. hanburyi</i>	<u>esson</u>	seeds	Ground seeds used as a remedy for the treatment of child's whooping cough
<i>Aframomum melegueta</i>	<u>ndong</u>	seeds	Seeds are ground and added to other remedies to give them more "power", their effects being magnified
<i>Angokea gore</i>	<u>angeuk</u>	bark	Ground bark used as a treatment for constipation. For babies, powdered bark is rubbed into the nipples prior to breast feeding
<i>Baillonella toxisperma</i>	<u>adjap</u>	seeds	Oil from seed used for rheumatic pains
<i>Cissus dinklagei</i>	<u>dik ntoo</u>	sap	The stem produces copious sap when cut. This is boiled and given to a baby of 1-2 months - said to stimulate growth
<i>Dioscorea sp.</i>	<u>mbang</u>	fruit	Use not disclosed
<i>Enantia chlorantha</i>	<u>nfoo</u>	bark	Fever (malaria, yellow fever)
<i>Entada gigas</i>	<u>ndju</u>	fruits, seeds	Diuretic
<i>Fagara heitzii</i>	<u>olon</u>	bark	Used in traditional rites; using this plant it is possible to bring a person back from the point of death. Bark is placed in boiling water, which is then used to wash the patient
<i>Garcinia kola</i>	<u>akuin</u>	fruits	Stimulant
<i>Garcinia lucida</i>	<u>essok</u>	bark and fruit	Anti-poison (purgative)
<i>Guibourtia tessmannii</i>	<u>oveng</u>	bark	Stimulant. Also anti-witchcraft and fights bad spirits
<i>Okoumea klaineana</i>	<u>okoumé</u>	bark	Used not disclosed
<i>Pachypodianthum staudtii</i>	<u>ntom</u>	bark	Extract of bark in boiling water used to kill infestations of head lice. Used as a general tonic to alleviate fatigue
<i>Strombosiopsis tetandra</i>	<u>edjip</u>	bark	Bark boiled in water and mixture drunk by young children to prevent bad spirits and illness
<i>Urera sp.</i>	<u>ndik</u>	stems	Use not disclosed
<i>Vernonia conferta</i>	<u>abenga</u>	bark	Bark placed in boiled water drunk as a treatment for asthma. Powdered bark also used as antiseptic; placed directly in cuts

### 3.2.2. Condiments

A range of condiments are widely-sold in all of the markets surveyed and the range of products available in both territories is fairly ubiquitous. However, many of these products are actually imported from Cameroon, despite occurring in both Rio Muni and Bioko. Most condiments are sold in surprisingly small amounts, being carefully wrapped in polythene prior to sale. Bush pepper (*Piper guineensis*), the seeds of *Monodora myristica* (fep), *Ricinodendron heudelottii* (essesang), and *Afrostryax kamerunensis* (esun) are sold in this way. Fruits of *Xylopia aethiopica* (oyang) are sold whole and loose, as are those of *Tetrapleura tetraptera* (enziese). The bark of *Scorodophleus zenkeri*, (also called esun in Fang), another garlic-like condiment, is also widely available. The seeds of *Mucuna sloanei*, with their characteristic hard, patterned seed coat are also widely sold, the endosperm being used as an additive to soups and stews.

An interesting condiment, not previously encountered, are the leaves of *Strychnos* spp.. We were informed that these were used in small quantities as a condiment in soups and stews, notwithstanding the presence of the powerful poison strychnine in this group of plants.

Rather against the general trend, a number of other condiments and cooking additives are cultivated in both Rio Muni and Bioko in small-scale cultivation systems. These include okra (*Abelmoschus esculentus*) and the chilli pepper (*Solanum annuum Longum* group). Besides being easily cultivated, these plants are often spontaneous around habitation, with their seeds passing through a human stomach intact and still viable. The pumpkin-like fruit of *Cucurbita pepo* (egusi) is also cultivated locally, with the ground seeds forming the base of many local dishes.

#### **Box 1:** *Irvingia gabonensis* (andok)

The kernels of this species are used as a soup thickener and additive and are the most widely sold of all forest products in Equatorial Guinea. The trade of this species alone accounts for a huge proportion of the total products sold in the markets of both Rio Muni and Bioko. An interesting pattern in the trade of this species has emerged. On the mainland, nearly all the seeds of bush mango sold in the Bata market originated in Cameroon from where it is shipped to the border town of Ebebiyin and then sold to market traders from Bata. In Mbini, however, the produce on sale was harvested locally and in the southern region of Rio Muni a clear pattern of harvest and sale (to Gabon) has emerged. In fact this is one of the few, and possibly only (excepting bushmeat), forest product to be exported from Rio Muni, providing an immediate cash-based income. The *Irvingia* found in the Malabo markets also originates from Cameroon.

Strong seasonality with this product also influences its sale and price. During the rainy season (June to September) when bush mango is widely available, it is purchased at CFA 100 for 40 seeds; when supplies are drying up (September - December) CFA 100 will only buy 20 seeds. During this period, some traders hoard their supply by grounding up the seeds, mixing them with oil and preparing a bush mango “cake” that will keep during the dry season. This too is sold in the markets, ensuring a year-round supply.

Interestingly, and a trend that is not apparent in either of the neighbouring countries, Cameroon (Ndoye *et al.*, 1997) and Gabon (Yembi, this volume), some temperate herbs are packaged and sold locally. These are imported via Cameroon, where they are, in turn, imported from Europe. The products are re-packaged and re-sold at greatly increased prices. These products include bay leaves (*Laurus nobilis*), white ground pepper (*Piper nigrum*),

oregano (*Origanum vulgare*), basil (*Ocimum basilicum*), rosemary (*Rosmarinus officinalis*) and cloves (*Syzygium aromaticum*).

### 3.2.3. Edible fruits

Most commonly sold edible fruits are by far those of *Dacryodes edulis* (bush plum - vern., asia - Fang) and the true mango (*Mangifera indica*). The bush plum, when in season, originates both from Cameroon and from local home gardens. However, the majority sold in the markets are grown locally as the fruits do not store well and need to reach market 1-2 days after harvesting. Along with the exotic mango, *Dacryodes edulis* is one of the few trees cultivated and deliberately planted by local people and it is a common tree in compounds and home gardens. The fruits ripen in June and July, when the market is swamped by them, with none at all being available the remainder of the year. Similarly, mangoes (*Mangifera indica*) exhibit a highly seasonal pattern, being available only in March and April at the end of the dry season. Although present in the forests of Rio Muni, in particular, the fruits of *Poga oleosa* (afo) are imported from Cameroon to both territories. The extremely hard seed case encloses an edible endosperm that is eaten like groundnuts.

### 3.2.4. Leafy vegetables

All of the leafy vegetables found in the markets originate locally (i.e. in Equatorial Guinea). Some are cultivated by women in home gardens, or intensive farms close to the village, whilst some are harvested from the forest or on farm regrowth vegetation. All of these plants are available all year round. The most commonly sold vegetable is *Amaranthus hispidus* (nfeng), followed by water leaf (*Portulaca grandiflora* - aluasop) and the young leaves of the edible coco-yam, *Xanthoxylum* spp. (lom). Also widely available are the young leaves of the climber *Basella alba*, which is widely cultivated and often semi-spontaneous in home gardens. In addition to those mentioned above, *Gnetum africanum* is also commonly available in the Malabo market. This is collected solely from the forests of Bioko and, although commonly found in the forests of Rio Muni, is not collected or sold there.



**Figure 1.** The processing of the leaves of *Gnetum* spp. (Photo: T. Sunderland).

### 3.2.5. Stimulants

The rituals surrounding the passing and use of c(k)ola (from *Cola* spp. and *Garcinia kola*) in Cameroon and elsewhere in West and Central Africa are elaborate and deeply ingrained into all aspects and levels of society. This does not seem to be the case in Equatorial Guinea for reasons postulated by Liniger-Goumaz (1986). Despite this, some species of cola are sold in the market and are ingested for the purposes of providing a stimulant and appetite suppresser. The fruits of both *Cola acuminata* and *C. nitida* (which, despite being different species are called abe-cola in Fang) are harvested locally and sold widely, as is the seed of bitter kola (*Garcinia kola*).

### 3.2.6. Beverages

As is common throughout this region of Africa, palm wine is widely available locally. In Bata and Mbini, both types of palm wine are available: the “down-wine”, harvested from the terminal shoot of felled *Elaeis guineensis*, and the “up-wine” from the inflorescence of a standing *Raphia vinifera* and *R. hookeri*. A distilled spirit, almost 100% alcohol, is distilled and sometimes sold in both markets, although most of this spirit is for home consumption.

Another spirit, produced from the crushed stems of sugar cane (*Saccharum officinarum*) is also commonly found in both markets. This is often produced on a village level, with most villages in the Rio Muni region in particular having at least one sugar cane press. This spirit is augmented by the addition of seeds, and sometimes wood of *Garcinia kola*, which makes the beverage extremely bitter.

### 3.2.7. Wrapping leaves

The leaves of a number of Marantaceae species are used in the wrapping of *baton de manioc*, which is a common component of the local diet. The leaves are harvested from the forest locally and brought fresh to market each day. The two main species used as wrapping leaves are *Megaphrynium macrostachyum* and *Marantochloa purpurea*.

#### **Box 2:** The export of *Piper guineensis* and *Prunus africana* from Bioko

Despite the fact that the majority of NWFPs for local consumption are imported from Cameroon, the island of Bioko exports two major forest products:

*Piper guineensis* (bush pepper): There is considerable local use of this species as a condiment and it is widely found in all of the markets of the country. The dried fruits are also exported in large quantities (150 tonnes per annum) to Nigeria where it is reputed to be scarce. This trade involves both Guineans as well as immigrant Nigerians.

*Prunus africana*: The bark of this montane forest species provides a compound used to treat prostate disorders. It is widely exploited in Cameroon, Madagascar and Kenya and the raw or macerated bark is then shipped to a number of pharmaceutical companies in Europe for processing (Cunningham *et al.*, 1997). As supplies have begun to diminish elsewhere, large quantities of *Prunus* bark have recently begun to be exploited from the montane forests of Bioko for the lucrative export market now worth some US\$150 million/year (*ibid*). The bark is also an important component of the Bubi primary health care system and is widely sold and traded in the markets on Bioko.

### 3.2.8. Rattan

The rattan trade in the Rio Muni region seems to be in some ways less complicated than that of Cameroon, yet paradoxically more advanced in the respect that there are more formal workshops and artisan businesses using it than roadside and rather *ad hoc* businesses, as in Cameroon and Nigeria in particular. Bata is supplied from wild cane stocks in Littoral Province by many independent harvesters who may or may not be artisans. There are no middle men and the canes are brought direct from the bush to the market or factory. In general, the rattan trade operates outside the trade in other NWFPs due to its high value and raw cane cannot be purchased in the markets. For a more detailed discussion of the rattan industry in the Rio Muni region, see Sunderland (1998).

## 4. Discussion

### 4.1. Why import when it's there already?

The most surprising, and perhaps disturbing, findings of this survey is that forest use in general in Rio Muni has diminished to such an extent that many of the NWFPs sold in the markets are in fact imported from Cameroon. With the exception of perhaps the high-value products for which there is an important local as well as thriving export market, (*Prunus africana*, *Piper guineensis*, and *Irvingia gabonensis*) and other high-value or immediately perishable products such as rattan, some medicinal plants and Marantaceae wrapping leaves, the general trend seems to be that the majority of NWFPs products are imported to both territories. This is despite the fact that many, if not all, of the species occur locally.

The fact that many Guineans have clearly "lost" the knowledge of how to use the forest is recorded by Dounias (1997) and other workers (Serrano, 1997; Cogels, 1997). Dounias, in particular, who has worked extensively with the Bulu of Campo (closely related to the Fang of Equatorial Guinea) where he recorded widespread forest resource use and complex indigenous management systems, found no corresponding level of forest use, or even basic knowledge of NWFPs in Equatorial Guinea, especially amongst the younger generation. This is despite undertaking field work in two different village areas with widely representative populations (Fang and Ndowe) and with one of these villages being close to the Campo area. Dounias's conclusions are strongly supported by these market surveys; even basic NWFPs are not collected from the local forests, despite being widely available, and are imported through the intervention of non-Guineans.

However, the fact that Lopez (1946) records the extensive use of NWFPs throughout the Rio Muni territory during the colonial era and the presence of complex trading patterns during the early colonial period indicates that the loss of knowledge of natural resources is a recent event. Despite highlighting the phenomenon of this lost knowledge, Dounias in particular does not explain why this might have occurred and merely makes note of the phenomenon. In contrast, Serrano (1997) and more importantly (Liniger-Goumaz, 1988) postulate that the highly tumultuous post-independence political arena in Equatorial Guinea has seriously affected the country on all levels, affecting every aspect of life, including natural resource knowledge and management. Further discussion of this is beyond the scope of this report but the issue is presented fully by Liniger-Goumaz (1988).

### 4.2. Traditional medicine and NWFPs

Whilst, in general, it may be argued that the use of forest resources has diminished amongst the people of Rio Muni, the reliance on traditional medicine has been maintained and primary health care is still depended upon by the majority of the population, especially in the absence

of a well-developed, western-based health-care system. The reliance on traditional medicine was especially pronounced in the isolationist period immediately following independence, when no western medicine was available.

In contrast to markets in Cameroon and Nigeria, however, the sale of medicinal plants and plant parts is concentrated on unprocessed samples and the remedies as such have undergone no preparation prior to sale. Hence, it is common to find whole fruits, seeds, pieces of bark etc. rather than ground, distilled or otherwise prepared mixtures and admixtures commonly found in markets, both rural and urban, elsewhere in the region.

Although basic knowledge within the population of the use of plants for primary health care is still strong, with most customers purchasing raw materials for later home-processing, many traditional doctors will advise their patients what to buy, in what quantity and how to prepare the remedy. It was clearly stated that, unlike Cameroon, where many people will harvest medicinal plants themselves in the forest, the majority of the harvesting of such plants in Rio Muni is undertaken by “specialists”. It is these specialists that are the main vendors of the plant remedies.

### **4.3. Local cuisine and NWFPs**

In general, and in contrast once more to Cameroon, Nigeria and elsewhere in the region, the local cuisine and dietary patterns in Rio Muni are not as developed and there is, surprisingly, no strong tradition of wide ranging African-style cookery in Equatorial Guinea. Most rural Guineans rely on cassava with fish (for those near the coast and large rivers) or cassava and bushmeat (notably in the interior). There is a strong bushmeat trade that supplies towns and cities such as Bata and Malabo to cater for this preference by urban dwellers (Fa, 1991). The influence of European-style cookery is particularly strong and in general most restaurants and chop-houses in Bata provide only these kind of dishes - a lingering element of colonialism. This undoubtedly accounts for the presence of so many temperate herbs for sale in the market.

In recent times, however, the growing population of other Africans in Equatorial Guinea, particularly Nigerians, Cameroonians and Ghanaians, has led to an increased use of forest condiments and local ingredients in cookery and the availability of some food such as *fufu* and *eru*, *ndole* and plantains and pounded yam. It was clearly stated to us that these immigrants were responsible for bringing the now commonly available forest-based condiments found in the markets and were now influencing Guineans to use such products themselves.

## **5. Conclusion**

The NWFPs sector in Rio Muni exhibits a complicated pattern of use and trade heavily influenced by post-independence political events and in contrast to the other countries of the region. There is a distinct and clear pattern of trade and exchange of NWFPs within Equatorial Guinea itself, especially in border markets as well as more importantly with neighbouring countries such as Cameroon. The complexities of the use and trade of these NWFPs will become clearer as the surveys continue through 1998/99.

What is remarkable is the fact that the demand for NWFPs is so high, and still growing, and that the well-established cross-border trade is part of a strong mainstream trading pattern. This reiterates the fact that NWFPs in Central Africa do not suffer from lack of markets for their promotion and sale, and hence conservation and development value. Quite the opposite,

the well-developed nature of such markets and trade routes, coupled with guaranteed prices, often contributes in the long-term to scarcity and over-exploitation.

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### References

- Cogels, S. 1997. *Etude du terroir du village d'Ayamiken (Reserve Forestier Rio Ntem /Rio Campo*. CUREF, Guinea Ecuatorial
- Cunningham, M. A.B. Cunningham, & U. Schippmann. 1997. *Trade in Prunus africana and the implementation of CITES*. German Federal Agency for Nature Conservation.
- Dounias, E. 1997. *Mission d'expertise ethno-sociologique dans le cadre du Programme CUREF*. CUREF, Guinea Ecuatorial.
- Fa, J.E. 1991. *Conservacion de los ecosistemas forestales de Guinea Ecuatorial*. IUCN, Gland & Cambridge.
- Falconer, J. 1994. *Non-timber forest products in Southern Ghana - main report*. ODA/Ghana Forestry Department.
- Garcia, J.E. & F. Eneme. 1997. Diagnóstico de las áreas críticas para la conservación. Proyecto Conservacion y Utilizacion de los Ecosistemas Forestales de Guinea Ecuatorial (CUREF).
- Liniger-Goumaz, M. 1986. *Small is not always beautiful - the story of Equatorial Guinea*. Hurst & Co., London.
- Lopez, E.G. 1946. Ensayo Geobotanico de la Guinea Continental Espanola. Direccion de Agricultura de los Territorios Espanoles del Golfo de Guinea. Madrid. pp241-247.
- Morat, P. & P.P. Lowry. 1997. Floristic richness in the Africa-Madagascar region: A brief history and prospective. *Adansonia*, ser.3. 19(1). pp101-115.
- Ndoye, O., M. Ruiz-Pérez & A. Ayebe. 1997. The markets of non-timber forest products in the humid forest zone of Cameroon. *ODI Network Paper 22c*.
- Obama, C. 1998. *La Situación de los Productos Forestales non Leñosos en la Isla de Bioko*. Report for Proyecto CUREF.
- Serrano, N.C. 1997. Etude de terroir coutumier de village de Engombegombe à la Reserve Forestière de Ndote. CUREF, Guinea Ecuatorial.
- Sunderland, T.C.H. 1998. A preliminary study of the NWFPs of Rio Muni, Equatorial Guinea. CARPE (Washington DC) and CUREF (Equatorial Guinea).

# A PRELIMINARY MARKET SURVEY OF NON-WOOD FOREST PRODUCTS TRADED IN THE POINTE-NOIRE MARKETS (CONGO-BRAZZAVILLE)

Victor Kimpouni

## Abstract

This preliminary study on NWFPs in Congo Brazzaville, concerns the town of Pointe-Noire only. A number of ethnobotanical studies show that the Congolese flora provides a wide range of traded NWFPs, many of which were encountered during this survey. In terms of quantity, the most important NWFPs are wrapping leaves, aphrodisiacs and ritual plants, leafy vegetables such as *Gnetum africanum* and *buchholzianum*, plants for arts and crafts, and palm wine from *Elaeis guineensis* and *Raphia vinifera*.

**Key words:** Congo-Brazzaville, Point-Noire, non-wood forest products, markets

## 1. Introduction

In the Congo Republic, NWFPs as such have not been widely studied, except by the PAFT-Congo programme (Profizi *et al.*, 1993). However, a number of ethnobotanical studies (Adjanohoun *et al.*, 1988; Kimpouni, 1993; Kimpouni and Koubouana, 1997) suggest that the principal NWFP groupings are edible and medicinal plants. The importance of these NWFPs may not be accurately reflected in market surveys of economically-valued goods, as they exclude the huge range of products used on a domestic basis and never enter formal trade.

This preliminary study, based on market surveys, investigates the main NWFPs with high economic value, highlighting the wide range of NWFPs that originate from the forest and emphasising the integral value of these products to local people.

## 2. The study site

Pointe-Noire, the economic centre of Congo, is the nation's second most important city after the capital, Brazzaville. Located between the Atlantic Ocean and the Mayombe, Pointe-Noire (4°53'S and 11°49'E) has open access to markets in Gabon (to the north) and Congo-Kinshasa via Cabinda (in the south). Pointe-Noire has two main markets: the Central market (or "big market"), which is open 5 days a week; and the "Tie-Tie market" open 6 days a week. There are also two smaller markets: the "railway station market" and the "boundary market" which were not included in this study.

## 3. Methodology

For the purposes of this study, the methodology outlined by Clark and Sunderland (this volume) was followed. This included extensive botanical stock-taking of market stands and in-depth interviews with a wide range of vendors. During these interviews, the data collected were: the specific plant parts collected, their uses, product conservation techniques, the ecological environment the products are collected in, and any associated and complimentary information.

## 4. Findings

### 4.1. The main NWFPs

During the market surveys, approximately 100 main species of NWFPs were encountered that are used for food, traditional pharmacopoeia, arts and crafts, wrapping, etc (see Appendix 1). The ten most commonly traded NWFPs (based on both quantities sold and frequency of recording) can be classified into five major groups:

- Food plants (both forest fruits and vegetables plants);
- Aphrodisiacs, magic ritual plants and medicinal plants;
- Drink (both intoxicant and non-intoxicant);
- Plants used for arts and crafts;
- Food wrapping products.

#### 4.1.1. Food plants

During the study period of March - April, there are few fresh fruits such as *Dacryodes edulis* coming from the forest, recognising the seasonal nature of fruit production, hence the absence of forest fruits in local markets during the recording period. However, the major food plants recorded were: the leafy vegetables *Gnetum africanum*, *G. buchholzianum*, and *Basella alba*, and the condiments *Piper guineensis* and *Xylopiya aethiopica*.

#### 4.1.2. Aphrodisiacs, magic ritual plants and medicinal plants

The plants in this category are those used for magic rituals against bad spirits and those used as aphrodisiacs to increase libido. In most cases, the vendor was not a traditional practitioner and did not know the plants used in the particular mix for healing concoctions or the disease it was meant to treat. Hence there is no information on the mode of preparation for the majority of the species listed in Appendix 1. However, the market stands sell the plant parts of a number of general traditional medicinal remedies used to treat common diseases such as anaemia, diarrhoea, malaria, stomach pain, post-delivery pains, etc. For aphrodisiac species, the main customers are teenagers and men whilst older women and traditional healers purchase the majority of the other medicinal and ritual plants.

#### 4.1.3. Drinks

The species that are tapped for palm wine are *Elaeis guineensis* and *Raphia vinifera*, to which the bark of *Garcinia kola* is added to augment the taste and ease digestion. A herbal tea made from an infusion of *Lippia adoensis* is also commonly encountered.

#### 4.1.4. Arts and crafts

Fibres of *Cocos nucifera* fruits and the midribs of the leaflets of *Elaeis guineensis* are used as brooms, and the fibres of some *Raphia spp.* are used for traditional clothing. The sale of rattan (*Eremospatha spp.* and *Laccosperma secundiflorum*) in the markets studied is not widespread. The sale of rattan cane is largely limited to rattan workshops.

#### 4.1.5. Wrapping leaves

The most commonly-used species for wrapping food are from the Marantaceae family (*Megaphyrynium spp.*, *Sarcophrynyium spp.*, *Marantochloa*, etc.) although the leaves of the aroid *Cyrtosperma senegalense* and *Palistota spp.*, a member of the Commelinaceae, are also used.

## 4.2. Vendors

The majority of the vendors encountered were generally older persons, long-experienced in the sale of forest products. Because the study was undertaken in a large urban area, the origins of both NWFP sellers and their products varied considerably. However, the majority of both vendors and their products originate from the localities surrounding Pointe-Noire (Niari, Lekoumou, Bouenza, Kouilou). Therefore the vendors understand the local demand and preference for certain NWFPs. The only NWFP supplied to the Pointe-Noire urban markets from beyond the local region were wrapping leaves.

## 4.3. Processing and preservation

Many NWFP products (especially for bark, roots and other lignified vegetative structures) are preserved through drying, either naturally or through the use of a heat source such as a cooking fire. Some products, such as the bark of *Pterocarpus soyauxii* are further processed by grinding into a powder.

The leaves of *Gnetum spp.* are sold both whole and finely chopped. The added processing of chopping the leaves increases the value markedly; with a packet of whole leaves selling for CFA 100, but after chopping the retailer can easily obtain CFA 300-400 for the same packet.

## 5. Discussion

The market surveys and other studies (Kimpouni & Koubouana 1998; Profizi *et al.*, 1993; Kimpouni, 1993; Kimpouni, in prep.; Adjanohoun *et al.*, 1988) have shown that there are numerous NWFPs in Congo-Brazzaville with a wide range of uses. However, the relative scarcity of some high-value NWFPs in the Pointe-Noire markets does not mean that they are not used in this area, but may reflect the fact that their consumption and trade is at the household level, or that trade is within village trade networks.

The predominant forest products in the Pointe-Noire urban markets, in terms of use-value, are medicinal plants, especially aphrodisiacs and magic ritual products. Their importance and presence at the markets are undoubtedly linked to the widespread use of traditional knowledge and plant-based medicines by the local population.

NWFPs used in craft industries such as rattan (*Laccosperma secundiflorum* and *Eremospatha* spp.) are not sold at the main markets. After harvesting, they are directly sent to local workshops and the marketing of the finished products is undertaken from there. Some NWFPs used for craft are available as finished articles in the mainstream markets; this is the case of certain tools made from Marantaceae leaves and the stems *Cyperus papyrus*.

The market survey shows that the NWFPs involved in this study have potential in both local and international markets. The local markets do not fully exploit the potential of many high value NWFP's such as *Burseraceae* exudates, *Irvingia* and *Panda oleosa* kernels, *Xylopia aethiopica* and *Ricinodendron heudelotii* seeds, despite the international market demand for these products being high (Tabuna, this volume). Any future development of marketing strategies that are both economically profitable and sustainable on an ecological level will require careful valuation and management strategies for these NWFPs.

## References

- Adjanohoun E.J. *et al.*, 1988. Médecine traditionnelle et pharmacopée: Contribution aux études Ethnobotaniques et floristiques en République populaire du Congo. ACCT, Paris, 605 p.
- Kimpouni V. 1993. Le potentiel alimentaire de la flore sauvage des réserves naturelles d'Afrique Centrale peut être évalué par interprétation des données ethnobotaniques disponibles dans les zones adjacentes. Thèse annexe (doctorat), Univ. Libre de Bruxelles, 30 p.
- Kimpouni V. & Koubouna F. 1997. *Etude Ethnobotaniques sur les plantes médicinales et alimentaires dans et autour de la réserve de Conkouahi* 65 p. PROGECA/GEF-Congo, UICN.
- Kimpouni V. (en préparation). Contribution aux études ethnobotaniques et floristiques de la forêt de Lossi (Nord-Congo): Plantes de cueillette à usage alimentaire.
- Profizi J. P. *et al.*, 1993. *Plan d'action forestier tropical du Congo: Les ressources végétales non ligneuses des forêts du Congo*. Rapport d'étude, Fac. Sc. Univ. Marien Ngouabi, Brazzaville, 67 p. 5 annexes.

**Appendix 1:** General list of NWFPs encountered in the markets of Pointe-Noire, Congo-Brazzaville

Family / species	Habitat	Plant part used	Use
ANACARDIACEAE <i>Pseudospondias longifolia</i> <i>Antrocaryon micraster</i>	Forest Forest	Fruit Seeds	Edible Ritual
ANNONACEAE <i>Annona senegalense</i> <i>Cleistopholis patens</i> <i>Enantia chlorantha</i> <i>Monodora myristica</i> <i>Xylopiya aethiopica</i>	Savannah Forest Forest Forest Forest	Bark Seeds Bark Seeds Fruit	Medicinal Ritual Medicinal Ritual Condiment & medicinal
APOCYNACEAE <i>Landolphia owariensis</i>	Forest	Fruit	Edible
ARACEAE <i>Anchomanes difformis</i> <i>Crytosperma senegalensis</i>	Forest Aquatic	Rhizome Leaves	Medicinal Wrapping
BALANOPHORACEAE <i>Thonningia sanguinea</i>	Forest	Whole plant	Medicinal
BASELLACEAE <i>Basella alba</i>	Cultivated	Leaves	Vegetable
BOMBACACEAE <i>Adansonia digitata</i>	Savannah	Fruit, Bark	Edible, Ritual
BURSERACEAE <i>Canarium schweinfurthii</i>	Forest	Seeds	Ritual
CAPPARACEAE <i>Bucholzia macrophylla</i> <i>B. coriacea</i>	Forest Forest	Seeds Seeds	Ritual & Medicinal
COMMELINACEAE <i>Palisota</i> sp. <i>Pollia condensata</i>	Forest Forest	Leaves Fruit & seeds	Wrapping Medicinal
CUCURBITACEAE <i>Momordica charantia</i>	Forest / farm	Whole plant	Medicinal
CYPERACEAE <i>Cyperus articulatus</i> <i>C. papyrus</i>	Aquatic (cult.) Aquatic	Rhizome Stems	Ritual Artisanal
EBENACEAE <i>Diospyros</i> sp.	Cultivated	Leaves, stems, roots	Cosmetic & medicinal
GNETACEAE <i>Gnetum africanum</i> <i>G. buchholzianum</i>	Forest Forest	Leaves Leaves	Vegetable Vegetable
GRAMINAE <i>Cymbopogon citratus</i>	Cultivated	Leaves	Ritual
GUTTIFERAE <i>Garcinia kola</i>	Forest	Bark, seeds	Stimulant, aphrodisiac, palm wine additive
LEGUMINOSAE <i>Caesalpinia bonduc</i> <i>Canavalia ensiformis</i> <i>Desmodium velutinum</i> <i>Dialium</i> sp. <i>Dioclea reflexa</i> <i>Erythrophloeum suaveolens</i> <i>Erythrina</i> sp. <i>Pentaclethra macrophylla</i>	Littoral forest Littoral forest Savannah Forest Forest Forest Forest Forest	Seeds Seeds Leaves Fruit Seeds Bark Bark Bark & seeds	Ritual Ritual Medicinal Edible Ritual Ritual Medicinal Ritual

<i>Pterocarpus soyauxii</i>	Forest	Wood	Cosmetic
<i>Tetrapleura tetraptera</i>	Forest	Pod	Medicinal
LOGANIACEAE			
<i>Mostuea hirsuta</i>	Forest	Roots	Aphrodisiac
MARANTACEAE			
<i>Marantochloa</i> sp.	Forest	Leaves	Wrapping
<i>Megaphrynium</i> sp.	Forest	Leaves	Wrapping
<i>Sarcophrynium</i> sp.	Forest	Leaves	Wrapping
MELIACEAE			
<i>Carapa procera</i>	Forest	Seed	Ritual
MORACEAE			
<i>Dorstenia scabra</i>	Forest	Roots	Aphrodisiac
<i>Trilipisium madagascariensis</i>	Forest	Leaves	Vegetable
OLACACEAE			
<i>Coula edulis</i>	Forest	Seeds	Edible
OXALIDACEAE			
<i>Biophytum petersianum</i>	Savannah	Whole plant	Medicinal
PALMAE			
<i>Cocos nucifera</i>	Littoral (& cult.)	Nut and fibre	Artisanal, edible & cosmetic
<i>Elaeis guineensis</i>	Forest (& cult.)	Fruit, seeds, rachis & sap	Palm wine, cosmetic, edible, artisanal, ritual
<i>Erenospatha</i> spp.	Forest	Stem	Artisanal
<i>Laccosperma secundiflorum</i>	Forest	Stem	Artisanal
<i>Raphia</i> spp.	Forest (swamp)	Sap, Leaf fibre	Palm wine, crafts
PANDACEAE			
<i>Panda oleosa</i>	Forest	Seeds	Ritual
PENTADIPLANDRACEAE			
<i>Pentadiplandra brazzeana</i>	Forest	Roots	Aphrodisiac
MENISPERMACEAE			
<i>Penianthus longifolia</i>	Forest	Roots	Aphrodisiac
PIPERACEAE			
<i>Piper guineensis</i>	Forest	Fruit	Medicinal & condiment
RUBIACEAE			
<i>Brenania breyeri</i>	Forest	Fruit	Fish poison, ritual
<i>Crossopterix febrifuga</i>	Savannah	Roots	Medicinal
<i>Gardenia tenuifolia</i>	Forest	Stem & fruit	Ritual
<i>Nauclea latifolia</i>	Forest	Roots and fruit	Medicinal
SAPOTACEAE			
<i>Autranella</i> sp.	Forest	Seeds	Ritual
SIMAROUBACEAE			
<i>Quassia africana</i>	Forest	Roots	Medicinal
STERCULIACEAE			
<i>Cola acuminata</i>	Forest	Seeds & bark	Stimulant, medicinal & aphrodisiac
<i>C. nitida</i>	Forest	Seeds & bark	
TILIACEAE			
<i>Glyphaea brevis</i>	Forest	Fruit	Medicinal
VERBENACEAE			
<i>Lippia adoensis</i>	Savannah	Leaves	Tea
ZINGIBERACEAE			
<i>Aframomum melegueta</i>	Forest	Fruit	Aphrodisiac & medicinal
<i>A. stipulatum</i>	Savannah	Fruit	Edible
<i>A. sp. 1</i>	Forest	Fruit	Ritual
<i>A. sp. 2</i>	Forest	Fruit	Ritual

# A PRELIMINARY MARKET SURVEY OF THE NON-WOOD FOREST PRODUCTS OF THE DEMOCRATIC REPUBLIC OF CONGO: THE BENI AND KISANGANI MARKETS

Innocent Liengola Bauma

## Abstract

Despite the fact that a number of ethnobotanical studies have been carried out in many regions of the Democratic Republic of Congo, there is little information on the marketing of NWFPs in Congolese markets, despite their widespread use and trade. However, preliminary market studies of traded NWFPs have been recently carried out in the Kisangani (Eastern Province) and Beni (North-Kivu Province) markets. These studies have begun to provide data about the marketing and trade of a wide range of NWFPs in the Democratic Republic of Congo, and may contribute to the further understanding of the NWFP sector in this region and the potential for the sustainable use of the forest.

**Key words:** Democratic Republic of Congo, non-wood forest products, markets

## 1. Introduction

The Democratic Republic of Congo (DRC) is the largest country in Central Africa, with a surface area of 2 345 000 km<sup>2</sup> and contains the largest block of undisturbed tropical forest on the continent. However, even in the vast expanse of forest, commercial exploitation for timber, bushmeat and NWFPs has led to some areas of forest being significantly denuded. A number of strategies need to be developed to ensure that the conservation of the forest region takes place.

The sustainable harvest of NWFPs could contribute not only to preserving an important part of the tropical forest biological diversity but also might improve the lot of local communities through income generation and the equitable distribution of benefits. The NWFP sector in DRC is attracting increasing interest because of its role in the livelihood of forest dwellers, as well as the commercial potential for the development of novel medicinal, cosmetic and food products. However, before such development can take place, essential background information is needed to determine which NWFPs are of value and how they contribute to the local economy.

To this end, preliminary studies to assess the range importance of NWFPs in selected areas have been undertaken. Further reiterative studies will provide more information about the sector and the effects of seasonality. The objectives of these studies are:

- To make an inventory of the NWFPs sold in urban markets;
- To determine the marketing channels of NWFPs;
- To determine the plant parts used and modes of preparation;
- To assess the sustainability of the exploitation of selected NWFPs;
- To assess the potential (or need) for domestication of some NWFPs.

Additional household surveys were conducted at Epulu (a station of Okapi Faunal Reserve), with the purpose of comparing the utilisation of NWFPs by urban and rural populations.

#### 4. Results

From the preliminary market surveys the most important NWFPs (in terms of value and abundance) were identified.

**Table 1.** The major NWFPs sold in the Kisangani and Beni markets

Scientific name	Local name	Part used	Uses	Market
<i>Gnetum africanum</i>	<u>fumbwa</u> (Kikongo)	Leaves	Vegetable	Kisangani
<i>Piper guineensis</i>	<u>bokango</u> (Nonde) <u>toketu</u> (Lokele)	Fruits	Medicinal, condiment	Beni and Kisangani
<i>Cola acuminata</i>	<u>ngongoka</u> (Nonde) <u>libelu</u> (Topoke) <u>gbongbolia</u> (Swahili)	Seeds	Aphrodisiac, medicinal	Beni and Kisangani
<i>Garcinia cola</i>	<u>bobale</u> (Topoke) <u>olale</u> (Lokele)	Seeds	Aphrodisiac, medicinal	Kisangani
<i>Aframomum</i> spp	<u>ndehe</u> (Nonde) <u>tondolo</u> (Swahili) <u>soso</u> (Topoke)	Fruits and seeds	Edible fruits, medicinal	Beni and Kisangani
<i>Scorodophloeus zenkeri</i>	<u>bumba</u> (Topoke)	Bark	Condiment	Kisangani
<i>Pentadiplandra brazzeana</i>	<u>geene</u> (Topoke) <u>etekele</u> (Lokele)	Roots	Medicinal	Kisangani
<i>Thaumatococcus daniellii</i>	<u>longodo</u> (Ngelema) <u>mangongo</u> (Swahili)	Leaves	Wrapping leaves, roof thatching	Beni and Kisangani
<i>Elaeis guineensis</i>	<u>nganzi</u> (Swahili)	Nuts, sap	Palm oil, palm wine	Beni and Kisangani
<i>Raphia</i> spp	<u>mabondo</u> (Swahili)	Sap	Palm wine	Beni and Kisangani
Fungi	<u>buyoka</u> (Swahili)	All	Food	Beni and Kisangani

##### 4.1. Condiments

A number of condiments are sold in both markets. The fresh fruits of *Piper guineensis* are often eaten raw for their spicy taste. The fruits are also dried and are then pounded and sieved; this powder is added to tea or coffee or used for seasoning vegetables. *Scorodophloeus zenkeri* bark with its alleaceous smell (which is often very strong after rain) is also commonly used for seasoning sauces.

## 4.2. Edible fruits

*Aframomum* spp. fruits are edible when fresh, their taste is both sweet (endocarp) and sour (seeds). The seeds are also sometimes used as a condiment. *Cola acuminata* and *Garcinia kola* seeds are consumed for their aphrodisiac and stimulatory properties. *Raphia* seeds are boiled and the yellow skin is eaten. Palm oil from *Elaeis guineensis* is much appreciated by the populations of Kisangani and Beni.

## 4.3. Vegetable plants

*Gnetum africanum* leaves are finely chopped and cooked as a vegetable. This NWFP is found in markets throughout the year (Bhua, 1991). Young white-yellowish shoots of *Thaumatococcus daniellii* are cut off prior to cooking or they can be added with other vegetables to replace pieces of macaroni. Adult leaves are used for wrapping or for the building of roofs. Many species of edible mushroom are also widely sold in both markets.

## 4.4. Palm wine

The intoxicating palm wine is enjoyed by the majority of the local population, both rural and urban. Palm wine is tapped from both the oil palm, *Elaeis guineensis*, as well as from a number of species of *Raphia*. For the former, the palm is felled and the sap is tapped directly from the leaf terminal bud, whilst from the latter, the sap is harvested by incising the stem at the base of the inflorescence, or at the base of the leaf sheath.

## 4.5. Medicinal plants

Contrary to what happens in Cameroon and Equatorial Guinea where many of the forest population gather and use a number of medicinal plants (Sunderland and Obama, this volume), in DRC it is primarily traditional healers and traders of medicinal plants who are involved in the collection and sale of forest-based remedies. Many traditional healers do not want to share the secrets of the use of many medicinal plants. They are reluctant to share their benefits, nor do they want to lose their unique knowledge and monopoly of the trade and sale of medicinal plants in both markets.

## 4.6. NWFPs household survey

The result of a preliminary household survey at Epulu has shown that the local population uses a wide range of NWFPs for food, medicinal, artistic, ornamental, ritual and magic purposes. At Epulu, more than one hundred species are used by the population, especially pygmies and, whilst some of these species are also represented in the markets studied, the majority are not.

## 5. Discussion

The results of this preliminary NWFP market survey in Kisangani and Beni show that the populations of these towns know and use a number of NWFPs. However, compared to their utilisation by the rural population, NWFPs are conspicuously under-represented in the urban markets. This may be due to:

- The population under-estimates the market value of most NWFPs;
- NWFPs do not have enough retail outlets (transport is a particular problem);
- The sector is not particularly profitable;
- This population has other, more profitable income generating activities;

- NWFP gathering requires a lot of energy and effort for transportation and conversion;
- The laws concerning NWFP exploitation are very strict;
- There are no appropriate conservation techniques;
- The population has lost its ancestral customs and knowledge of the utilisation of forest natural resources.

Some studies in Kisangani, for example, have indicated that the trade in NWFPs is not particularly profitable, except for the trade in *Gnetum africanum*. Bhua (1991) found a total of only eleven food-producing species were sold in the markets of Kisangani, with *Gnetum africanum* being the most common. In contrast, Beni is the centre of extensive non-forest based commercial activities, and NWFP marketing and trade is not of sufficient interest for most traders.

The further quantitative data gathered on NWFPs sold at the Kisangani and Beni markets, and the understanding of the commercial trade channels, will be assessed through further study of these markets. In addition, continued comparison between household use of NWFPs and their formal trade will shed some light on the limited development of the NWFP sector in DRC and will perhaps provide insight into how the sector might be developed for a more meaningful contribution to both the rural and urban economies.

## References

- Baelongandi, L. 1984. Etude des plantes sauvages à fruits comestibles utiles à la population environnante de Kisangani. Monographie inédite, Fac. Sc., UNIKIS, 33 p.
- Bagula, B.Z. 1977. Plantes commercialisées aux marchés de Kisangani. Mémoire inédite, Fac. Sc., UNIKIS, 73 p.
- Bhua, D. N. 1991. Plantes alimentaires spontanées vendues aux marchés de Kisangani et l'étude de leurs circuits d'entrée. Monographie inédite, Fac. Sc., UNIKIS, 30 p.
- Birandano, M. 1981. Les plantes médicinales contre les maladies vénériennes à Kisangani. Mémoire inédite, Fac. Sc., UNIKIS, 83 p.
- Bokdam, J. & Droogers, A. F. 1975. *Contribution à l'étude ethnobotanique des Wagania de Kisangani, Zaire*. Mededeling Landbouwhogeschool, Wageningen, 74 p.
- Liengola, B. L. 1989. Contribution à l'étude des plantes alimentaires spontanées chez les Turumbu et les Lokele de la Sous-Région de la Tshopo (Haut-Zaire). Monographie inédite, Fac. Sc. UNIKIS, 43 p.
- Udar, U. K. 1983. Contribution à l'étude des plantes utiles chez les Batiabetuwa à l'île Mbie (Kisangani). Monographie inédite, UNIKIS, Fac. Sc. UNIKIS, 49 p.
- Vasolene, K. 1987. Plantes sauvages alimentaires chez les Kumu de Masako. Monographie inédite, Fac. Sc. UNIKIS, 38 p.
- Wome, B. 1977. Plantes médicinales des Kisangani. Mémoire polycopié, Fac. Sc. UNAZA, (inédit).
- Wome, B. 1985. Recherches ethnopharmaceutiques sur les plantes médicinales utilisées en médecines traditionnelle à Kisangani (Haut-Zaire). Thèse inédite, Fac. Sc. U.L.B., 561 p.
- Yekonda, L. 1984. Les plantes purgatives utilisées dans la ville de Kisangani. Mémoire polycopié, Fac. Sc., UNIKIS, 59 p. (inédit).

# A PRELIMINARY SURVEY OF THE NON-WOOD FOREST PRODUCTS OF THE LIBREVILLE MARKETS (GABON)

Paulin Yembi

## Abstract

The local and regional trade in NWFPs is generally not quantified, despite the high value of many forest products. The current CARPE research initiative, entailing a year-long study of a wide range of markets, seeks to address this by determining the importance of traded NWFPs throughout the region, and to identify those that are in increasing demand and under the threat of endangerment through over-harvesting. This paper presents the preliminary results of the Libreville portion of this regional study and is based on the methodology outlined in the CARPE training course held in February 1998 (see Clark and Sunderland, this volume).

**Key words:** Libreville, Gabon, non-wood forest products, markets

## 1. Introduction

The preliminary survey was carried out in the centre and in the northern suburbs of Libreville. Three main markets were sampled. In terms of surface area and the number of traders, Mont Bouët is the most important market in the city. There are also many informal pharmacies (stalls for medicinal plants) in this market. Nkembo, strewn chaotically on and near the roadside, is the second most important market with about three hundred and fifty traders. Akebé is located in the most populated quarter of Libreville, and the market there is characterised by the presence of many stalls of nkumu (*Gnetum africanum*). Other forest product based industries such as rattan artisan workshops are also present close to these markets. The sale of vast quantities of palm wine is ubiquitous to all three markets.

## 2. Methodology

The basic methodology implemented during this study was based on that described by Clark and Sunderland (this volume). Investigators from the Centre d'Actions pour le Développement Durable et l'Environnement (CADDE) utilised the questionnaire and interviewed as representative a number and group within the markets as possible. In general, traders provided local names, making species' identification easier; however, samples were also collected for authoritative identification.

For the quantification of the major NWFPs in the markets, three basic criteria were applied:

- the abundance of the products on stalls (the case of *Gnetum africanum*);
- the frequency of the product (chewing stick);
- the combination of the former criteria (*Irvingia gabonensis*).

## 3. Products recorded in the markets: A summary

The following list of the most commonly sold products is not exhaustive and will be modified as more surveys take place. Because of the seasonal differences in product availability to be found in the markets throughout the year, the list will undoubtedly vary in terms of the species and quantity of products sold.

### 3.1. Wrapping leaves

*Megaphrynium macrostachyum* leaves are used mostly to wrap cassava stick (bâton de manioc); a minimum of two leaves are necessary to wrap one cassava stick. The increasing demand for this low-cost food means that there is a high consumption of leaves. The leaves of this species and other *Marantaceae* are said to give a special taste to some food and is the reason why they are preferred to bananas leaves (*Musa* spp.).

**Table 1:** List of the most commonly sold products in the Libreville markets

Scientific name	Local name (in Fang, unless stated otherwise)	Used part	Utilisation
<i>Irvingia gabonensis</i>	<u>andok</u>	Kernel	Condiment
<i>Megaphrynium macrostachyum</i>	<u>ngungu</u>	Leaves	Wrapping
<i>Gnetum africanum</i>	<u>nkumu</u>	Leaves	Vegetables
<i>Garcinia klainiana</i>	<u>wali</u> or bitter wood	Bark	Palm wine additive
<i>Cola</i> spp.		Fruits	Stimulant
<i>Enantia chlorantha</i>	<u>nfoo</u>	Bark	Medicinal
<i>Aframomum</i> spp.	<u>esson, ndong</u>	Seed	Condiment/Medicinal
<i>Scorodophloeus zenkeri</i>	arbre a ail	Bark, seed	Condiment
Unidentified		Chewing stick	Oral hygiene
<i>Elaeis guineensis</i>	oil palm	Fruit, sap, heart	Oil, wine, food
<i>Duboscia macrocarpa</i>	<u>akac</u>	Fruit	Medicinal, (magic)
<i>Ricnodendron heudelotii</i>	<u>essesang</u> <u>mughele</u> (Bapounou)	Bark, root, seeds	Condiment; protection against evil spirits

### 3.2. Vegetables

Nkumu (*Gnetum africanum*) is a large component of the trade in leafy vegetables in all markets in Libreville (except the Nkembo market) and is widely appreciated in fish and meat sauces. It is sold in packets, finely-chopped and ready for cooking. Wild yam leaves (*Dioscorea dumetorum*), unidentified fern leaves and cultivated vegetables, such as young cassava leaves, are also commonly seen.

### 3.3. Fruits and seeds

There is a strong seasonal influence on the availability of some forest fruits. Mangoes (*Mangifera indica*) are very abundant from December to March, whilst the bush plum (*Dacryodes edulis*) dominates the market in June-August. There are also a number of wild forest fruit commonly in the market and these include onzabili (*Antrocaryon klaineianum*) offos (*Pseudospondias longifolia*) and the highly-appreciated *Aframomum* spp..

*Irvingia gabonensis* kernels are the most common NWFP in all three markets and are available throughout the year. They are commonly imported from Cameroon and Equatorial Guinea, as well as originating from the forests of Gabon. This wide source of material ensures that a year-round supply is available. *Irvingia gabonensis* fruits are not often consumed when fresh. The kernels are dried, toasted, pounded and then moulded to form a cake called 'odika bread'. This can weigh between 100 to 5 000 grams and is sold for CFA francs 1 000 to 25 000, or for CFA francs 500 per glass of 'odika bread' powder. *Raphia hookeri* fruits are cooked and eaten by people of the Fang tribe and are commonly found in

the markets. *Coula edulis* fruits are also widely sold when in season and are generally consumed as a snack.

### 3.4. Spices and condiments

Gabonese use *Afrostryax lepidophilus* seeds and bark as a garlic substitute. *Ricinodendron heudelotii* seeds (essessang) are also used as a condiment. African expatriates use *Monodora myristica* as a condiment, while Gabonese attribute the species with magical attributes in traditional medicine. This is also the case with the fruits of *Afromomum* spp. and *Piper guineensis*.

### 3.5. Fuelwood

In the Libreville markets, most of the fuelwood sold is scrap from nearby sawmills. The primary species is okoumé (*Aucoumea klaineana*). A second often sold fuelwood species is okala (*Xylopia aethiopica*), the bark of which is also used to wrap okoumé resin for the manufacture of torches. Fishermen use mangrove wood (*Rhizophora racemosa* and *Avicennia nitida*) to smoke fish.

### 3.6. Rattan

The small diameter cane, *Eremospatha macrocarpa* is extensively used for basket work. In furniture manufacturing, this species is used to tie larger rattan canes together, and for weaving chair seats. The large diameter cane, *Laccosperma secundiflorum*, is bent with the help of welding-torch to form the framework needed for furniture manufacture. The supply channels of rattan are well organised. Men intensively harvest it in the forest around Libreville and sell it to wholesale desks or to craftsmen in rattan workshops. African expatriates (usually natives of Niger, Equatorial Guinea or Cameroon) have created workshops where young Gabonese are employed. The work is undertaken on a commission-only basis and, consequently, it is difficult to quantify monthly consumption. Craftsmen make big profits through rattan processing activities. In addition to the rattan stems being harvested the apical bud is also widely collected and eaten, particularly in the south west of Gabon. These hearts of palm are called mikandas or “asparagus”.

### 3.7. Medicinal plants

A considerable proportion of Libreville’s population cannot buy Western pharmaceutical products because they are too expensive. Instead, they use the medicinal plants used by the rural population in traditional medicine. To identify the most commonly sold medicinal plants, a number of “pharmacies” were surveyed separately.

### 3.8. Palm wine

Palm wine markets are places ironically called “reunion des parents d’élèves” (student’s parents meeting). These markets are commonly found at crossroads or junctions. This drink, extracted from *Elaeis guineensis*, is in high demand; it is not rare to see twenty to thirty persons around a seller (usually a woman) with molorolla (palm wine). In terms of quantity, the palm wine tapped after felling of the tree is the most common (i.e. the wine tapped from *Elaeis guineensis*). An adult palm tree can produce up to 4 litres/day for the first four days of tapping and 1 litre/day then on. The average duration for the viable tapping of a palm for wine production is three weeks. It should be noted that if the palm wine is not sold by the second day, it is sold on to merchants from Benin or Ghana who distil a stronger drink.

### 3.9. Sugar cane wine

The wine of sugar cane (*Saccharum officinarum*) is from Mouila, a town in the south of the country. It is sold at CFA 400 per litre. Palm wine and sugar cane wine are soaked with *Garcinia lucida* bark in cans to make the wine stronger. Women from West Africa produce 'makita', a drink made of water, sugar and ginger roots.

### 4. Discussion

Except for *Gnetum africanum* leaves, the majority of NWFPs available in the Libreville market are sold by African expatriates, and the trade in NWFPs is almost exclusively undertaken by non-Gabonese. However, it is essential to involve local populations in the protection of the environment because they are ultimately dependent on it. There is adequate provision for the control of the exploitation of forest products in the Forestry Law 1/82, article 16, which states that: "...no person can exploit or harvest forest products free of charge, and without prior permit delivered by the Forestry Administration. The type of permit and certificate of exploitation, and the procedure of their delivery are defined through statute." Unfortunately, lack of trained personnel and control ensures that these laws are often not satisfactorily implemented.

### 5. Conclusion

Although providing a source of well-being and improving the economic revenues of rural populations, many of the NWFPs listed above are threatened by unsustainable methods of exploitation. Some NWFPs have become so lucrative that urban exploiters use technology to more efficiently exploit the resource (e.g. the use of refrigerated trucks for bushmeat hunting). With this increasing demand, the wild populations of these species resources are drying up, and it is now necessary for many harvesters to travel further and further into the forest to obtain the products. The involvement of rural populations in the management of NWFPs, for both moral and cultural reasons, is necessary, and the forthcoming forestry legislation will make this possible. (See Profizi, this volume.) In addition, further knowledge of the marketing channels for different NWFPs will help encourage the equitable sharing of revenues, ensuring that local communities benefit from the sustainable exploitation and management of their forest resources.

### References

- Bourobou, H.B. & H.P. Mounzeo. 1997. Plantes utilisées comme poison de pêche chez les PUNU du Gabon. *Le Flamboyant* No. 44, 17 - 18.
- Chabot, I. 1997. *Etude de la filière des produits forestiers non ligneux au Gabon*. Rapport de mémoire DESS CIRAD-Forêt, PAFT Gabon Libreville.
- Clark, L. & N. Tchamou. 1998. La recherche sur les produits forestiers non ligneux en Afrique Centrale, la situation du secteur. Rapport pour CARPE.
- Ndoye, O., M.R. Perez & A. Eyebe. 1997. The markets for non-timber forest products in the humid Forest zone of Cameroon. *ODI Rural Development Series*. No.22. ODI. London.
- Sunderland, T.C.H. 1998. Preliminary market survey of the non-wood forest products of Rio Muni, Equatorial Guinea. CARPE (USA) and CUREF (Equatorial Guinea).
- Raponda-Walker, A. & R. Sillans. 1961. *Les plantes utiles du Gabon*. Lechevalier, Paris. 614 pp.
- White, L. & K. Abernethy. 1997. *A Guide to the vegetation of the Lope Reserve Gabon*. Wildlife Conservation Society, Libreville.

# RATTAN OR PORCUPINE: BENEFITS AND LIMITATIONS OF A HIGH-VALUE NWFP FOR CONSERVATION IN THE YAOUNDE REGION OF CAMEROON

Louis Defo

## Abstract

Rattans are one of the most important non-wood forest products in the Yaounde region of Cameroon. Within the framework of a study of rattan in the area, attention was focused on the attitudes of local people towards rattan exploitation, as opposed to commercial hunting or timber extraction, to test the “NWFP alternative hypothesis”.

The exploitation of rattan (gathering and selling of raw material; rattan processing) has undeniable benefits. However, it also has considerable disadvantages. Rattan’s advantages are related to its relative abundance, its socio-economic importance, the volume of its potential demand and others parameters of its exploitation. Its weaknesses are essentially due to the fact that it is undoubtedly linked to other, more unsustainable, forms of forest exploitation, such as those mentioned above. Often, most rattan harvesters when asked the question: “rattan or hunting?” usually respond: “rattan and hunting”.

**Key words:** Rattan (cane), hunting, non-wood forest products, Yaounde region

## 1. Introduction

Recently, many donor agencies and research organisations have turned to the potential of NWFPs to contribute to forest conservation initiatives whilst at the same time improving the livelihoods of rural people (Godoy and Bawa, 1993; NC-IUCN, 1997). This is also the case in Cameroon, with many NWFPs being investigated for their potential commercial and possible conservation value. Rattan is the most important NWFP in the Yaounde area, the marketing of which is the subject of on-going studies by APFT. Through the study of the behaviour of farmers in villages where rattan is exploited, a comparison was made between hunting and trapping and the felling of timber trees as opposed to rattan harvesting.

## 2. The study site

The area of study corresponds to the supply range of rattan raw material and products for the Yaounde markets and concentrates on the Yaounde - Ebolowa axis. Floristically, it is part of the Southern Cameroonian plateau in an Equatorial-Guinean climate zone covered by semi-deciduous forest dominated by the plant families *Sterculiaceae* and *Ulmaceae* (Letouzey, 1985).

Since the 14th century, this region has been inhabited by the Ewondos and Assimi tribes, distributed in widespread hamlets of varying sizes (Mveng and Beling-Nkoumba, 1983). It is a segmented society with an equally fragmented political structure. The main economic activities of the population are subsistence agriculture along with some cash crop production, notably cocoa. Extra-agricultural activities such as fishing, hunting, sand extraction, handicraft production and the gathering of NWFPs are also widely practised. However, the proximity to Yaounde, a sprawling metropolis of around 1 million people, has intensified the demand for many forest products, to the point at which many are now severely threatened.

## 2. Methodology

Field work was undertaken between April 1997 and February 1998 and began with preparatory visits to 19 villages near Yaounde where field observations and informal interviews provided useful information for the choice of representative sites for the more intensive study to follow. Seven of these villages and hamlets were selected for the survey, based on their accessibility and numbers of resident rattan harvesters and artisans.

For the intensive studies, formal interviews based on a questionnaire ( $n = 84$ ), guided by a stratification of the population, were undertaken. In addition to these interviews, informal discussions, both individually and collectively, were also undertaken. These informal discussions included people who work with rattan and those who do not. Additional direct observations and biological collections (with the assistance of a botanist) augmented the interviews and provided some “ground-truthing”.

## 3. Rattan: An abundant and important resource

Although inventories have not been carried out, rattan is considered an abundant and widely available resource in the study area. In spite of extensive forest clearing and the increasing rate of their harvesting in recent years, rattan populations can be observed not far from cocoa plantations, a median distance of less than one hour’s walk. Rattan is not only widely available but is also easily accessible from a traditional perspective. There are no social or cultural barriers to its exploitation and, in many settlements, all resident villagers can harvest rattan in the forest without any preliminary formalities.

The importance of rattan, notably the species *Laccosperma secundiflorum* and *Eremospatha macrocarpa*, can be seen at many levels in villages. Its exploitation (cutting and trading of raw cane for transformation into arts and crafts) occupies about 35% of households and make up an important component of farmers' time (13 days/month on average for artisans). In terms of income generation, rattan exploitation is a highly beneficial activity for those engaged in it, as illustrated in Table 1.

**Table 1:** Annual revenues (in CFA) for rattan exploiters.

Activity	Mean monthly income	% of total income
Agricultural activities	219 000	21,6
Rattan transformation-artisans	216 000	21,3
Sale of raw cane	166 000	16,4
Market gardening	136 000	13,4
Cocoa/ coffee production	115 000	11,4
Hunting	94 000	9,4
Other NWFP harvesting	50 000	5
small animal husbandry	18 000	1,5
<b>Total</b>	<b>1 014 000</b>	<b>100</b>

The contribution of rattan to global revenues of those involved is important, not only in absolute or relative value but also notably for its “immediate” benefits. This makes rattan an important means of obtaining cash for much-needed purchases such as medicines and school fees. This is particularly important as the majority of the population suffer from poor cash flow. Previous heavy reliance on cocoa for cash income has been significantly affected by the large reduction in the market price in 1989/90 and rattan has since gained in importance for the local cash economy.



**Figure 1.** Locally made rattan products for sale at the roadside (Photo: T. Sunderland).

### **3.1. Who is involved?**

The harvesting of rattan and its subsequent transformation is essentially a job for men who are generally young and married. Preliminary surveys show that 94.4% of harvesters are men aged between the ages of 16 and 40; 78.8% of these are married. This social strata also includes men involved with hunting activities (Dounias, 1993; Dethier, 1995). The fact that hunting and rattan exploitation is undertaken by the same members of a community provides a strong indication that these activities are undertaken simultaneously and suggests that there is often a degree of competition between them.

### **3.2. The effects of seasonality**

In comparison with the exploitation of other NWFPs such as bush mango (*Irvingia gabonensis*), nuts (*Coula edulis*) and bush bon-bon (*Trichoscypha arborea*), the fact that the harvested portion of the rattan is part of the vegetative structure of the plant (stems) enables its exploitation all year round. The seasonality effects that hamper direct revenues from other NWFP exploitation relying on fertile plant parts is not experienced. Hunting and timber exploitation activities also experience the effects of seasonality. For example, it is not possible to set traps for hunting during the dry season as the paths that are frequently used by animals are not visible during this period of the year. It is also not possible to extract timber during periods of heavy rain due to the problems of accessibility and transportation. Hence rattan is the only viable all-year-round activity that is capable of providing a continuous income.

### **3.3. Labour intensity**

Another potential advantage of rattan exploitation in comparison with the exploitation of other NWFPs is the fact that this activity is highly labour intensive. Labour is often the cheapest, and most easily available, commodity to most rural dwellers and both the harvesting and transformation of rattan is highly manual. Although rattan exploitation consumes a great deal of time, and this appears as a disadvantage in terms of productivity, in

fact it can be considered an asset (in terms of conservation) inasmuch as this task can occupy farmers and reduce time and energy that might be used for trap-based hunting. The criteria of comparison between would-be economic competitiveness or time remuneration, energy, finances, and the valuation of high intensity labour activity in rural communities is often considered as a strategy for conservation.

### 3.4. Capital intensity

In terms of capital investment needed to establish an artisanal operation, the rural rattan craft industry requires a small investment for the provision of technical or financial capital. This is usually less than CFA 5 000 for small-scale basketwork, and less than CFA 20 000 for the craft industry of rattan furniture. In comparison to the capital intensity required for other activities, the processing of rattan is highly favourable. For example, for timber exploitation the cost of hire or purchase of a chainsaw, as well as the running costs, is extremely high. Likewise, the ammunition needed to hunt with (usually homemade) guns also represents an extremely high capital investment. This investment is often not possible for the majority of the rural population.

### 4. Limits of rattan for conservation

Despite the intensity of rattan activity and the benefits that it brings to the rural population, the majority of the population interviewed indicated that they would not give up hunting for the exclusive harvesting of rattan. (See Table 2.) When asked if they would stop commercial hunting in favour of rattan exploitation, the majority of the informants replied in the negative (68%), with only 20% saying they would and 12% were undecided. Similar figures were given by timber exploiters. Half of them (50%) said they would not give up timber exploitation in favour of rattan, 25% said they would and 25% were undecided. The reasons given are outlined below in Table 2.

**Table 2:** Arguments/reasons given by villagers for not giving up hunting in favour of rattan activities ( $n = 23$ )

“Hunting and rattan are complementary to one another, all are sources of revenue”	43%
“Hunting is more profitable”	23%
“Rattan is a waste of time”	22%
“Transportation to Yaounde is difficult and causes a lot of trouble”	4%
“Animals eat crops and need to be controlled”	4%
“When hunting you can eat bush meat”	4%
<b>Total =</b>	<b>100%</b>

#### 4.1. Complementarities between rattan, hunting and other activities

As can be seen from Table 2, there is a strong complementarity between rattan and other forms of forest exploitation, such as hunting. This complementarity is at an economic level, i.e. income. Although rattan certainly provides greater revenues, this is not a sufficient reason for many rural people to abandon hunting and tree felling since all of these activities are moneymaking. This is not surprising; the key to many rural subsistence strategies is the diversification of revenue sources. For farmers interviewed those who undertake a number of income generating activities is 86%. This is especially the case since the fall in the price of

cocoa price in 1989/90 which highlighted the importance to farmers that it is not necessary, nor desirable, “to keep all the eggs in the same basket”.

#### **4.1.2. Rattan exploitation and hunting: Activities carried out together**

Many rattan collectors take advantage of their journey to the forest when going to harvest rattan to conduct hunting activities. The secondary forest much favoured by many species of rattan are also the optimum habitat for many of the animals prized for their meat, which has both subsistence and commercial value. The setting of traps within the same forest area as one is harvesting does not require a great deal of supplementary effort. Furthermore, trekking in the bush to prospect for rattan resources enables the harvester to identify well-used animal paths and *vice-versa*.

#### **4.1.3. Activities financing one another**

Much of the revenue earned from the sale of raw cane or the trade in finished rattan articles enables the farmer to buy necessities such as salt, soap and kerosene, and recreational goods such as alcohol. The cash is also used to purchase steel wire used to make snares, or cartridges for those who hunt with firearms. Some rattan harvesters also use some of the cash income from the sale of rattan to finance small-scale timber exploitation.

Conversely, the sale of cut timber or bushmeat can also finance rattan work. Much of the rural population has a weak capability for saving and frequently spends all of the cash-income derived from rattan trading, without saving enough money for the next trip to town for the sale of their products or for purchasing the basic items needed to support their rattan craft industries (such as nails, varnish and gas). To overcome this, many have recourse to the capture and sale of bushmeat. Hence, porcupine or some other easily trapped animal is sold along the road or in the nearest town.



**Figure 2.** Wire snare used for trapping (Photo: T. Sunderland).

#### **4.1.4. Activities that can support one another during seasonal changes**

During our investigations, a forty-year-old man from Ozam village, a well-known harvester and craftsman of rattan, when asked why he doesn't abandon timber exploitation to concentrate solely on rattan work, gave the following answer:

“..during holidays, there are many rattan traders in Yaounde and the rattan is cheap, so I prefer to manage at this moment with [the sale of] wood while waiting for rattan market to be [more favourable] ”.

#### **4.1.5. Further constraints to developing rattan as a sole NWFP activity**

Although rattan provides a high level of relative income, it is not only highly labour intensive but can be dangerous and unpleasant work. Firstly, it is often necessary to trek far into the forest to find adequate rattan resources (on average 7 km) whilst traps are set on average only 2km from the village. The harvesting of the rattan itself is often extremely unpleasant; the stems are covered with long thorns and, in the course of pulling a cut length of cane, dead branches often fall from the forest canopy. The harvested cane is then head-portered back to the village; a bundle of fresh cut cane can weigh up to 50 kg. If the raw cane is to be transported for sale to an urban centre (usually Yaounde), there are considerable transportation problems. Apart from the difficulties of procuring the transportation money, finding a suitable vehicle that will provide transport, further funds are required for bribing policemen along the road (harvesting is essentially illegal without a valid *permis d'exploitation*).

In this regard, it is not surprising that many harvesters complain that the rattan business is difficult and many complain that income earned is not proportional to the time spent, the energy exerted and the risks taken. It is regarded as a situation of low remuneration and reduces the comparative advantage of the relatively high final incomes. In some villages, timber exploitation is more profitable than rattan in this regard and remuneration of time spent for timber harvesting is ten times the remuneration of that spent on rattan exploitation.

In many villages, the numbers of hunters is higher than the number of those involved in rattan exploitation and commercial hunting is more culturally important than rattan work. The Fang-Beti group certainly has a long tradition of rattan use but this has been limited to local use. The technical know-how to undertake large-scale harvesting and transformation is not well known in some localities. It is often the case that more people are familiar with the techniques of animal trapping than they are with those of the rattan craft industry.

#### **4.1.6. The substitution hypothesis**

Some forms of forest utilisation are more in-line with the conservation agenda than others, and this had led to the development of the “alternative NWFP” hypothesis. According to this hypothesis, by finding equivalent cash income to that provided by hunting, for example, the farmers could abandon hunting in favour of more “sustainable” (and legal) forms of forest exploitation such as the harvesting of rattan.

Revenue substitution in a context of livelihood impoverishment (according to the World Bank, the number of rural households living under the poverty threshold in Cameroon increased from 49% to 71% between 1983 and 1993) seems not to be realistic, however. The need for a regular cash income precludes any need for immediate conservation for many communities and the altruism needed to deny any form of forest-based revenue only comes through relative comfort, often wealth from other sources.

## 5. Conclusion

Rattan exploitation has undoubted benefits in terms of forest exploitation. It is a relatively abundant resource and provides high revenues for both the raw material and finished products. Rattan harvesting is not affected by the effects of seasonality that plagues the commercial potential of other NWFPs, and the markets for rattan products are strong and rapidly increasing.

However, as seen from the results of this study, the exploitation of rattan, often considered as a sustainable form of forest use, is undertaken alongside more unsustainable and damaging forms of forest exploitation. This diversity of exploitation patterns is due to the need for immediate cash income.

It is also clear that there needs to be greater revenues generated from the existing trade and there is a clear challenge to the proponents of sustainable development: How can these resources be more profitable, increasing the revenue of the main actors involved without damaging production potential in the long term? The answer to this question requires further multi-disciplinary study into the ecology and socio-economic aspects of the industry.

From the studies outlined in this paper, it is clear that the situation is not one of “..rattan or porcupine?” but one of “..rattan and porcupine”.

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## References

- Alexandre, P. & J. Binet. Undated. Le groupe dit Pahouin (Fang - Boulou O Béti). P.U.F, Paris.
- Courade, G. 1994. *Le village Camerounais à l'heure de l'ajustement*. Karthala. Paris.
- Defo, L. 1997, La filière des produits forestiers non ligneux. L'Exemple du rotin au Sud-Cameroun. Approvisionnement et transformation. Le cas de Yaoundé. APFT.
- Defo, L. 1997. L'exploitation du rotin dans la proche campagne de Yaoundé. Rapport APFT en cours de rédaction.
- Dethier, M. 1995. Etude de chasse. ECOFAC, AGRECO-CTFT.
- Dounias, E. 1993. Dynamique et suggestion différentielles du systèmes de production à dominante agricole des MVAE du Sud-Cameroun forestier. Thèse de Doctorat, Univ. de Montpellier II.
- FAO. 1993. *More than wood: Special options on multiple use of forest*. Forestry report No. 4. FAO, Rome.
- Godoy, R.A., K. Lubowski, & A. Markandya. 1993. A method for economic valuation of non-timber tropical forest products, *Economic Botany*. 47(3): 220-233.
- Godoy, R.A. & K.S. Bawa. 1993, The economic value and sustainable harvest of plants and animals from the tropical forest: Assumptions, hypotheses and methods. *Economic Botany*. 47(3):215-219.
- MINAGRI/DA. 1987. *Calendrier agricole de la République du Cameroun*, 3è édition revue et corrigée.
- NC-IUCN. 1997. *Non-timber forest products from the tropical forests of Africa*. A bibliography. Amsterdam, NC-IUCN.

- Ndoye, O. undated. The impact of the macroeconomic and agriculture policies on forest conditions in Cameroon. CIFOR Working Paper no 3.
- Nzoo Dongmo, Z. L. 1995. Etude floristique, biologique, écologique et ethnobotanique des rotins de la réserve de faune du DJA, ECOFAC.
- Santoir, C. 1991. *Sous l'empire du cacao. Etude diachronique de deux terroirs Camerounais*. Paris. Editions de l'ORSTOM.
- Trefon, T., & L. Defo. 1998. Can rattan help save wildlife? *APFT Briefing note* no. 10.
- World Bank. 1995. Cameroun: Diversité, croissance et réduction de la pauvreté, Rapport No. 13167-CM 4.
- WWF International. 1993. *La nature au service de l'homme*. WWF, Gland.

# THE DEVELOPMENT OF QUALITY CONTROL STANDARDS FOR OGBONO (*IRVINGIA GABONENSIS* AND *IRVINGIA WOMBOLU*) KERNELS: EFFORTS TOWARDS ENCOURAGING ORGANIZED AND FURTHER INTERNATIONAL TRADE IN A NWFP OF WEST AND CENTRAL AFRICA

D. O. Ladipo

## Abstract

Most non-wood forest products are still collected and marketed informally. This does not allow for adequate attention to be paid to quality. Quality can mean different things to both producers and users and is usually tied to remuneration (i.e. attaining a good price) so farmers try to achieve as high a quality as possible to benefit from higher financial returns. Strict rules on quality determination are not new to West and Central African farmers who have grown cash crops such as coffee and cocoa for many decades for overseas processors and consumers.

Although many non-wood forest products of the native forests in this sub-region are still restricted to small local trade, some products have reached 'far national' and international markets. *Irvingia gabonensis* and *Irvingia wombolu* are the two *Irvingia* species that produce kernels eaten in West and Central Africa (Harris, 1996). The fruit of *Irvingia gabonensis* has a sweet mesocarp and it is eaten fresh, while that of *Irvingia wombolu* is sour and is not consumed locally. The edible kernels from both are used for culinary purposes and are traded widely; enough to be quoted on the weekly commodity lists in Nigeria. Ogbono is used as soup thickener in West and Central Africa and also to make dika cake in Central Africa, particularly in Gabon. Other uses of the kernels, such as their pharmaceutical grade fat (oil), are also being developed. A grading of quality classes is suggested for ogbono (kernels) ranging from grades A to D (with A being the best quality). The development of this quality classification has been dictated by the response of various farmers, wholesalers and consumers in the South of Nigeria where ogbono is consumed traditionally and extensively. The present effort is to provide at least a starting point in the process of quality standardisation in this commodity to increase revenues for both traders and producers.

**Key words:** *Irvingia gabonensis*, *I. wombolu*, kernels, quality, trade

## 1. Introduction

Most non-timber forest products in West and Central Africa are still marketed and sold on an informal basis often in forest fringe markets, and in local village market places from where users purchase them for direct use. In the case of more 'advanced' products however, wholesalers purchase these NWFPs in village markets from where they are cleaned, packaged and transported to urban markets. Some products are also traded further and supply growing international markets.

Ndoye *et al.*, (1997) reported substantial markets for a wide variety of non-wood forest products. This study provided sale prices and evidence of price variation as influenced by season or product seasonality within the Cameroon area. However, few product quality standards for the enhancement of market opportunities have been implemented to date though

the development of practical guidelines has considerable potential for the enhancement of product values and hence the income of the gatherer or producer.

A few examples do exist though. In the case of kola (*Cola nitida* and *C. acuminata*) informal rules and regulations have been applied in the marketing of kola nuts for many years. For trans-savannah trade within West Africa in particular, nuts are sorted according to colour and size and each of these classes command their own prices according to quality. For a few of the indigenous and more recent wild fruit crops, quality control is being exerted by informal associations or co-operative unions. A good example is the informal *Dacryodes edulis* export market in Douala, Cameroon. Export of the bush plum from Cameroon to Gabon follows strict gradings and the price varies according to quality.

However, for the marketer and consumer, the term quality is subjective. To the producer and wholesaler it could mean those kernels that secure a maximum price in the market at a particular time of the season. To the consumer quality could mean presentability and end product quality, i.e. soup drawability. Quality to this person could then be defined in terms of end-use.

For *Irvingia* kernels there are some general aspects of quality that can be considered and that are shared by both the marketer and consumer. These include size of kernel, thickness of kernel, colour, maturity and extent of blemishes or damage. Ladipo (1994) after a preference survey, reported that important factors in quality for the consumer in the case of the eating and cooking of *Irvingia* are:

- Appearance, including kernel size, colour and shape;
- Condition (pests) and absence of defects (mechanical damage, etc);
- Oil content;
- Flavour (sliminess of kernel after processing or cooking); and
- Level of adulteration of kernels (the mixing of *I. gabonensis* and *I. wombolu* kernels).

## **2. Local and international trade**

The market for ogbono products is said to be worth some US\$ 50 million (ICRAF, 1975). Ladipo and Boland (1994) reported extensive local and regional trade within Nigeria and between countries in West and Central Africa such as Nigeria, Gabon and Cameroon. Processed kernels of *Irvingia* are also transported from Africa to the UK and the USA, particularly to areas where African immigrants abound in large numbers. They are also sold in Paris and Brussels (Tabuna, this volume). Produce marketing in the 'raw' ungraded state attracts less financial returns. This is why a process of grading needs to be introduced for these NWFPs so as to enhance their value and the income of their producers. The various factors for consideration are presented below. Further uses of ogbono may increase this market yet further. For example it is suggested that the kernel oil could be of value in the binding of pharmaceuticals (Okafor, pers. comm.) and have considerable industrial applications.

## **3. Pre-harvest operations that determine kernel quality**

This is the cultural or field aspect of quality control. In the case of planted trees, this essentially involves the use of good planting materials and the application of good tree management techniques which will allow the full potential of the genotypes planted. It also involves good disease and pest control management. In the case of wild trees, the source of

which constitutes 99% of produce presently marketed in West and Central Africa, it is the selective collection of fruits that matters so the kernels extracted can be of good quality.

#### 4. Post-harvest operations that determine kernel quality

This comes into play post-harvest after the fruits have been collected. Post-harvest quality depends substantially on farmer practice and will include the handling of the produce even from kernel extraction. Factors include:

- Harvest of fruits
- Extraction of kernels
- Drying of kernels
- Sorting of kernels
- Storage and packaging

Fruit harvesting has to be undertaken at the optimum time to prevent the harvest of immature fruits. The extraction of the kernels entails the fruits being split open using machetes (when the fruits are fresh) or with truncheons or hard stones when they are dry or fermented fruits. The seed shell splits open through the longitudinal line of weakness, exposing the kernels wrapped in a dark brown testa. Extracted kernels are further dried for storage or for direct sale in units of 5, 10 or 25 kg sacks on the wholesale market. Methods of extraction have been reported to differ between countries. The kernels of *Irvingia* in South West Nigeria are usually extracted in the fresh state, then dried before storage and sale, whereas dry stage extraction, which requires very little additional drying, is the preferred means of extraction practised in Cameroon.

Drying of kernels is very important. Without this, stored kernels become discoloured and prone to fungal attack and this is a major determinant of quality. Post-harvest attack by insect pests can seriously affect products' market acceptability. Ashiru (1997) has isolated and described the insect pest responsible for the damage to *Irvingia* kernels in storage. Aside from pest and disease susceptibility there are also many environmental factors which can affect the rate of quality decline in ogbono. High humidity and also high temperature decreases colour quality as whitish cream kernels turn brownish or dark tan.

The sliminess of the dika cake (a preparation of hard-pressed kernels that resembles a cake) and ogbono soup is a vital traditional attribute. Kernels of *Irvingia wombolu* are well known for their high slimy consistency, while the kernels of *Irvingia gabonensis* are less slimy. Because of the abundance of *I. gabonensis*, it is common to encounter mixing of the two types and it is vital that the two species are separated. In general, a higher grade can be attributed to *I. wombolu* since it is slimier and preferred.

#### 5. Quality variables for consideration

With the above parameters to consider for quality determination in *Irvingia* the quality variables can be numerous. They include the following:

- **Visual quality:** If *Irvingia* is harvested in the immature state, extracted kernels are greenish, thin and shrunken. Kernel colour after drying should be whitish-cream on the inside and dark brown on the outside. Colour must be uniform on the kernel without being patchy.
- **Kernel size:** Generally larger, uniform kernels are preferred.
- **Kernel thickness:** This refers to the wholeness of kernels. Those damaged during extraction will break easily, especially at the drying stage, while immature kernels are prone to shrinkage and are often irregular in shape.

- **Level of sliminess:** This trait is vital for local acceptance, since the product (kernels) is use-oriented with consumers preferring a slimy consistency to the end product. To test for sliminess kernels should be ground into a paste, wetted with a little water and then rubbed between the fingers. The level of sliminess of the sample can then be determined. It can be classified as (i) high, (ii) average or (iii) low, depending on the observations obtained.
- **Pest damage to kernel:** Storage insects are known to cause significant damage to kernels (Ashiru 1996). These insects bore through kernels thus damaging them. Kernel infestation can be classified as having suffered (i) severe damage, (ii) average, (iii) low or (iv) no insect damage at all.

**Table 1.** *Irvingia* kernel parameters and quality classes.

Grade of sample	Parameters
A	<ul style="list-style-type: none"> <li>• No debris in kernel mass</li> <li>• Kernels dry (8% moisture content)</li> <li>• Cream in colour</li> <li>• Kernel is whole, unbroken</li> <li>• Kernel powder is very slimy</li> <li>• No pest damage</li> <li>• No fungal damage</li> <li>• Kernel is large and thick</li> </ul>
B	<ul style="list-style-type: none"> <li>• Little debris in kernel mass</li> <li>• Kernels dry (8-10% moisture content)</li> <li>• Cream / yellow in colour</li> <li>• Average kernel size</li> <li>• Kernel powder averagely slimy</li> <li>• No pest damage</li> <li>• No fungal damage</li> <li>• Kernel is averagely large and thin</li> </ul>
C	<ul style="list-style-type: none"> <li>• High debris content in kernel mass</li> <li>• Kernels dry (+10% moisture content)</li> <li>• Darkish brown in colour</li> <li>• Kernel size variable</li> <li>• Kernel powder not particularly slimy</li> <li>• Slight pest infestation</li> <li>• Slight fungal infestation</li> <li>• Kernel small and thin</li> </ul>
D	<ul style="list-style-type: none"> <li>• Very high debris content in kernel mass</li> <li>• Kernels inadequately dried</li> <li>• Blackish (mottled) or green (immature) in colour</li> <li>• Kernel powder not at all slimy</li> <li>• Kernel broken into pieces</li> <li>• Heavy pest infestation</li> <li>• Heavy fungal infestation</li> <li>• Kernel is small and thin</li> </ul>

- **Fungal damage to kernel:** Fungal infection causes discoloration in *Irvingia* kernels. This often results from improper handling during extraction due to high humidity and inadequate drying which will encourage fungal growth. Colour changes can vary from brown to black depending on the stage of infection and this could also vary from (i) extensive (more than half of kernel discoloured) to (ii) average (less than half of kernel discoloured) to (iii) low and (iv) no discoloration at all.
- **Level of kernel moisture content:** More effective drying helps prevent pest and disease attack.
- **Mechanical damage (breakage) to kernels:** Damage to kernels often occurs during extraction and damaged kernels reduce kernel quality significantly.

With the above considerations, it is clear that appropriate variations in price must be applied to justify the efforts of a farmer or wholesaler required to maintain the high quality prescribed. For example, a 50% price difference should be specified between the specific grades A and B, while a 10% difference should be specified for grades C and D compared to B. With this, D class is discouraged as only 30% of the price of A will be obtained. For further elaboration, see Table 1.

## 6. Potential for future marketing development

The impact of the international cocoa and coffee boards on the quality maintenance of these export products is well recorded. However, for NWFPs and other “minor” products, the need for local farmer co-operatives is critical, and I would suggest that *Irvingia* Farmers Associations (IFA) and Minor Crops Marketing Boards should be established in West and Central African countries along the same lines as the cocoa and coffee boards and the *Dacryodes edulis* trading system. This will conform with the European Union (EU) initiative on the enhancement of the tropical fruit trade to Europe which has resulted in the promotion of a number of forest fruits (otherwise considered “minor forest products”) with substantial economic returns to many developing countries and the producers concerned, small-scale farmers.

## 7. Conclusion

The present market spread of *Irvingia* kernels has been reported by Ladipo and Boland (1994) and is growing steadily. As more uses are promoted for *Irvingia* and its products, sales of ogbono will increase substantially in the near future. If the development of the resource take place under the guidelines outlined above, the case of *Irvingia* kernels could perhaps provide a model for the development of other NWFPs of West and Central Africa.

## 8. References

- Ashiru, M.A. 1996. Pest damage of *Irvingia* kernels in storage. In D. O. Ladipo & D. Boland (Eds) *Proceedings of the International Workshop on Irvingia in West Africa. International Centre for Research in Agroforestry (ICRAF)*, Nairobi, Kenya.
- Harris, D.J. 1996. A revision of the Irvingiaceae in Africa. *Bull. Jard. Bot. Belg.* 65:143-196.
- Ladipo, D.O. 1994. Farmer preference survey on *Irvingia gabonensis* in Southern Nigeria. Unpubl. report.
- Ladipo, D.O. 1997. Marketing and post harvest constraints of traditional vegetables in sub-Saharan Africa. Paper presented at NRI-IPGRI International Workshop on African Indigenous Vegetables, Limbe, Cameroon.

- Ladipo, D.O. & D.J. Boland. 1994. Trade in *Irvingia* kernels. In D. O. Ladipo & D. Boland (eds.): *Proceedings of the international workshop on Irvingia in West Africa*. International Centre for Research in Agroforestry (ICRAF) Nairobi, Kenya.
- Ladipo, D.O., J.M. Fondoun & N. Ganga. 1996. Domestication of the bush mango (*Irvingia* spp): Some exploitable intraspecific variations in West and Central Africa. In *Proceedings of the FAO/ICRAF International Conference on the Domestication and Commercialization of non-timber forest products in Agroforestry systems*, pp 193-206.
- Ndoye, O. M. Ruiz-Perez & A. Eyebe (1997). The markets of Non-timber Forest products in the humid Forest Zone of Cameroon. *Rural Development Forestry Network. Paper No 22c* ODI, London, UK.

# THE MARKETS FOR CENTRAL AFRICAN NON-WOOD FOREST PRODUCTS IN EUROPE

Honoré Tabuna

## Abstract

The trade in France and Belgium of non-wood forest products (NWFPs) from forests in Central Africa (Cameroon, CAR, Congo, DRC, Gabon) was as recently as 20 years ago aimed at immigrants originating from the region. The market is now opening up to a European clientele and expanding to other countries such as Germany, the United Kingdom and Switzerland. This trade involves wild-harvested products, as well as those from cultivation. The studies carried out on this poorly understood market have identified around 40 food and medicinal products that are commonly sold in Europe.

An analysis of the market (current outlets, vendors, distributors and distribution chains, and prices) shows that these NWFPs, principally imported from three countries (Cameroon, DRC and Congo), are still primarily aimed at African and Caribbean clientele (the “ethnic market”) but are now starting to penetrate rapidly into the market for organic products. In the “ethnic market” in both Belgium and France, NWFPs are sold in “local tropical groceries” and in “neighbourhood tropical markets”. NWFPs labelled as organic products are imported exclusively from Cameroon and distributed through shops specialising in natural and dietetic items, the numbers of which are increasing in France and throughout Europe. For the moment, these two sectors involve rather small amounts of NWFPs and remain poorly understood, due to a lack of both reliable official statistics and assistance from the importers who were contacted. However, retail prices are high.

The development of this market offers interesting possibilities for improving income among rural Africans, provided their production is adapted to market requirements for quality, quantity and regular availability. The impact of anticipated growth in European demand for organic, ethnic and dietetic products on biodiversity conservation in Central Africa should also be analysed carefully. It would be useful to conduct a quantitative analysis of the volumes of products being traded at each stage of the distribution chain and prices received at each level from the producer to the consumer.

**Key words:** market, Central Africa, non-wood forest products, Europe, rural populations

## 1. Introduction

Like other tropical regions, Central Africa is rich in resources referred to as non-wood forest products (NWFPs). Known and used for many years by local populations, they have been studied by many African and western researchers (Ake-Assi, 1985; Makita-Madzou, 1985; Hladick and Hladick, 1989; Stevels, 1990; Tabuna, 1993; Bourobou, 1994; Schneemann, 1994; Ndoye, 1995; Mialoundama, 1996; Silou, 1996).

In Central African countries, a proportion of these NWFP resources satisfy household consumption, whilst the remainder is sold in local and regional markets. Other products such as *Gnetum africanum* are exported to some European countries such as France and Belgium, where food and medicinal NWFPs have been increasingly commercialised over the past two decades. Initially, this trade was exclusively targeted at people from Central Africa resident

in Europe. However, this market is expanding towards European consumers and spreading to countries such as the United Kingdom, Germany and Switzerland. Considering the present growth of this market and the socio-economic benefits which derive from it for local suppliers (e.g. increased income, job-creation), it is an important aspect of NWFP research. This report presents the preliminary results of a study of the markets for NWFPs in Europe. Future work will involve a consumption survey which will be carried out on African and European consumers in Paris and Brussels. This will be followed by a second study stage devoted to assessing the optimum means for the African-based suppliers to access markets.

## 2. Methodology

This study aims to contribute to the development of NWFPs in Central Africa and Europe. Thus, this work has four main objectives:

- To assess how the existing markets work and are organised;
- To study the evolution of this trade and its development prospects;
- To identify impediments on the markets and needs of wholesalers;
- To define the conditions for gaining access to this market.

To achieve these goals, we have used the general ethnobiology methodology developed by Porteres (1961) and Barrau (1971). This approach was used by Woldesselassie (1989) for his work on African food and food plants in Paris, and by Baruto Walujo (1985) for his work on the plant products sold in the Asian stores of the Paris region.

For this study, the following activities were undertaken:

- Contacting Africans living in Paris in order to evaluate the selling points of African products;
- The identification of Central Africans involved in the sale and use of NWFPs;
- The identification of the commercial name of the NWFPs sold and the photographic recording of the products on display;
- The collection of samples of the NWFP for scientific identification;
- The identification of the retailers in order to assess the structure of the trade network;
- The interviewing of the various players in the network.

## 3. Imported products and their destination

The imported NWFPs come from wild-harvest sources as well as from cultivated sources. Our work has identified over 44 NWFPs commonly sold in Europe (See appendix). Fourteen come from the wild, 24 from agroforestry and six come from both wild and cultivated sources. These products fall into two groups: raw and transformed products. They are mainly imported from Cameroon and DRC. Perishable products are transported by air, while most transformed NWFPs (e.g. palm oil) are shipped by sea.

Among the most frequently imported NWFPs are the fumbua or koko (*Gnetum africanum* and *G. buchholzianum*), cola nut (*Cola nitida*), safou (*Dacryodes edulis*), djansang (*Ricinodendron heudelotii*), bush mango (*Irvingia gabonensis*), pepe or peve (*Monodora myristica* or *Monodora tenuifolia*), bitter kola (*Garcinia kola*), ndolé (*Vernonia amygdalina*), saka-saka (*Manihot esculenta*), mushrooms and caterpillars. Some of the more traditional tropical fruits such as avocados, mangoes and many varieties of banana, cultivated in village orchards and other agro-forests, are also widely traded. Because of a lack of statistics on the value and volumes traded, it is difficult to quantify this trade. However, the trade in African NWFPs is known to employ several hundred persons in France and Belgium.

#### **4. The ethnic market**

In France and Belgium, the history of trade of African products is linked to the immigration of people from sub-Saharan Africa. According to Poiret (1996), before the wave of independence in the 1960s, this immigration mainly concerned West-Africans. Therefore, only sub-Saharan products were available. The Central African NWFP market started developing in the 1960s in France and Belgium. The pioneers of this activity, often Europeans, ran grocery stores and were also street vendors in African meeting places such as the 'African House', or the DRC 'Student Hall' in Brussels. Gradually, this market developed and reached its peak level in the mid 80s when the law on family reunion was passed in France, allowing family members to join people of Central African origin studying or working in the country.

#### **5. Demand and its evolution**

Demand is comprised of two consumer categories:

- The nationals of Central African countries resident in Europe;
- Persons who recently discovered the products on a trip to Africa.

Central African natives number 13 000 in Brussels, according to the latest census by the National Statistics Institute (SNI). In France, according to the results of the census by the INSEE, the population of Central Africans is 60 604 people; a total of 73 000 in both countries. However, this is only the registered population and, if those not yet registered or those who now have French or Belgian nationality are taken into account, there are close on 100 000 potential customers for African NWFPs.

#### **6. The selling points**

NWFPs are available in two kinds of stores; the "local tropical groceries" and in the "neighbourhood tropical markets".

##### **6.1. The local tropical groceries**

In Paris, there are around 50 local tropical grocery stores, many of which have been established since 1982. These shops are always well-stocked and offer a wide range of products from Africa, notably smoked and salted fish, cosmetics, newspapers, and, most importantly, fresh produce. Products are generally displayed on two kinds of stalls: fresh produce on mobile stalls outside the shop, and the less perishable products are displayed inside on fixed shelves.

##### **6.2. Neighbourhood tropical markets**

Before the development of the local tropical groceries, the neighbourhood tropical markets were the only Central African NWFP outlets. They were simple grocery shops scattered throughout Paris. Neighbourhood tropical markets are less well stocked than local tropical grocery stores and are located in cities with large African suburban populations such as Paris and Brussels. The choice of products is limited, especially for fresh NWFPs. According to importers and wholesalers, the number of neighbourhood tropical markets is increasing. First clustered in central Paris, neighbourhood tropical markets spread first to the Paris suburbs and then on to other large French cities. The numbers have grown from six in the late 1970s to around 100 in Paris and its suburbs. They are run, in most cases, by Asians, although sometimes by Africans.

## 7. The products sold on the ethnic market

### 7.1. Imported products

The majority of imported NWFPs arrive at ethnic markets, the first destination of most of the imported products from Cameroon and DRC. These fall into two groups: regularly imported products that are available all year round (e.g. cassava leaves, bush mango kernels) and seasonal products (e.g. the fruits of *Dacryodes edulis*; the larvae, *Ryncophorus phoenicis*, a grub found in the apex of the oil palm, *Elaeis guineensis*, also belongs to this category).

### 7.2. Quantities imported

Because of the absence of official statistics on African NWFPs, it is very difficult to quantify the trade volumes. However, it has been possible to estimate the most commonly imported products to France, and these are:

- Fresh and dried leaves of *Gnetum* spp. (fumbua)
- Leaves of ndolé (*Vernonia amygdalina*)
- Fruits of *Dacryodes edulis* (safou)
- Cassava leaves (*Manihot esculenta*)
- Kernels of bush mango (*Irvingia* spp.)
- Leaves of *Corchorus olitorius* (dongo-dongo ya makasa)
- Cola nuts (*Cola acuminata*)
- Bitter kola (*Garcinia kola*)
- Djansang (*Ricinodenron heudelottii*).

## 8. The actors and distribution network

Four main actors are involved in the distribution of NWFPs in France and Belgium; the importers, the wholesalers, the retailers and the consumers. Some importers and retailers combine these different functions (import, wholesale and retail).

### 8.1. The importers

The NWFP importers can be divided into three groups: fixed, itinerant and occasional importers. The fixed importers handle large volumes of food NWFPs and other products (smoked fish, drinks, cosmetics, etc.) targeted at people from tropical regions. They obtain their stock from West and Central Africa or other tropical regions, and are either of African or European origin. They import both fresh and transformed NWFPs. Recently, however, some European importers have given up trading in fresh products and left that to African importers. The primary reason for leaving the trade being the difficulty of obtaining adequate supplies of stock and its uneven quality. This was the case for two French companies, Anarex and Racine, which specialise in the importation of African food crops. The majority of NWFP importers buy their products in Central Africa through a local partner or purchasing agent who is in contact with the in-country markets and suppliers (farmers and manufacturers). The commercial links with the latter are usually exclusive, as stated in the terms of their contracts.

Itinerant importers regularly import fresh and transformed products. The volumes imported are often small and are delivered to the clients on the same day the goods are unloaded at Roissy airport in Paris. They have no storage facilities and try to avoid having to handle large amounts of stock. Occasional importers are often retailers or people on holiday who take advantage of trips to Central Africa to import goods on their return. The quantities

involved are very small, with some of the products going for domestic consumption and the remainder often sold to neighbourhood tropical markets and local tropical groceries.

## 8.2. The wholesalers

In the NWFP trade in Paris and Brussels, there are no independent wholesalers. Instead, wholesaling is done by the fixed and itinerant importers. There are as many importers as there are wholesalers (about three in Brussels and around ten in Paris).

## 8.3. The retailers

In France and Belgium, retail sale of NWFPs is almost exclusively in the hands of Africans and Asians, and very rarely, of Europeans (as is the case in Brussels). There are three kinds of retailers; independent fixed retailers, integrated fixed retailers and itinerant retailers.

Independent and integrated fixed retailers are mainly Asians. Their outlets are the neighbourhood tropical markets and local tropical grocery shops. They sell products targeted at people from Central African and other tropical regions (West Africa, West Indies, Latin America, etc.). Their success may lie in the fact that they come from the merchant classes in their country of origin and that they are often provided with capital by their community (Ma Mung, 1996). The entrepreneurial Bamileké ethnic group of Cameroon also play an important role in the retail business.

Independent fixed retailers from Central Africa have specialised in the retail sale of products from their country of origin such as *Dacryodes edulis*, or *Gnetum*. Thus, a typical NWFP from Congo can only be found at a retailer originating from this country and this "local factor" is therefore important in the behaviour of the consumer. This attitude can also be justified by the absence of any kind of label indicating quality of the products. Consumers go to the grocery shops owned by fellow nationals, in whom they have more confidence.

## 8.4. The consumers and the products

Although all consumers come from Central Africa, they do not all buy the same products. Except for the fruits of *Dacryodes edulis*, NWFP consumption is national and not regional. For example, saka saka (cassava leaves), koko (sugar cane) and fumbua (*Gnetum* spp.) are targeted at nationals from CAR, Gabon and DRC. In contrast, products such as djansang (*Ricinodendron heudelotii*), miondo (processed cassava) and ndolé (*Vernonia amygdalina*) are bought only by people from Cameroon.

## 8.5. Distribution networks

NWFPs are distributed in France and Belgium through three types of chains: the direct, short and long tracks.

### 8.5.1. The direct track

The ultra short track has two actors: the importer and the consumer with the products going straight from one to the other. It is a system of direct sale. This type of distribution was found twice in Brussels and once in Paris. One portion of the imported product goes to the wholesale business and the other to direct retail in the importer's own grocery.

Importer .....Consumer

### 8.5.2. The short track

This has three actors: the importers, the retailers or restaurant manager, and the consumer. The products go through the hands of an intermediary before reaching the consumer. This distribution strategy can be found in Brussels, Paris, Lyon and Montpellier.

Case 1:           Importer.....Retailer.....Consumer

Case 2 :         Importer.....Restaurant Manager.....Consumer

### 8.5.3. The long track

This has at least four actors, and can only be found in French cities such as Montpellier, Toulouse, Bordeaux and Marseille, where there are no importers. Retailers usually have to obtain their stock from the Paris-based retailers. Thus, the product goes through the Paris retailer (retailer 1) and a second retailer (retailer 2) or restaurant manager, before it reaches the consumer.

Case 1:           Importer.....Retailer 1.....Retailer 2.....Consumer

Case 2:           Importer...Retailer 1...Retailer 2...Restaurant Manager....Consumer

## 9. Prices

Pricing of Central African NWFPs is not subject to any particular regulation. Enquiries undertaken between January and July 1997 revealed the existence of certain products with stable prices (e.g. *Gnetum*, cassava leaves, ndole) which do not seem to be affected by changes in supply and demand. On the other hand, the price of certain fruits, such as *Dacryodes edulis*, fluctuate depending on the quantities circulating within the market.

According to many retailers, the majority of consumers find the prices too high and this often limits purchasing (Boudimbou, 1991). However, these high prices can be explained by the numerous losses sustained during transportation and the costs of air freight and customs. A lowering of e prices would necessitate an increase in volume and the establishment of better conservation techniques for fresh vegetables and fruit, both in Africa and during transport by air.

## 10. Advertising and promotion

The commercialisation of NWFPs is undertaken without any advertising policy. The majority of importers and retailers communicate with consumers through word-of-mouth and the display of their products being sold. Many shops, notably those run by Africans, have signs indicating the country of origin of the manager and the origin of the products.

The utilisation of these methods of communication is explained by two main reasons: the absence of large budgets for communication and restriction of the commerce to natives of Central Africa who already know the products well in terms of quality, seasonality, dates of arrival, utilisation and the retailers who sell the desired products. However, it is fair to say that some companies are developing advertising for the products, in particular European importers in Brussels such as "Exotic Foods" and "Tropical Taste". The products are imported from Central Africa in bulk and packaged in Brussels according to European legislation, indicating the country of origin and the sell-by date. This innovation is used by companies from Cameroon for several products such as ndolé and frozen cassava leaves.

## **11. Limitations to the growth of the network**

The expansion of the NWFP trade in France and Belgium is encountering several obstacles. In addition to the lack of any regulation in Europe on the importation of these resources, the majority of the impediments are to be found in the exporting countries (Guichard, 1991; Dalle, 1991). For the importers, the main bottlenecks are:

- The absence of any institutional framework for the management of the NWFP markets in Africa;
- The poor organisation of the network in Central Africa;
- The absence of transportation infrastructure (roads) for the rapid shipment of the products between production zones and the nearest major town;
- The lack of cold storage facilities at airports;
- The irregularity of supply and non-compliance of products to European regulations;
- The absence of quality control of the products by the exporters;
- Administrative inefficiency in the export departments.

## **12. Future prospects for the development of the NWFP trade**

All importers interviewed are convinced of the continuing growth of the trade in NWFPs from Central Africa. This growth should follow two paths:

- The improvement and development of existing outlets
- Prospecting new outlets.

### **12.1. Improvement and development of the NWFP market**

The improvement of the existing market will have to address certain constraints: harmonising of the regulations on the imports of NWFPs into Europe, regularity of fresh products, increasing the size of NWFP outlets, improvement of packaging and conditioning of products, and of the reception and informing of the customer, development of transformed NWFPs and frozen products, growth of mini-markets and price reduction or discounting. These tasks, to be undertaken in Europe, must be complemented by an organisation of production and the implication of other participants in the network from the Central African countries as well as from Europe (customs, forwarding agents, air transporters, etc.).

### **12.2. Extension of the market to other European countries**

Our study reveals that NWFP trade is moving towards other European countries such as the United Kingdom, Germany and Switzerland. In addition to these three countries, the market should include Portugal, where there is an important community of people from DRC and Angola. The latter, having spent a long time living in DRC during the Angolan war, are consumers of many NWFP products from Central Africa. It would thus be advantageous for importers to target this population settled for the most part in Lisbon.

### **12.3. Opening up trade to the European consumer**

For some years demand has been growing in Europe, especially in France, for food products from overseas (Volatier, 1997; Gillet, 1997; Normand, 1995; CDI, 1997). This change in the pattern of consumer demand can be explained by globalisation, the frequency of visits made by Europeans to distant countries and the acquisition of new tastes, etc. Studies carried out in France and published in the *Ethnic Food News* (1997) show that 37% of consumers today buy ethnic foodstuffs. The typical consumer is identified as being young, urban and successful. Professionals thus believe that the market will develop through a generation effect. Consumers who are now 25 years old will doubtless continue to buy for the next 40 or

50 years. Unfortunately, present statistics show an absence of African products in this segment of the market. Considering its size and purchasing power, the European consumer is an important potential outlet for the NWFPs of Central Africa.

### **12.5. The development of the organic NWFP market of Central Africa**

Through the initiative of an importer from Cameroon, EXODOM, in 1979, the organic market represents the second largest market in France for NWFPs from Central Africa. Imports, for the moment limited to this importer, total 160 tons per year, representing a value of FF 2 000 000. According to the manager of this company, the volume of products imported is far below the present demand, which is increasing constantly in France. Therefore, important market opportunities exist for new suppliers both in France and in other consumer countries (especially the United Kingdom, Germany, Netherlands and Denmark). The products imported by EXODOM are destined for French consumers and sold through retail outlets for organic and natural products (specialised shops, organic supermarkets, mini-markets and dietetic or healthfood shops, etc.). For the time being the activities of EXODOM are mainly concentrated in France.

The market for organic products has existed in Europe since the beginning of the 1980s. It is now in constant growth though its size remains modest (Reynaud, 1996; Buley, 1997). Its share of the market is 1% at present and should reach 2.5% in the year 2000 (Bio Convergence, 1997). Moreover, prices are higher than those observed in the conventional market and, depending on the product, they can be three to four times greater. Organic dessert bananas from the forest gardens of Cameroon are sold at a retail price of FF 24 per kg while at the same time dessert bananas of non-organic origin from the same country are sold in retail chains at FF 8. This gap in the market would therefore seem to represent an opportunity for the producers, on the condition that they comply with the regulations for organic agriculture established by the European Union (Reynaud, 1997). These require that all products sold under the organic label be produced by agricultural practices that do not use chemical fertilisers and protect the environment.

### **12.6. Development of African restaurants**

The number of African restaurants in France, as well as in other European countries, is rapidly increasing (Leroux, 1996; Defrance, 1996). Despite this, Asian restaurants are still the most popular ethnic restaurants followed by Mexican, Middle Eastern, Caribbean, North African and Indian restaurants and dominate the market for ethnic food. A marketing effort therefore is necessary in order to make known the richness and variety of the African cuisine to the discerning European consumer (Andriamirado, 1997).

### **12.7. Other possible outlets for NWFPs**

Apart from the two existing types of outlets, NWFP foodstuffs could also be directed towards:

- the market for dietetic and health foods;
- the association for fair trade based in Northern Europe.

#### **12.7.1. The market for dietetic and health foods**

Like the market for organic products, the demand for dietetic foodstuffs is rapidly expanding in France and elsewhere in Europe. The emergence of this market is explained by the fact that consumers are increasingly concerned with health and quality. Food scandals and the utilisation of transgenics are the main causes for the development of this outlet (Gunning,

1998). Dietetic food products include among other things: artificial sweeteners, substitute foods, appetite suppressing products, isotonic products, isotonic drinks and energising foodstuffs. This represents a turnover of FF 1 719 billion and its growth rate varies between 2 and 5 % per year (*ibid.*). Products such as the fruits of *Pentadiplandra brazzeana*, much appreciated by the pygmy children (Hladick, 1989), can be targeted for this market.

The market for energising foodstuffs now represents FF 237 million in 1997 in sales and its growth rate is 5% per year (*ibid.*). It is in full expansion, notably in so far as energising drinks for the young are concerned. Products such as pepe or mpeve (*Monodora myristica* or *Monodora tenuifolia*), the kola nut (*Garcinia kola*) and mudongo (*Aframomum melegueta*), used as ingredients in the manufacture of ginger juice much used in Central Africa, could thus be destined for this market.

### **12.7.2. Fair trade**

Created in 1964 in England (EFTA, 1995; Bowen, 1997), fair trade practices are promoted by associations whose aim is to promote the development of autonomy and emancipation through the establishment of commercial relations based on fair trade. These organisations buy directly from the producer of foodstuffs and craft products at reasonable prices. The profits are transferred back to the producers to be invested in the further development of their activities. This concept constitutes an alternative market for several countries in Central Africa. In Europe, there are now some 70 000 merchants involved in this type of trade, which is growing at a rate of 5% per year (Bowen, 1997). A number of co-operatives in Asia and South America market their products by means of this channel.

## **13. Conclusion**

At the present time three types of outlets for NWFP food products and medical supplies from Central Africa exist in France and Belgium; the ethnic market, the organic market and African restaurants. Constantly developing since their creation, these markets should continue to expand, given the growth of the demand for ethnic and organic products in France and elsewhere in Europe. The growth of catering outside the home should play an important role in the spread of African cuisine. Other emerging markets could also contribute to this trend. These include the healthfood market and the fair trade market. In order to penetrate these profitable markets, the organisation and adaptation of the channels from the producers to the importers is indispensable. An efficient marketing-mix (policy on products, distribution, price and promotion) must be established in Europe by those participants interested in these products.

This work must be complimented in Africa by the organisation of the channels from production through to exportation, and the establishment of an institutional framework promoting NWFPs in Europe. The aim is to ensure that supply and demand develop in parallel and that the products satisfy the expectations of the European clients on the one hand, and improve the income of the producers on the other. This is a big challenge and may be difficult, but it is not insurmountable. Working progressively, it is clear that the NWFPs of Central Africa will be able to follow the commercial path taken by numerous tropical products that are now sold in large quantities on the international market (avocados, mangoes, bananas, etc).

## References

- Ake-Assi, L. *et al.*, 1985. Contribution aux études ethnobotaniques et floristiques en République Centrafricaine. ACCT, Paris.
- Andriamirado, V. 1997. L'Afrique à table. *Jeune Afrique*. No. 1900, Semaine du 4 au 10 Juin.
- Barrau, J. 1971. L'Ethnobotanique au carrefour des sciences naturelles et des sciences humaines. *Bull. Soc. Bot. De France* 118 :237-248.
- Bercy-Expo, 1997. L'Europe Bio. La France sur les traces de l'Allemagne, de l'Autriche et du Danemark. Paris.
- Boudimbou, G. 1991. *Habitat et mode de vie des immigrants africains en France*. L'Harmattan. Paris.
- Bourobou-Bourobou, H. 1994. Biologie et domestication de quelques arbres fruitiers de la forêt du Gabon. Thèse de Doctorat de l'Université de Montpellier II. 320p.
- Buley, M. 1997. Le marché des produits biologiques. Séminaires sur "Les opportunités et contraintes des produits biologiques" à Maurice. COLEACP, CDI et PROTRADE.
- CDI, 1997. Les saveurs caribéennes à la conquête de l'Europe. *Le courrier Afrique Caraïbe Pacifique*, no 166: 99-100.
- Chandrasekharan, C. 1995. Terminology, definition and classification of forest products other than wood. *In International Expert Consultation on Non-wood Forest Products*. FAO Non-wood Forest Products No. 13.
- Chirouze, Y. 1993. *Le marketing: les études préalables à la prise de décision*. Ellipses, Paris.
- Cunningham, A.B. & F.T. Mbenkum. 1993. Sustainability of harvesting *Prunus africana* bark in Cameroun. *People and plants working paper* No.2.
- Dalle, F. 1991. Mieux connaître les fruits et légumes frais pour réussir l'adaptation de l'offre à la demande des consommateurs. *In Production de fruits et légumes frais dans les pays ACP pour l'exportation vers de la CEE*. CTA, Wageningen.
- Defrance, J. 1997. Cuisine ethnique: Un petit marché prometteur que les britanniques convoitent. *Produits frais*. Mars.
- Doumenge, C. 1992. La réserve de Conkouati: Congo, le secteur sud-ouest. UICN. Gland.
- Gandoulou, J.D. 1989. *Au cœur de la sève, mœurs et aventures des congolais à Paris*. L'Harmattan. Paris.
- Gillet, C. 1997. Le marché des produits ethniques. Communication à l'ouverture du 1er Salon Ethnic Food Show. Bercy Expo, Paris. 5p.
- Guichard, J. 1991. Les enjeux du commerce ACP/CEE des fruits et légumes frais. *In Productions de fruits et légumes frais dans les pays ACP pour l'exportation vers les pays de CEE*. CTA, Wageningen.
- Gunning, A. 1988. Le point sur le marché français des aliments santé et compléments nutritionnels. *In Les aliments santé et compléments nutritionnels: Croissance assurée, positionnement incertain?* Bercy-Expo, Paris.
- Hernandez, A. 1993. La dynamique de la consommation des fruits exotiques en Europe. DEA Economie du développement agricole et agro-alimentaire. ENSAM, Montpellier.
- Hladick, C.M. 1989. Les produits de la forêt dense. *In Hladick, C.M., S. Bahuchet, & I. De Garine I. (eds). 1989. Se nourrir en forêt équatoriale. Anthropologie alimentaire des populations des régions forestières humides d'Afrique*. UNESCO/MAB, CNRS, Paris.
- Kengue, J. & J. Nya Ngatchou J. 1994. Le safoutier: The African pear. Proceedings of the domestication of the African pear. Douala, 4-6 October.
- Le Roux, S. 1996. "Plats ethniques:" les Anglais donnent l'exemple. *L.S.A.*, No 1492.
- Light, I. 1972. *Ethnic enterprise in America*. University of California Press, Berkeley.
- Light, I. 1984. Immigrant and ethnic business in North America. *Ethnic and racial studies*, Vol. 7: 196-216.

- Makita Madzou, J.P. 1985. Etude morphologique et phytogéographique des fruits comestibles de la flore spontanée du Congo. Thèse de Doctorat 3<sup>ème</sup> cycle. Université d'Orléans.
- Ma Mung, E. 1992. L'expansion du commerce ethnique : asiatiques et magrhebains dans la région Parisienne. *Revue européenne de migrations internationales*. Pp. 39-60.
- Ma Maung, E. 1996. Le développement de l'entrepreneuriat ethnique en France. In *Mobilités et investissements des émigrés Maroc, Tunisie, Turquie, Sénégal*. L'Harmattan, Paris.
- Mialoundama, F. 1996. Nutritional and socio-economic value of *Gnetum* leaves in Central African forest. In Hladick, C.M., Hladick, A., Linares, O.F., Pagezy, H., Semple, A. & Hadley, M. (eds.) *Tropical forests, people and food : biocultural interactions and application to development*. UNESCO.
- Ndoye, O. 1995. The markets for non-timber forest products in the humid forest zone of Cameroon and its borders: Structure, conduct, performance and policy implications. Report to CIFOR. Bogor, Indonesia.
- Normand, J.M. 1995. Les plats et saveurs venus d'ailleurs rencontrent un succès commercial et culturel grandissant. *Le Monde*, 30th Septembre.
- Porteres, R. 1961. L'Ethnobotanique : Place, Objet, Methode, Philosophie. *Journal de l'Agriculture Tropicale et de Botanique. Appliquée*. Vol. 8, 4-5: 101-109.
- Ragot, S. 1997. Matongue: chroniques congolaises. *L'autre Afrique*, No. 6.
- Rastion, J.L. 1993. Fruits exotiques: Un marché porteur. *L'echo des marchés*. Paris.
- Raulin, A. 1992. Commerce, consommation ethniques et relations intercommunautaires. *Migrations Etudes*. 25th Février.
- Reynaud, M. 1996. L'agriculture biologique. Une nouvelle voie d'exportation pour l'Afrique. *Bulletin du reseau. TPA*. No. 12: 19-20.
- Schneemann, J. 1994. *Etude sur l'utilisation de l'arbre moabi dans l'est-Cameroun*. Rapport final. SNV.
- Schneemann, J. & Dijkstra, W. 1994. Rapport sur la commercialisation des produits de cueillette et des articles d'artisanat dans la province de l'Est-Cameroun ; Arrondissements de Mbang et Yokadouma. Projet Intégration socio-économique des pygmées Baka, SNV/MINASCOP.
- Silou, Th. 1996. Le safoutier (*Dacryodes edulis*): Un arbre mal connu. *Fruits*. Vol. 51 (1): 47-60.
- Stevens, J.M.C. 1990. Légumes traditionnels du Cameroun, une étude agrobotanique. *Wageningen Agriculture University Papers* 90-1.
- Tabuna, H. 1993. La commercialisation du safou (*Dacryodes edulis*) à Brazzaville. Rapport de mission. CIRAD-SAR.
- Volatier, J.L. 1997. La consommation ethnique : une autre façon de découvrir les nourritures terrestres. *Ethnic Food News*, No. 1: 3-4. Bercy Expo, Paris.
- Woldesselassie, O. 1989. *Etude ethnobotanique des plantes africaines vendues dans les boutiques exotiques à Paris*. DEA Université Paris 6.

**Appendix:** . List of NWFPs imported from Central Africa and sold in Europe (C: Cameroon; CA:Central African Republic; CK: Congo Kinshasa; CB: Congo Brazzaville; G: Gabon).

Species	Family	Vernacular name	Trade name	Status	Part sold
<i>Abelmoschus esculentus</i> (L.) Moench	Malvaceae	dongo dongo (CK,CB)	gombo	cultivated	fruit
<i>Afrostryax lepidophyllus</i> Mildbraed	Styracaceae	omi (C)	omi	spontaneous	bark
<i>Aframomum</i> spp.	Zingiberaceae	m'bongo (C), Nzo za nungu (CB)	maniguette	spontaneous	fruit dried/fresh
<i>Amaranthus hybridus</i> L.	Amaranthaceae	bitekuteku (CK), badi (CB)	bitekuteku	cultivated	leaves
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	pineapple (CK,CB,G,C,CA)	ananas	mixt	fruit
<i>Arachis hypogea</i> L.	Fabaceae	nguba (CK,CB), groundnut (C)	arachide	cultivated	seed
<i>Artocarpus communis</i> Forst	Moraceae	jack fruit	Jack fruit	mixt	fruit
<i>Basella alba</i> L.	Basellaceae	épinard	spinach	cultivated	leaves
<i>Cajanus cajan</i> (L.) Millsp	Fabaceae	petit haricot (C)	beans	cultivated	seed
<i>Capsicum annum</i> L.	Solanaceae	pilipili (CK), pidi pidi (CB), piment	pilipili	cultivated	fruit
<i>Carica papaya</i> L.	Caricaceae	papaye (C,CK,CB,G,CA)	papaye	cultivated	fruit
<i>Cola nitida</i> A. Chev.	Sterculiaceae	makazu(CK,CB), noix de cola (C,CA)	kola	mixt	seed
<i>Colocasia esculenta</i> (L.) Schott.	Araceae	taro (CK,CB,CA,C,G)	taro	cultivated	tubercule
<i>Cucurbita maxima</i> Duch	Curcubitaceae	m'bika (CK,CB), graine de courge, C	graine de courge	cultivated	seed
<i>Corchorus olitorius</i> Per ex DC	Tiliaceae	dongo dongo ya makasa (CK,CB)	gombo	cultivated	leaves
<i>Cymbopogon citratus</i> (DC) STAPF	Poaceae	lemon grass	citronnelle	cultivated	dried leaves
<i>Dacryodes edulis</i> (G. Don) Lam.	Burseraceae	safou (C,CK,CB,CA,G)	safou	mixt	fruit
<i>Elaeis guinensis</i> Jacq	Arecaceae	m'bila (CK,CB), noix de palme (C,G)	noix de palme	mixt	fruit, oil, beverage
<i>Garcinia kola</i> Haeckel	Clusiaceae	petit cola (C), démarreur (C)	petit cola`	spontaneous	seed
<i>Gnetum</i> spp.	Gnetaceae	fumbua (CK,CB), okok (C), koko (CB,CA), eru	fumbua	spontaneous	leaves
<i>Hibiscus sabdariffa</i> L.	Malvaceae	ngai ngai (CK,CB)	ngai ngai	cultivated	leaves
<i>Hua gabonii</i> Pierre	Styracaceae	omi (C)	omi	spontaneous	fruit dried
<i>Ipomoea batatas</i> (L.) Lam	Convolvulaceae	m'bala (CK,CB), patate douce (C,CA)	patate douce	cultivated	tubercule

<i>Ipomoea</i> sp.	Convolvulaceae	matembele banki (CK)	matembele banki	cultivated	leaves
<i>Irvingia gabonensis</i> Baillon	Irvingiaceae	sioko (C)	sioko, mango	spontaneous	seed
<i>Landolphia</i> sp.	Apocynaceae	malombo (C)	malombo	spontaneous	fruit
<i>Lippia adoensis</i> Hochst	Verbenaceae	bulukutu (C)	bulukutu	spontaneous	leaves dried
<i>Luffa cylindrica</i> M. Roem	Cucurbitaceae	liniuka (CK), nsania (C),	éponge végétale	cultivated	fruit dried
<i>Mangifera indica</i> L.	Anacardiaceae	mangolo (CK)	mangue	cultivated	fruit
<i>Manihot esculenta</i> Grantz	Euphorbiaceae	saka saka (CB), pondu (CK)	saka-saka	mixt	leaves
<i>Mondia whitei</i> Skeels	Periplocaceae	mundjodjo (CB)	mundjondjo	spontaneous	root
<i>Monodora miristica</i> L.	Annonaceae	pèpè (C)	pepe	spontaneous	seed
<i>Monodora tenuifolia</i> Benth	Annonaceae	pèpè (C)	pepe	spontaneous	seed
<i>Musa</i> sp.	Musaceae	banana	banane	cultivated	fruit
<i>Ocimum gratissimum</i> (L.) Forsk	Labiaceae	mantsusu (CB), lumbalumba (CK)	lumbalumba	cultivated	leaves
<i>Persea americana</i> L.	Lauraceae	avocado (C,CA,CK,CB,G)	avocat	cultivated	fruit
<i>Ricinodendron heudelotii</i> (Baill) Pax	Euphorbiaceae	djansang, dansan (C)	djansan	spontaneous	seed
<i>Solanum nigrum</i> L.	Solanaceae	bilolo (CK)	bilolo	cultivated	leaves
<i>Saccharum officinarum</i> L.	Poaceae	koko (CK,CB), sugar cane	fumbua	cultivated	stem
<i>Spondias cytherea</i> Sonn.	Anacardiaceae	pomme cythère	pomme cythère	cultivated	fruit
<i>Tetrapleura tetraptera</i> Tauba	Mimosaceae	caroube (C)	caroube	spontaneous	leaves
<i>Vernonia amygdalina</i>	Composaceae	ndolé (C)	ndolé	cultivated	tubercule
<i>Xanthosoma sagittifolia</i> Schott	Araceae	macabo (C), taro (CK,CB)	macabo	cultivated	seed
<i>Xylopia aethiopica</i> A. Rich	Annonaceae	ekolababa (C)	ekolababa	spontaneous	fruit

# MEDICINAL PLANTS AND FOREST EXPLOITATION

Robert Nkuinkeu

## Abstract

“Forest exploitation” in the minds of many people is often associated with the tropical timber trade. However, other non-wood forest products (NWFPs) such as medicinal plants, now provide the opportunity for a more seemingly benign form of forest exploitation that is also extremely profitable. Many laboratories throughout the world are currently studying the action and biochemical composition of African plants and recent scientific studies on the activity and toxicity of traditional medicines have shown a number of local medicinal plants are as efficient as the “Western” prescription medicine imported by many developing countries.

Undoubtedly, African medicinal plants can contribute to conservation and development through sustainable use in both *in-situ* and *ex-situ* situations, and if the appropriate legislation regarding the exploitation and management of medicinal plants is adhered to. Plantecam has for several years aimed at the conservation of Cameroonian medicinal plants through cultivation, as well as educating local communities in the management of the resource in the wild.

**Key words:** Medicinal plants, exploitation, Cameroon

## 1. Introduction

This paper will focused on three main areas of activity:

- The framework of research and identification;
- Harvesting and marketing;
- A discussion of the actions that have been taken by Plantecam to ensure the sustainable management of *Prunus africana* and other medicinal plants

## 2. Research and Identification

### The framework of research

Information on plants is obtained through extensive ethnobotanical surveys undertaken by Plantecam, supplemented through the perusal of existing literature, especially traditional pharmacopoeia. A wide variety of use categories are studied, for example:

- Plants with known veterinary uses (*Tephrosia vogelii*, *Swartzia madagascariensis*);
- Cosmetology (*Carapa procera*, *Alöe spp.*, *Calophyllum inophyllum*, *Myrianthus spp.*, *Pentadesma macrophylla*, *Allanblackia spp.*);
- Dietetic (*Adansonia digitata*, *Carica papaya*);
- Herbal (*Chrysanthellum americanum*, *Euphorbia hirta*, *Desmodium adscendens*);
- Pharmacological (*Prunus africana*, *Pausinystalia johimbe*, *Strophantus gratus*, *Tabernanthe iboga*, *Fagara macrophylla*, *Phyostigma venenosum*).

## Identification

Once the uses of species are established during the ethnobotanical surveys, authoritative identification is necessary. Voucher specimens are collected and through the use of keys and previously identified species, are then named. The determination of plant names allows further collection and development of the resource with the confidence that the same species previously shown to be useful can be recognised and re-collected.

## Index cards

For each plant, an index card is completed and is composed of the following information: phenology, taxonomy, natural distribution, morphology, life form, the possibility of domestication and the estimated accessible potential wild resource.

## 3. Harvesting

Plantecam harvests and trades in large quantities of a number of medicinal plants. These include the following species:

- *Prunus africana* (for the treatment of benign prostate hyperplasia);
- *Pausinystalia johimbe* (as a remedy for male organic impotence);
- *Voacanga africana* (a hyper-tensive);
- *Strophantus gratus* (heart tonic);
- *Physostigma venenosum* (for use in ophthalmology).

Medicinal plant harvesting is controlled by the preliminary obtention of an exploitation license of forest species; the prerequisites or qualifications are described in the *Forest, Faunal and Fisheries Regime* (Law No 94/01 of January 20th, 1994) and in the directions of use of this regime (Decree No 94/436 of August, 23rd 1994). The delivery of this license is accompanied with a report book describing clearly the harvesting practices according to the vegetative structure to be extracted. Plantecam uses its report book for *Prunus africana* debarking. Raw material received at Plantecam is supplied only by the holders of a valid exploitation licence and the company will not accept material without this license.

Before any harvesting activity takes place the following procedures are undertaken:

- A preliminary inventory to determine the potential harvestable resource;
- Training (theoretical or practical) of collectors in sustainable practices of debarking or gathering.

In the case of the exploitation of *Prunus africana* for example, an operational team is composed of a team leader, prospectors, de-barkers and porters. This team is supervised by a camp leader who regularly provides a report of the quantities harvested, the number of de-barked trees, and the quality of de-barking according to the report book. The assessment of this exploitation activity to determine the sustainability of the harvesting is based on the following information:

- A regular estimate of field work following the norms of the report notes book; this allows an appreciation of the long-term health of trees, and the time necessary before re-exploitation can take place;
- A general forest inventory: for example there has been an intensive inventory of *Prunus africana* on Mount Cameroon. This inventory was undertaken in 1996-1997 by ONADEF (National Board for Forest Development) at the request of Plantecam and the Mount

Cameroon Project. The results obtained have provided an overview of the density of *Prunus africana* and potential bark yield, thus permitting the potential for sustainable management of the remaining resource.

- A study of the natural stands of *Prunus africana* in certain key areas of Mount Cameroon with the aim of determining the rate of natural regeneration and hence future production.

### **Medicinal plant trade**

Raw material (seeds, bark, etc.) often undergoes processing such as grinding (as in the case of *Pausinystalia johimbe* bark) or full extraction (e.g. *Prunus africana*) prior to trading. Processing in-country maximises revenues and attempts are made to add as much value to each product prior to export. Without exception, all material processed at the Plantecam factory is exported. Trade of the medicinal plant products is controlled by Plantecam's parent company in Paris, Groupe Fournier, and their commercial department deals with all contracts and negotiations regarding the sale of both raw and processed products.

### **4. Plantecam and the sustainable management of medicinal plants**

To ensure the sustainable management of the medicinal plants exploited by the company, Plantecam has undertaken extensive cultivation trials with the objective of domesticating some key species as well as looking at the management of a number of these species in natural forest. This programme is comprised of a number of components:

- (i) Inventory and sensitisation of the local populations (chiefs of villages, medicinal plants exploiters, common interest associations, non-governmental organisations, local communities) through workshops, training courses for demonstration (nursery, forest) in the wise management of natural forest and potential for domestication of some key species;
- (ii) The integration of local communities in the protection and rational management of the forest through exploitation agreements such as the one signed with selected villages around Mount Cameroon. The immediate effects of this agreement are:
  - The control of illegal over-exploitation;
  - The improvement of farmers revenue and the development of social infrastructure in some villages (e.g. community hall in Mapanja);
  - The provision of planting stock of *Prunus africana* and a guaranteed market for future bark harvests from cultivated sources;
  - Controlled exploitation of wild trees under the supervision of Plantecam.
- (iii) Production of planting stock of high-value species through bulk seed propagation;
- (iv) Distribution of plants for plantations and agroforestry schemes with the ecological requirements of the species being taken into consideration prior to planting;
- (v) Monitoring of planted material in both plantations and agroforestry systems;
- (vi) Partnership with NGOs (Non Governmental Organisations), MINEF (Ministry of Environment and Forest) and research institutions such as the Limbe Botanic Garden to further the aims of forest conservation and sustainable exploitation;

- (vii) The promotion of *Prunus africana*, *Voacanga africana*, *Strophantus gratus* and *Physostigma venenosum* cultivation through an active extension programme;
- (viii) The creation of an arboretum in the factory location site, with the aim of acclimating medicinal plants. This arboretum has a wide collection of local and exotic plants species.



**Figure 1.** Plantecam nursery producing stock for replanting (Photo: Plantecam).

## 5. Summary

The sustainable development of medicinal plant exploitation depends on a combination of a number of factors:

- Research in agronomy, biochemistry, pharmacology;
- Appropriate legislation for the registration of traditional medicines ensuring the production of low cost medicine (herb tea, capsule, extract, syrup) for local people;
- A well-implemented forest policy ensuring that taxes due from exploitation are collected and equitably disbursed to the advantage of rural communities and those concerned with natural forest management;
- The provision of long concessions to medicinal plant exploiters thereby ensuring the interest of the company in the long-term health of the resource;
- The initiation of training programmes for trainers and extension workers for the popularisation of medicinal plant cultivation and appropriate associated agricultural practices (agroforestry; multi-strata culture);
- To make available information opportunities for medicinal plant development;
- The creation of a data bank for phytochemical, pharmaceutical, marketing and utilisation aspects of medicinal plant exploitation.



**Figure 2.** Confiscated bark of *Prunus africana* on Mount Cameroon (Photo: T. Sunderland).

## **NETWORKS AND INFORMATION EXCHANGE**

# AN OVERVIEW OF FAO'S PROGRAMME ON THE DEVELOPMENT OF NON-WOOD FOREST PRODUCTS

Paul Vantomme

## Abstract

This paper presents FAO's programme on the Promotion and Development of Non-Wood Forest Products (NWFPs). This global programme aims at enhancing the sustainable utilisation of Non-Wood Forest Products in order to contribute to the wise management of the world's forests and the conservation of their biodiversity, and to improve food security and income generation for rural people. The programme consists of three key elements: (i) gathering, analysis and dissemination of key technical information on NWFPs (including a presentation of those FAO technical publications of relevance to the products and topics discussed at this seminar); (ii) full appraisal of the socio-economic contribution of NWFPs; and (iii) improved networking among individuals, companies and organisations concerned with the promotion and the development of NWFPs.

## 1. What is FAO and how does it work ?

Established in 1945, FAO, the Food and Agriculture Organisation of the United Nations, is the UN's largest technical agency and is among the world's leading international agriculture, forestry and fishery technical development organisations. Today FAO has 174 member governments, a comprehensive regional representation structure (e.g. a Regional Office for Africa, Europe, Asia, Latin America, Near East and North America; and with sub-regional offices for Southern and Eastern Africa, Eastern Europe, Pacific, Caribbean and Mahreb countries), a physical presence in more than 100 countries and, at its headquarters in Rome, a cadre of specialists in agriculture, fisheries, forestry and related disciplines. The fact that FAO houses under the same roof, so to speak, all the major disciplines related to overall agriculture development puts it in a unique position with respect to the pursuit of holistic agricultural and agro-industrial development programmes, including those related to the sustainable production of NWFPs.

The primary roles of FAO are to serve as:

- a **neutral forum** to enhance dialogue on technical and policy issues (including international governmental meetings on agriculture, forestry, NWFPs, trade, natural resource management and conservation issues, etc.);
- a **source of information** and knowledge (technical information on products, methodologies and statistical data on production and trade in agriculture, forestry and fishery products);
- a **provider of technical assistance** (field projects to develop/introduce new products or technologies, to assist governments in institutional capacity building, etc.).

include non-wood forest products (including such preparatory work like developing appropriate and globally applicable NWFP definitions and classification schemes).

FAO is also a major source of information on forest science, technology and practice, and its Forestry Department develops and facilitates the exchange of technical information, often in multiple languages, on the environmental, economic and social dimensions of forestry. This includes, for example, information on the protection and management of forests and other natural resources, rehabilitation of degraded or marginal lands, tree planting, especially in a land-use context, enhancing the value, efficiency and environmental soundness of harvesting, utilisation and marketing of wood and non-wood forest products, policy analysis, planning and institution strengthening.

For a number of years, FAO has been pioneering work on the social dimension of sustainable forest management, with a focus on self-reliance and participatory approaches involving local communities. Through this community forestry initiative, FAO stresses decentralised planning, communal management of forests and tree resources, conflict resolution among user groups, equity issues, the role of gender, and the contribution of forests, trees, and NWFPs to food security and nutritional well-being.

FAO's Forestry Department has published many publications on the issues dealing with sustainable forestry development. However its flagship publication is the "State of the World's Forests" (SOFO), a report published every two years, which provides a comprehensive overview of the status of the world's forests and their products (including NWFPs). More detailed information regarding FAO's activities and publications can be obtained at its web site:

<http://www.fao.org/WAICENT/FAOINFO/FORESTRY/forestry.htm>

FAO's **NWFP Programme** consists of the following three main activities: a) information gathering, b) partnership building, and c) technical assistance.

### **Information gathering**

Successful implementation of programmes on NWFPs require comprehensive, quality information on the resources themselves, the forest ecosystems in which they grow, on their harvesting and processing practices, and on the marketing and trade aspects of these products. The collection, analysis, interpretation and dissemination of such information world-wide has been a priority of FAO from the very beginning.

Essentially, three types of information are provided:

- descriptive information on given NWFPs;
- information on technologies, methodologies and best practices for their production, harvesting, processing and marketing;
- production and trade statistics (including the required preliminary work on NWFP definitions and classifications).

The NWFP programme has two types of publications:

- The *Non-Wood Forest Products Series*: which are in-depth technical documents on specific NWFPs or issues. Examples of issues already published (11 so far) are:
  - Flavours and Fragrances of Plant Origin*;
  - Gum Naval Stores: Turpentine and Rosin from Pine Resin*;
  - Edible Nuts*;
  - Domestication and Commercialisation of NWFPs in Agroforestry Systems*,
  - NWFPs for Rural Income and Sustainable Forestry*;
  - Medicinal Plants for Forest Conservation and Health Care*;
  - Trade Restrictions affecting International Trade in NWFPs*.

The full list of the NWFP-related publications can be obtained upon request to FOPW, Forest Products Division, FAO Forestry Department.

- The *Non Wood News* bulletin which is a newsletter, published yearly by FAO of approximately 60 pages, compiling all relevant information on ongoing activities dealing with NWFPs world-wide, and for which text contributions are made by readers themselves. The bulletin links some 1,500 people, institutions and agencies which are involved in one way or another with the promotion and development of NWFPs. Five issues have been published so far. The newsletter is also available on Internet at: <http://www.fao.org/waicent/faoinfo/forestry/nwnews/default.htm>

### **Partnership building**

As FAO is an intergovernmental organisation, our main line of communication is with our member governments but it is not our only one. We need to receive and welcome input from a broad range of interest groups, including the private sector, universities, forest industries and non-governmental organisations representing environmental and developmental interests. There is need, therefore, to ensure collaboration and to avoid duplication of efforts so that skills and resources are utilised most efficiently.

To increase awareness on NWFPs and strengthen collaboration, networking and partnerships at the national, regional and global level, FAO's Non-wood Products Programme has organised:

- Two global expert consultations:
  - Social, Economic and Cultural Dimensions of NWFPs, Bangkok, Thailand, 1994;
  - Interregional Expert Consultation on NWFPs, Yogyakarta, Indonesia, 1995.
- The following regional expert consultations (organised by FOPW and/or in collaboration with other agencies):
  - Asia and Pacific Region, Bangkok, Thailand, 1991;
  - Anglophone African Countries, Arusha, Tanzania, 1993;
  - Latin America and Caribbean, Santiago, Chili, 1994;
  - Near East, Cairo, Egypt, 1997;
  - Boreal and Cold Temperate Forests, Joensuu 1998 (EFI/ECE).

To facilitate networking activities on NWFPs, a global *Directory on Who's Who on NWFPs* is under development. Through a questionnaire, all interested partners involved in one way or another with the development and promotion of NWFPs are being identified. This questionnaire form is available upon request to FOPW. The results of processing this questionnaire will lead to the development of a global Directory on "Who is Who" in the

field of NWFPs (including governments, private sector, universities, funding agencies, etc.). This Directory will serve as a base to identify relevant partners to further develop globally applicable (and acceptable) definitions and classification schemes for NWFPs, statistical knowledge on production and trade figures on NWFPs, and support to a better assessment of NWFP resources in the forests.

### **Technical assistance**

Developing and implementing sustainable production and conservation of NWFPs, with rigid product quality control, efficient marketing and an equitable distribution of benefits to all concerned along the full chain from the producer to the consumer, is a key component of a successful programme to achieve more sustainable management of all forest resources (wood and non-wood), including better conservation of their biodiversity.

To help put into practice policies and technologies on NWFP management, production and commerce, FAO offers technical assistance to all member countries. The objective of such assistance is to strengthen national capacities to effectively plan and carry out the full cycle of improving or introducing new products and or techniques for NWFP development in a sustainable manner. Technical project-level assistance covers most dimensions of sustainable NWFP development, but with emphasis on resource protection and management, information gathering and processing, improved people's participation through community forestry, enhancing food security and institutional strengthening.

At the project level, FAO is currently active in close to 200 forestry technical assistance projects in over 90 countries. For many of them NWFP activities are an essential component. Financial support for such projects comes from a variety of sources, including FAO, but especially from donor governments, the United Nations Development Programme (UNDP), the World Bank and others.

More detailed information on this Programme can be downloaded from:

<http://www.fao.org/WAICENT/FAOINFO/FORESTRY/NWFP/NONWOOD.HTM>

## NETWORKS WITH AN INTEREST IN NWFPs

Laurie E. Clark

Networks with interest in NWFPs	Publication frequency
ELCI	1x year (BP 90 Lakouanga, Bangui, RCA tel: 236 61 68 67 fax: 236 61 31 70)
PRGIE/REIMP (Le Projet Regional de Gestion et d'Information Environnementale/Regional Environmental Information Management Project)	Association pour le Développement de l'Information Environnementale (ADIE) Regional Coordinator: Jean-Roger Mamiah - Tel: +241 76 22 50/51 - Fax: +241 76 48 53 - adie@internetgabon.com <a href="http://www-esd.worldbank.org/reimp/">http://www-esd.worldbank.org/reimp/</a>
People and Plants	2x year
AETFAT (Association for the Taxonomic Study of the Flora of Tropical Africa)	2x year
FAO NonWood News	1x year (NonWood News - FOPW FAO, Viale delle Terme di Caracalla 00100 Rome, ITALY email: non-wood-news@fao.org <a href="http://www.fao.org/waicent/faoinfo/forestry/nwfp/nonwood.htm">http://www.fao.org/waicent/faoinfo/forestry/nwfp/nonwood.htm</a>
CEFDHAC (Conférence sur les Ecosystèmes des Forêts Denses Humides d'Afrique Centrale)	
IUCN Collaborative management network (International Union for Conservation of Nature and Natural Resources/ World Conservation Union)	
AFAN (African Forestry Action Network)	4x year (Zachee Nzoh Ngandembou, BP. 2503 Yaounde Cameroon Tel: +237.23.97.02 Fax: +237.23.97.02)
Forest, trees and people network	1x year ( Department of Rural Development Studies, Swedish University of Agricultural Sciences (SLU) Box 7005, 750 07 Uppsala, Sweden Tel. +46-18-672001 Fax: +46-18-673420 email: FTTP.Network@lbutv.slu:se <a href="http://www-trees.slu.se/index.html#desig">http://www-trees.slu.se/index.html#desig</a>
ASANET	2x year
ASCODAP	4x year
NAPRECA (African Network of Natural Product Chemists for Eastern and Central Africa)	1x year
RIAT	4x year

CORAF-FORET (Conférence de responsables de recherche agronomique africains)	2x year
ECOFAC (ECOsystèmes Forestiers d'Afrique Centrale)	5x year - Canopee
APFT (Avenir des Peuples des Forêts Tropicales)	12x year (Centre d'Anthropologie Culturelle CP 124 Université Libre de Bruxelles 44 avenue Jeanne 1050 Bruxelles, BELGIQUE Tel: 32.2.650.43.38 Fax: 32.2.650.43.37 email: cleger@ulb.ac.be <a href="http://lucy.ukc.ac.uk/Rainforest/">http://lucy.ukc.ac.uk/Rainforest/</a> )
TROPENBOS	3x year (Jelle Maas - Network Officer) Tropenbos Foundation, P.O. Box 232, 6700 AE Wageningen, The Netherlands Tel: 317 426 262 Fax: 317 423 024 Email: tropenbos@iac.agro.nl WWW: <a href="http://www.bib.wau.nl/tropbos/">http://www.bib.wau.nl/tropbos/</a> )
CIFOR (Center for International Forestry Research)	4x year (Director of Communications, Sharmini Blok, Center for International Forestry Research (CIFOR) P.O. Box. 6596, JKPWB Jakarta 10065, Indonesia Tel: +62(251) 622 622 Fax: +62(251) 622 100 E-mail: cifor@cignet.com <a href="http://www.cgiar.org/cifor">http://www.cgiar.org/cifor</a> )

## **APPENDICES**

## LIST OF ACRONYMS

asl	Above sea level
dbh	Diameter at breast height
CARPE	Central African Regional Programme for the Environment
CDC	Cameroon Development Corporation
CFA	Currency: Communauté financière africaine
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CTC	Conservation Through Cultivation programme (Cameroon)
DFID	Department for International Development (formerly ODA) UK
FAO	Food and Agriculture Organization of the United Nations
GTZ	German Agency for Technical Cooperation
HULWA	Humid Lowlands of West Africa (ICRAF geographic delimitation)
ICRAF	International Centre for Research in Agroforestry
IPGRI	International Plant Genetic Resources Institute
IRAD	Institut de Recherche Agricole pour le Developpement (Cameroon)
LBG	Limbe Botanic Garden
MAP	Months after planning
MCP	Mount Cameroon Project
MINEF	Ministry of Environment and Forestry (Cameroon)
NGO	Non-Governmental Organization
NWFP	Non-wood Forest Product
TCP	Tropenbos Cameroon Programme
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
UNESCO	United Nations Educational, Scientific and Cultural Organization

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**This volume contains the outcome of the International Expert Meeting on Non-Wood Forest Products in Central Africa, held at The Limbe Botanic Garden, Cameroon, from 10 to 15 May 1998. The report includes a summary of discussions, recommendations and background papers and is organized according to the four thematic areas considered by the consultation: ecological issues, socio-political issues, market-economic issues, and networks and information exchange. The 28 background papers give a comprehensive overview of the situation and prospects for the development of non-wood forest products in the countries of central Africa.**