Food and Agriculture Organization of the United Nations

NON-WOOD FOREST PRODUCTS
21
ISSN 1020-9727

Living in and from the forests of Central Africa

Living in and from the forests of Central Africa

Food and Agriculture Organization of the United Nations
Rome, 2017

Recommended citation: FAO. 2017. *Living in and from the forests of Central Africa.* Rome.

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of FAO and can in no way be taken to reflect the views of the European Union.

ISBN 978-92-5-109489-1

This publication has been printed using selected products and processes so as to ensure minimal environmental impact and to promote sustainable forest management.

Contents

Part II
Contribution of NWFPs to forest peoples' food security

Chapter 5
A plentiful source of good-quality food
(Florence Tonnoir)

Chapter 6
Bushmeat and forest peoples' quality of life
(Julius Chupezi Tieguhong and Jean Lagarde Betti)

Part III
NWFPs and their economic and social importance

Chapter 7
NWFPs help to generate income for poor households
(Verina Ingram, Awono Abdon and Jolien Schure)

Chapter 8
Immigration and the development of food NWFP exports from Central Africa
(Honoré Tabuna)

Part IV
Resource management: a highly complex issue

Part V
Building knowledge and maximizing the NWFP sector

Acknowledgements

This publication has been produced by the GCP/RAF/441/GER Project, Enhancing the Contribution of Non-wood Forest Products to Poverty Alleviation and Food Security in Central African Countries, financed by the German Federal Ministry of Food, Agriculture and Consumer Protection and implemented by FAO between October 2009 and April 2013 under the supervision of the Central African Forests Commission (COMIFAC). It also enjoyed the financial support of the European Union, the African Development Bank and the Congo Basin Forest Fund.

Coordination
Ousseynou Ndoye, Project Head, and Paul Vantomme, former FAO Senior Forestry Officer.

Contributors
Yaya Alhadji (GIC PRO3LOCAUX), Ebenezer Asaah (ICRAF), Armand Asseng Zé (FAO representation in Cameroon), Abdon Awono (CIFOR), Jean Lagarde Betti (Douala University), Ann Degrande (ICRAF), Divine Foundjem-Tita (ICRAF), Sophia Gazza (FAO), Coert J. Geldenhuys (Forestwood), Sophie Grouwels (FAO), Verina Ingram (Wageningen UR), William Armand Mala (SNV Cameroon), Juliane Masuch (International Consultant), Philomene Charlie Feuedjo Mbosso Mafomekiet (ICRAF), Jean-Claude Nguinguiri (FAO Forestry Officer), Aloys Nnama (Consultant, FAO Representation in Cameroon), Justin Claver Fotsing (Consultant, FAO Representation in Cameroon), Godwill Nimino (ICRAF), Ravi Prabhu (ICRAF), Thaddée Sado (ICRAF), Jolien Schure (CIFOR), Terence C.H. Sunderland (CIFOR), Honoré Tabuna (ECCAS), Bertin Takoutsing (ICRAF), Martin Tambinyuo Frambo (Dschang University, Cameroon), Zacharie Tchoundjeu (ICRAF), Julius Chupezi Tieguhong (Bioversity International), Florence Tonnoir (FAO), Marie Torbay (Ecole d'Ingénieur en Agronomie Tropicale, Montpellier Sup Agro.), Alain Calice Tsobeng (ICRAF), Jana Vandoren (FAO trainee) and Jan Maes (FAO trainee).

Editorial support
Giulia Muir, Isabel Fougeres, Claire Guichoux and Kate Ferrucci (design).

Administrative support
Michela Mancurti

Foreword

This book leads us deep into the very heart of the rainforest and Sahelian zones of Central Africa, which constitute a precious ecosystem vital to the daily life of its inhabitants and make up one of our planet's three main tropical wooded zones.

Ten countries (Burundi, Cameroon, the Central African Republic, Chad, the Congo, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe) are home to these forest and savannah zones so rich in major natural resources. They share a long history linked to colonization, followed by the experience of a variety of aid and cooperation initiatives since independence, and are now moving steadily toward economic and monetary integration.

Tribute is paid to the unflagging strength and intelligence of the Bantu, Baka-Bandjeli and Bororo-Wodaabe peoples and, by extension, to all the "lords of the forest" of Central Africa. Over the generations, these peoples have developed a body of knowledge that has enabled them to live in and from the forests and their biodiversity, while preserving and enhancing them, even before the introduction of classic food and export crops.

Today, when the age-old balance between human beings and nature seems to have been disrupted, when food security, poverty alleviation, and biodiversity and forest resource conservation have become global issues, and when uncontrolled population growth is leading to conflicts over living space and jeopardizing the continued existence of forest ecosystems, the phenomenon of climate change is yet another challenge to the creative genius of forest peoples to preserve and sustainably manage forests and the non-wood forest products (NWFP) found there.

In this complex situation, the Central African Forests Commission (COMIFAC) and the governments of its member states need greater support in establishing, promoting, validating and applying ecosystem management strategies that combine economic development with resource conservation. Such strategies must be based on updated environmental and economic knowledge and on good governance practices for Central African forests, drawing inspiration from indigenous traditions.

This publication is the work of FAO's technical staff with the contribution of international and local partners involved in developing NWFPs. It is a valuable document devoted to the development of peoples through the promotion of NWFPs in Central Africa with a view to boosting food security and alleviating poverty.

Eva Muller
Director, Forestry Policy and Resources Division
Forestry Department, FAO

Preface

Since 2005, the Observatory for the Forests of Central Africa (OFAC) has been publishing a biennial reference document on the state of the Congo Basin forests in order to assist COMIFAC member states in their adoption of forest governance policies that are not only beneficial for the natural environment, but also help boost the inhabitants' food security and promote the economic development of the subregion. Although non-wood forest products (NWFPs) are a major component in the biodiversity and wealth of forests, not enough is known about their ecological, social and economic value. This hampers the monitoring, regulation and sustainable management of these resources. This FAO document on the state of NWFPs in Central Africa offers an overview of the main aspects of forest biodiversity as an essential resource that can be sustainably exploited by local communities for both nutritional and economic benefit.

Living in and from the forests of Central Africa is intended first and foremost as a full-scale extension tool concerning NWFPs in Central Africa. It is a work on the groups who have always lived in these forests, forests that contribute to every aspect of their daily lives, both material and spiritual, and enable them to survive even in periods of extreme crisis.

These Central African forests constitute a natural heritage and contain an immense diversity of plant and animal wildlife. For this reason and also because they can have an impact on the global climate as a whole, they are the object of special attention on the part of the international community. Local inhabitants who live in close relation to the forests have in-depth knowledge of the NWFPs that they have been using since time immemorial. These products are an important source of food, building materials, household items, fodder and medicinal ingredients. Forests supply a vast range of such products, also for people living outside them in both rural and urban zones. Efforts have been made to develop markets for such NWFPs as fruit, nuts, leaves, oils, latex, rattan and bamboo, with a view to providing alternative sources of income for a range of stakeholders in various value chains.

This publication is intended to describe the techniques and processes already developed and still in development, depending on the availability or increasing shortage of forest resources, the emergence of new market outlets, population pressure and the livelihood strategies of local people in the face of the crisis.

It is a hymn to forest peoples' know-how and knowledge of nature, paying tribute to the manual skill, ingenuity, creativity, resourcefulness and perseverance of men and women who have to cope with thorns, snakes, scorpions and wild beasts, not to mention the rigours of the climate.

The forests of Central Africa teem with life – wild fruit, flowers and mushrooms, insects, nuts, eaves, bark, bushmeat, molluscs and algae – and contain an extraordinary wealth, which this book seeks to identify and highlight.

Acronyms

AACP	African, Caribbean and Pacific States
ACP-FORENET	African-Caribbean-Pacific Forest Research Network
CARPE	Central African Regional Program for the Environment
CBFP	Congo Basin Forest Partnership
CEFDHAC	Conference on Central African Moist Forest Ecosystems
CEMAC	Central African Economic and Monetary Community
CIFOR	Center for International Forestry Research
CIG	common interest group or common initiative group
CITES	Convention on International Trade in Endangerous Species of Wild Fauna and Flora
COMIFAC	Central African Forests Commission
ECCAS	Economic Community of Central African States
ECOFAC	Programme for the Conservation and Rational Use of Forest Ecosystems in Central Africa
ECOWAS	Economic Community of West African States
EFSA	European Food Safety Authority
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Stewardship Council
GIZ	German Society for International Cooperation
IAPSC	Inter-African Phytosanitary Council
ICRAF	International Center for Research in Agroforestry
IFOAM	International Federation of Organic Agriculture Movements (Organics International)
IMF	International Monetary Fund
INERA	National Environmental and Agricultural Research Institute (Democratic Republic of the Congo)
IRAD	Agricultural Research Institute for Development
IRET	National Research Institute for Tropical Ecology (Gabon)
IUCN	International Union for Conservation of Nature and Natural Resources
MA&D	Market Analysis and Development
NGO	non-governmental organization
NWFP	non-wood forest product
OECD	Organisation for Economic Co-operation and Development
OFAC	Observatory for the Forests of Central Africa
PCI	principles, criteria and indicators
RAF	right to adequate food
RDA	recommended dietary allowance
REBAC	Central African Botanists Network
RIDDAC	Information Network for Sustainable Development in Central Africa
SAILD	Support Service for Local Development Initiatives
SFM	sustainable forest management
SME	small and medium-sized enterprise
SMFE	small and medium-sized forest enterprise
SNV	Netherlands Development Organisation

SYVBAC	Central African Bushmeat Monitoring System
TRAFFIC	Wildlife Trade Monitoring Network
TRIDOM	Tri-National Dja-Odzala-Minkébé
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
WCS	Wildlife Conservation Society
WHO	World Health Organization
WRM	World Rainforest Movement
WTO	World Trade Organization
WWF	World Wide Fund for Nature

Introduction

Ousseynou Ndoye

The forests of the Congo Basin are our planet's second-largest forest zone and constitute one of its richest areas in terms of biodiversity. The region is home to 130 million people, most of whom depend directly on forest resources, particularly non-wood forest products (NWFPs). Some of these products, such as game, fruit, seeds, roots, insects and mushrooms, are used as a source of food, contributing to both food security and a balanced diet for inhabitants, while others are used for building materials or medicines, or provide support to ancient customs and traditions. Their trade on local and international markets plays a considerable role in generating income for all those involved in the various value chains, not only those who gather them, but also those who process, transport, export or sell them.

NWFPs have exceptional socio-economic importance and potential. Demand is on the constant rise, sometimes for products that are in increasing everyday use by the wider public and not just people from Africa. For example, certain barks, particularly those containing components of medicinal interest, are enjoying a considerable success in the pharmaceutical industry throughout the world. In its efforts to meet this growing demand, the NWFP sector has to face some real challenges regarding conservation and sustainable management of the resources, optimization of the products, and organization of the various value chains.

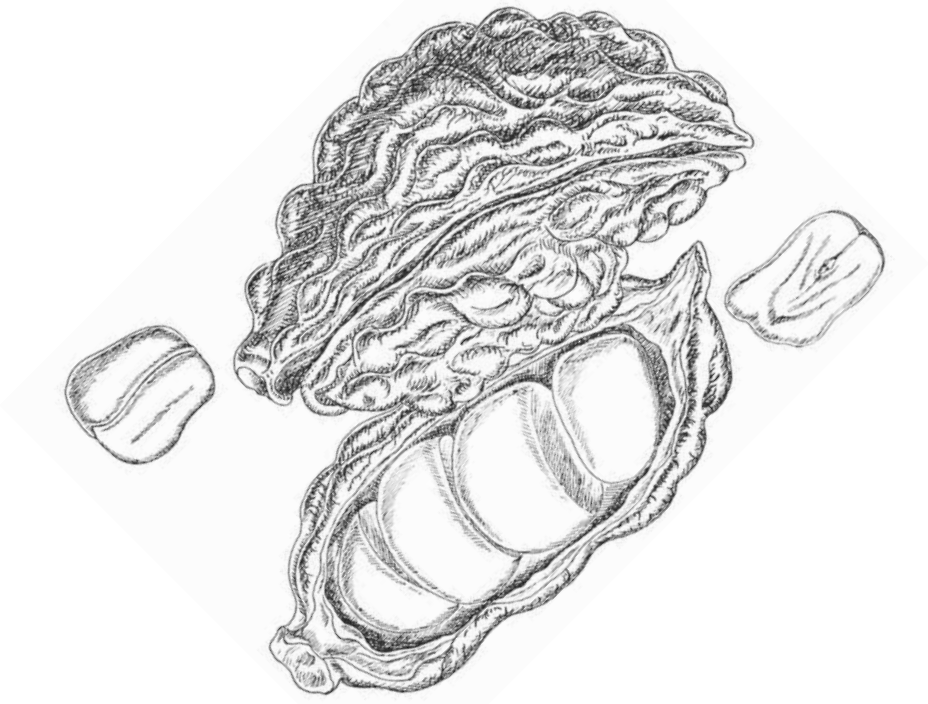
There is a tendency to underestimate the contribution of NWFPs to food and nutritional security and poverty alleviation because they are not included in national economic statistics, inasmuch as in most cases their use and trade are confined to the informal sector. Through their commitments within the Central African Forests Commission (COMIFAC), African governments have been showing how interested and motivated they are in sustainably developing and regulating the trade in NWFPs. What is now needed is to gather already existing knowledge to show the role of forests in general and NWFPs in particular for inhabitants in their efforts to boost their food and nutritional security and improve their living conditions.

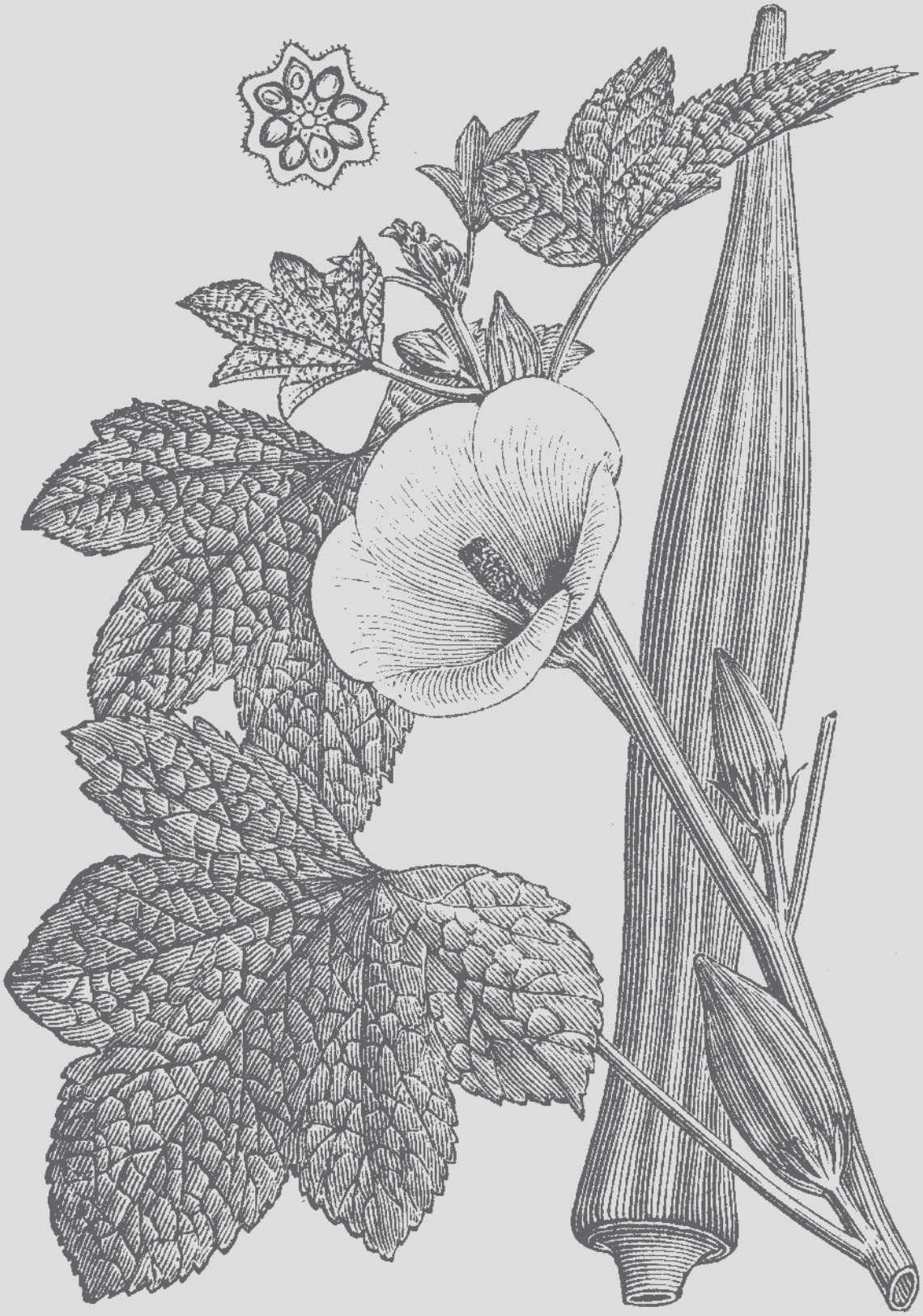
This book brings together knowledge and information about NWFPs and those who harvest, use and consume them. It offers readers an accessible collection of papers produced by people with experience on the ground in COMIFAC member countries and under other projects or programmes. The work, which makes no claim to being exhaustive, is part of the documents produced under the GCP/RAF/441/GER Project, Enhancing the Contribution of Non-wood Forest Products to Poverty Alleviation and Food Security in Central African Countries, which was implemented in the Central African Republic, the Congo and Gabon between October 2009 and April 2013. It is a reference document on the importance of NWFPs for nutrition and on the indigenous knowledge of Central African forest people. It is based on the collection and updating of work carried out by researchers and institutions from a variety of disciplines with the aim of establishing the multiple ways in which NWFPs contribute to the lives and diets of forest inhabitants.

The book is divided into seven parts. The first gives an overview of Central Africa and NWFPs, while the second shows how animal and plant NWFPs contribute to the food and nutritional security of forest people. The third part discusses the causes of the local population's major

involvement in the harvesting and use of NWFPs i.e. the growing crisis in staple foods in the 1990s and the economic and social importance of these products. The fourth describes the consequences of this major involvement, which has led, for example, to increased pressure on NWFPs from the local population, thus making sustainable management of these resources more problematic. The fifth part describes the initiatives carried out by COMIFAC, FAO and other partners to optimize knowledge of NWFPs and increase the value of the sector. The sixth and seventh parts constitute the culminating point of advocacy on behalf of NWFPs in Central Africa, with a vital need, on the one hand, for their sustainable management and, on the other, for development of entrepreneurship with a view to increasing their added value.

This work has been produced thanks to the financial support of Germany through its Federal Ministry of Food, Agriculture and Consumer Protection.





Part I
General information on Central Africa

Map of Central Africa

Chapter 1
Background

Marie Torbay and Paul Vantomme

1. Introduction

Central Africa is a subregion of the African continent covering more than 5 million square kilometres (FAO 2011a), almost 2 million of which are covered by the forests of the Congo Basin (Mayaux *et al.*,1998). In the present work, the term "Central Africa" designates the ten countries of the Central African Forests Commission (COMIFAC): Burundi, Cameroon, the Central African Republic, Chad, the Democratic Republic of the Congo, Gabon, the Republic of the Congo (hereinafter referred to as "the Congo"), the Republic of Equatorial Guinea (hereinafter referred to as "Equatorial Guinea"), Rwanda, and Sao Tome and Principe. Their areas range from less than 1 000 square kilometres for Sao Tome and Principe to more than 2 million square kilometres for the Democratic Republic of the Congo (FAO, 2011a).

2. Climate and vegetation

From Gabon to Cameroon and as far as the Democratic Republic of the Congo, the climate of Central Africa is equatorial, becoming drier as one moves north and south away from the equator, and the length of the dry season increases with the latitude. Coastal regions, particularly in the Gulf of Guinea, have a humid tropical monsoon climate and receive the most rain in Africa, with an annual rainfall of 17 metres at the foot of Mount Cameroon (maximum value at Debundscha, with an average of 9 metres: Houcrou, 2009). The closed rainforests enjoy an annual rainfall of about 2 000 millimetres.

The region can be divided into six ecological zones (FRA, 2010):

- the tropical rainforest zone, dominated by the forests of the Congo Basin at an average altitude of 400 metres;
- the tropical moist semideciduous forest zone, which surrounds the rainforests at higher altitudes and has a marked dry season;
- the tropical dry forest zone in the Sudano-Sahelian region, particularly in Cameroon, the Central African Republic and Chad, consisting mainly of tree savannah;
- the high-altitude tropical montane zone, with high population densities, such as the highlands of Burundi, Cameroon and Rwanda;
- the tropical shrubland zone, mainly in the north of Cameroon and Chad, with very low rainfall, always combined with high temperatures;
- the tropical desert zone, which follows on from the Chad shrubland and where the minimal rainfall does not allow the development of continuous plant cover.

3. POPULATION

The total population of Central Africa was estimated at 126 million in 2010 and it is generally very young. Those under 15 years old account for 44 percent of the population, while 51 percent are between 15 and 60, and only 5 percent are over 50. The average density is 100 people per square kilometre, with wide variations between rural and urban zones, very high rates in Burundi and Rwanda and very low rates in Chad, the Democratic Republic of the Congo and Gabon (United Nations, 2011).

Table 1
Some key figures from Central Africa

Country	Area (km²)	Population (millions)	Rate of population growth (annual average %)	Density (inhabitants/km²)	Average age (years)	Proportion of rural population (%)	Growth rate of urban population (annual average %)	Contribution of agriculture to GDP (%)	Forest cover	
									% of area	km²
Burundi	27 830	8.6	1.9	299	16.7	90	4.5	34	3.7	1 000
Cameroon	475 440	20	2.1	41	19.2	43	3.2	20	51.3	243 900
Central African Republic	622 980	4.5	2.0	7	18.8	61	2.6	56	36.8	229 300
Chad	1 284 000	11.5	2.6	9	16.5	73	3.0	21	17.9	229 800
Congo	342 000	4.1	2.2	11	16.8	39	2.8	5.6	64.6	220 900
Democrative Republic of the Congo	2 344 860	67.8	2.6	28	16.4	66	4.2	46	68.0	1 594 505
Gabon	267 670	1.5	1.9	6	18.6	15	2.3	4.9	84.7	226 700
Guinée équatoriale	28 050	0.7	2.7	25	18.9	61	3.2	2.7	62.5	17 500
Rwanda	26 340	10.9	2.9	379	18.7	82	4.5	41	29	7 600
Sao Tome & Principe	960	0.2	2.0	169	16.4	39	3.0	17	40.4	400
Total	**5 420 135**	**129.8**							**51.1**	**2 771 605**

Sources: FAO, United Nations Population Fund (UNFPA) and Atlas Challenges websites.

Approximately 70.5 million of the 126 million inhabitants live in rural areas. The region is undergoing a generalized high rate of urbanization, which could reverse the ratio between urban and rural populations by 2030 and foster the development of NWFP-linked food habits in towns. This could create a problem over supplies of food and fuelwood for the new town-dwellers as their numbers grow (UN-HABITAT, 2012).

Central Africa is populated by a variety of ethnic groups, including the Baka, Bandjeli, Bakola and Bayaka Pygmies and the Bantu (Shoup, 2011; Chrétien, 1985; Fourche and Morlighem, 2002; Lewis, 2001; Mauduit, 1962; Ngoun, 1999). Pygmies draw all of their resources from the forest and are traditionally hunters, fishers and gatherers. Hunting is typically the men's prerogative, while fishing and gathering are the women's domain, although in many cases every member of a single family will participate in all the activities so as to obtain a better harvest or more abundant game.

Nature supplies the Pygmies' daily needs (wood, leaves, stones, plants, pelts etc.: AAPPEC,[1] 1998) and they obtain whatever nature cannot provide through barter with their Bantu neighbours, with whom they maintain trade and complementarity relations. The Bantu do not confine their relations with the Pygmies to exchanges concerning forest resources. As the NWFP project team has observed in the field, the Bantu often employ Pygmies to clear land for agriculture, act as porters or build huts, paying them with sacks of flour or cassava, salt, soap or other commodities (clothing, shoes, alcohol etc.).

For a long time the Pygmies lived protected by the forest, which was their habitat, their spiritual mother and their source of food. Since colonization, intensive forest exploitation in the countries of Central Africa (FAO, 2007) has been threatening their way of life. As this fully-fledged exploitation of nature and timber reaches places ever deeper in the forest, it leads to steady impoverishment of the forest ecosystem. The Pygmies, a hunting and NWFP gathering people, are seeing their food system threatened, as certain trees rich in fruit and bark are felled, while others are uprooted by bulldozers and a multitude of seeds needed for food are destroyed. Furthermore, traps set for animals are crushed, nets are dragged down and the game seek refuge deeper and deeper in the forest. With the passage of building or felling machines, streams become polluted pools and eventually dry up altogether. Water has always been a rare commodity, but is now becoming yet another worry for the Pygmies (FONDAF, 2010).

Added to all this, there are spiritual and moral issues. The Pygmies' sacred places are often profaned by vehicles, when they are not simply destroyed by bulldozers. As a result, the rhythms of traditional practices are also disrupted. Many Pygmy tribes are therefore leaving their forest environment to settle in villages, which can lead to conflict with their Bantu neighbours. These upheavals, which have been observed by people working in the field, have profoundly modified the Pygmies' lives, with the development of poaching, the adoption of a sedentary lifestyle and an increase in the numbers of children in school and the rate of attendance at health centres, complementing the traditional pharmacopoeia. This sedentary lifestyle has in particular led to a move from a system of bartering NWFPs to a monetary trading system.

The Bantu (a term meaning "humans" in the Kongo language of the Democratic Republic of the Congo) form a body of peoples speaking about 400 related languages known as Bantus. They are present in Africa from west to east, between Gabon and the Comoros, and from north to south, between Sudan and Namibia. They occupy the entire southern part of Africa, along with the San and Khoikhoi (Afrikhepri, 2016).

4. SOCIO-ECONOMIC CONTEXT

At present, the main economic sectors in Central Africa are linked to subsistence farming and the exploitation of forest resources. Some countries, such as Cameroon, Chad, the Republic of the Congo, the Democratic Republic of the Congo, Equatorial Guinea and Gabon, have an economy that also depends to varying degrees on the extraction of minerals and petroleum.

[1] AAPPEC = Association pour l'auto-promotion des populations de l'Est Cameroun: a former Pygmy project run by the Catholic Church in East Cameroon.

4.1 Agriculture

Agriculture is practised essentially by smallholders, with a few exceptions particularly on the west coast of Cameroon, where large-scale farms produce palm oil or bananas. It is therefore focused primarily on food crops, mainly for household consumption, with the sale of any surplus in rural, semi-urban and urban markets.

The crops grown depend on climate and ecosystem: in humid regions, the main crops are coffee, cocoa, roots and tubers, while cereals and livestock production predominate in drier zones. Farming is the primary employment sector in Central Africa, even in countries producing petroleum and minerals. It contributes to the livelihoods of 70 million people in rural zones (UN-HABITAT, 2012). However, not enough is produced to cover the food requirements of the urban population in terms of either volume or variety.

Central Africa remains one of the regions of the world worst affected by famine, with situations ranging from moderate for Gabon, to severe for Cameroon, the Republic of the Congo and Rwanda, alarming for the Central African Republic and Chad, and extremely alarming for Burundi (von Grebmer *et al.*, 2012).[2] The issue of access to food products is thus of vital importance for these countries, and in this situation edible products from forests can have an important role to play in boosting the food security of millions of people.

4.2 Importance of forests

Central Africa's forests teem with an abundant diversity of remarkable species and an endemism rate among the highest in the world for both vertebrates and plants. They are home to nearly 50 percent of the animal wildlife of the African continent and more than 10 000 species of plants (de Wasseige *et al.*, 2009). They represent a real local, national and global treasury. For example, the presence of many timber species harvested for export – such as okoume or Gabon mahogany (*Aucoumea klaineana*), ayous or African white wood (*Triplochiton scleroxylon*) or sapeli (*Entandrophragma cylindricum*) – has led to the emergence of a substantial timber industry.

NWFPs also play an essential role for the inhabitants, providing them with food (fruit, game, mushrooms etc.), building materials (rattan, bamboo etc.), medicines and flavourings. Moreover, they can be traded in markets, allowing diversification in household income. Apart from this clear economic value, there is an ecological value in the form of soil protection, the recycling of organic matter, the maintenance of biodiversity and good-quality water resources, and regulation of the climatic cycle of the subregion and even the planet, not to mention the immense cultural and religious value associated with forests by various peoples (Lescuyer *et al.*, 2009a).

The annual rate of deforestation in this part of the world is still relatively low but is increasing due to improved transport infrastructure and political instability (Debroux *et al.*, 2007). It was estimated at 0.09 percent between 1990 and 2000, but reached 0.17 percent between 2000 and 2005. Despite the reforestation efforts that have been observed, pressure on forests is growing with the demographic growth that Central Africa is experiencing (de Wasseige *et al.*, 2009).

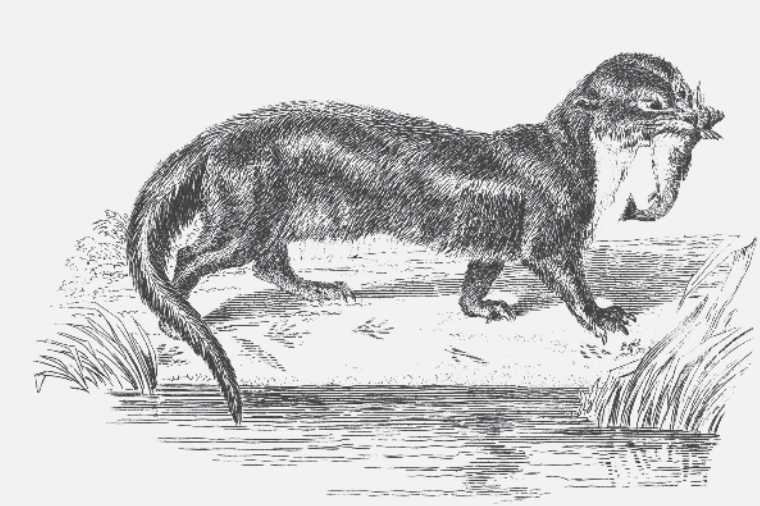
[2] There are no data for the Democratic Republic of the Congo, Equatorial Guinea or Sao Tome and Principe.

The main current and future threats can be listed as:

- land acquisition for large-scale cash crops, particularly oil palms to produce biofuel;
- mineral and petroleum extraction, which has direct effects on forest cover, but also indirect effects such as the construction of roads;
- the use of fuelwood and charcoal for cooking, not only in villages but also by households living in towns;
- the increase in slash-and-burn agriculture (clearing a section of forest in order to cultivate it, then moving on); this was originally considered a sustainable practice, with the section being left fallow while soil fertility is restored after the cropping cycle; however, beyond a certain demographic threshold, the forest no longer has time to regenerate between two cropping cycles;
- large- and small-scale forest extraction, which, like mineral and petroleum extraction, facilitates access to forests and their fragmentation;
- climate change, which leads to variations in temperature and rainfall; the repercussions of this phenomenon on forest products, particularly those destined for food, cannot yet be estimated.

5. Conclusion

Approximately 56 percent of the population lives in rural areas. Even if this rate varies from one country to another, the whole region is undergoing a high rate of urbanization and demographic growth. The economy is based mainly on subsistence farming, but Central Africa is still one of the world's regions most severely affected by famine. The forests of Central Africa, the world's second-largest tropical forest zone, are therefore, with their NWFPs, a genuine source of wealth for the mainly Pygmy and Bantu inhabitants, and a fundamental issue for the region's governments.



The Congo Basin, covering the ten countries of COMIFAC, is one of the main reservoirs of African biological diversity. The survival of its 100 million inhabitants depends on the forest sector, which plays an essential socio-economic role (FAO, 2011b). Major areas of Central Africa's forests have been allocated to forest concessions or reserved as protected areas. The history and ways of life of the various peoples living in these zones show the importance of the NWFPs on which they depend for their subsistence and the generation of income.

Chapter 2
NWFPs in Central Africa: history, importance and challenges

Ousseynou Ndoye, Juliane Masuch, Armand Asseng Zé and Aloys Nnama

1. Introduction

Forests are for the most part seen simply in terms of the number of exploitable timber species they contain and their economic potential as "green gold": the number of logs to be extracted, the species to be replanted and the management and development approach to be adopted. However, detailed analysis shows that forests also provide other products such as food (staples, spices and flavourings), plants for traditional medicines, oils, clothing (of bark, leaves, feathers or pelts), game and edible insects. These products were long labelled "secondary" or "non-wood" forest products to indicate their lesser importance (Loubelo, 2012). Over the years, however, various specialists have noted the central role of NWFPs in improving the livelihoods of local inhabitants (Ndoye and Ruiz-Pérez, 1999; Belcher and Schreckenberg, 2007). According to some authors such as Peters (1989) and Hall and Bawa (1993), the long-term value of NWFPs could surpass the short-term gains obtained from converting forests to timber harvesting, agriculture and plantations.

Here, a closer look is given to the history of these not-so-secondary products, their growing importance in Africa and ways of consolidating their exploitation.

2. History of NWFPs

NWFPs have played a more important role than timber in the development of the people of Central Africa. A look at the traditional way of life of certain indigenous communities such as the Baka, Bandjeli and Bororo[3] is testimony to this. The steady shift from the nomadic lifestyle of hunters and gatherers to a sedentary lifestyle has been encouraged by the domestication of plants, wild animals and savannah and forest areas.

The ancestral and local knowledge of many communities developed particularly through the use and discovery of the virtues of NWFPs. The sociocultural roots of the peoples of Central Africa lie in part in these practices, which form the basis of some of their economic activities involving barter and trade at the regional and continental levels. Wood products, on the other hand, have become commodities of international interest only relatively recently (see Chapter 8), a phenomenon that first came to the fore with colonization (Marshall and Chandrasekharan, 2009).

[3] See the previous chapter.

3. Importance of NWFPs in Central Africa

Since the end of the 20th century and the start of the 21st, the NWFPs have been recognized for their positive contribution to improving the standard of living in rural areas and boosting food security, and also for their more benign ecological impact than timber extraction, not to mention their economic potential, both nationally and internationally (Shackleton *et al.*, 2011). This awareness started to grow in the early 1970s (Tabuna, 1999a) and gathered momentum with the Rio Earth Summit in 1992. It was restated more recently at the Conference of the Parties to the Convention on Biological Diversity (held in Nagoya in 2010) and through various international commitments both towards fostering the conservation of biological diversity (objectives adopted by the Convention on Biological Diversity in 2002) and to alleviating poverty throughout the world.

The 1990s were marked by a strong rise both regionally and internationally in the export of food NWFPs and traditional agricultural products from Central Africa. The main food NWFPs traded are safou or bush pear (*Dacryodes edulis*), eru/okok/mfumbu/fumbwa/nkumu (*Gnetum* spp.) and such spices as andok or bush mango (*Irvingia gabonensis*). International exporters exclusively target the world market, while subregional exporters specialize either in trading between places on either side of borders (for example, between Kinshasa and Brazzaville or between the towns of Kye-Ossi in Cameroon and Ebibeyin in Equatorial Guinea) or longer-distance trading (for example, between Douala and Libreville or Brazzaville) (Tabuna, 2000a). In recent years, experts were initially optimistic, then pessimistic, while their views on the potential of NWFPs are rather more nuanced today (Shackleton *et al.*, 2011). We shall return to this in Chapter 9.

4. The cocoa crisis and the rise of NWFP exploitation by rural people

In the 1980s, the countries of Central Africa adopted structural adjustment programmes under the instigation of the World Bank and the International Monetary Fund (IMF) in order to cope with the economic crisis. This period was also marked by migratory movements away from towns and back to the countryside because of growing poverty in urban areas (Sunderlin and Pokam, 1999). In Cameroon, for example, in order to resolve the crisis in staples, the government severely reduced and then eliminated farm subsidies and suppressed the Cocoa Development Company (SODECAO)[4], a state body responsible for promoting and developing cocoa cultivation, for example through the regeneration of plantations, the supply of seedlings and the technical training of producers. Despite this suppression, cocoa cultivation continued, thanks to the use of preparations of NWFP-based natural inputs to combat brown pod rot and capsids (Nnama, 1997). Diversification within cocoa plantations also led to the adoption of a multistorey model, making use of NWFP species present on the plantations (Adesina *et al.*, 1997). Dubbed "women's cocoa", NWFPs and food crops allowed a diversification in sources of income (Nnama, 1997).

Other research has shown that deforestation in the rainforest regions of Central Africa increased during the years of the cocoa-coffee crisis because of the expansion of food crops such as plantain (Bikié *et al.*, 2000). On 12 January 1994, the African countries of the CFA franc zone decided to devalue the franc by 50 percent to restore their level of competitiveness. This resulted in cocoa and coffee becoming more competitive and in an increase in the price of items such as

[4] La SODECAO (Société de Développement du Cacao) est une institution étatique.

pharmaceutical products, which in turn led to an increase in the use of medicinal plants by the general population (Ndoye and Tieguhong, 2004). Since then, the reputation of NWFPs has not looked back, growing from year to year with diversification and intensification, to the point of attracting interest from governments and international bodies and becoming the subject of agreements and concrete projects in the Nagoya Protocol (2010). The idea of boosting food security on the basis of NWFPs has thus been endorsed and implemented by FAO and other bodies.

5. Issues in the Nagoya Protocol affecting Central Africa

The Nagoya Protocol was adopted on 29 October 2010 during the 10th Conference of the United Nations on Biological Diversity, held in Japan. This international agreement deals with access to genetic resources and the fair and equitable sharing of benefits arising from their use. It follows on from the Convention on Biological Diversity, which was intended to reconcile economic development and the need to conserve biodiversity (Persegol *et al*., 2012).

5.1 Consequences of the Nagoya Protocol for Central Africa

The agreement specifies a certain number of rules benefiting the inhabitants of the countries of Central Africa:

- it recognizes the importance of the knowledge and practices of indigenous and local communities, as well as their rights over their territorial resources;
- it establishes legal certainty for both "providers" (mainly developing countries rich in biological diversity) and "users", pharmaceutical and bioprospecting enterprises, research institutes located mainly in industrialized countries.

In order to ensure a fair and equitable sharing of "benefits arising from the utilization of genetic resources as well as subsequent applications and commercialization", contractual obligations should be established by common accord between the party wishing to use the resources and the party providing them. The protocol breaks new ground in anticipating the creation of a multilateral global body with the mission of ensuring that the benefits to the users (of genetic resources and the traditional knowledge associated with these resources) are placed at the service of the conservation and sustainable use of biological diversity and not solely of economic interests.

Various provisions have been made by the states of Central Africa for effective implementation of the protocol, notably the following:

- the appointment by the parties of a correspondent and one or more national officials responsible initially for providing information and advice on obtaining prior consent and then for granting or not granting access to the resources;
- the creation of a clearing house for information on access and the sharing of benefits, which gathers together all the relevant information, measures and procedures that the parties have to provide to potential users;
- the raising of public awareness regarding the value of biodiversity;
- support and encouragement for the transfer of technologies to developing countries.

5.2 Authors' recommendations

On the basis of the Nagoya Protocol, a number of local, national and regional actions affect the consolidation of NWFP exploitation in Central Africa.

At the regional level, COMIFAC[5] should:

- confirm its working subgroup on NWFPs;
- promote use of the toolbox on integration of the right to adequate food (RAF) into the sector of NWFPs of plant origin in Central Africa and continue awareness-raising on this topic and its links with the NWFP sector;
- encourage the adoption of COMIFAC's subregional guidelines for improving the institutional and legal framework governing the NWFP sector in the various countries.[6]

At the national level, each government of the ten COMIFAC member countries should:

- maintain or revise its national policies, taking account of the voluntary guidelines supporting the progressive implementation of the right to adequate food and the subregional guidelines concerning the sustainable management of NWFPs in Central Africa;
- support the development of NWFP value chains and small and medium-sized forest enterprises (SMFEs).[7]

At the local level, inhabitants, rural organizations, civil society organizations and environmental NGOs should:

- support and encourage the creation of SMFEs;
- participate in building the entrepreneurial capacities of SMFEs;
- consolidate and disseminate NWFP harvesting and processing techniques so as to promote sustainable, participatory management of NWFPs in forests and ecological niches.

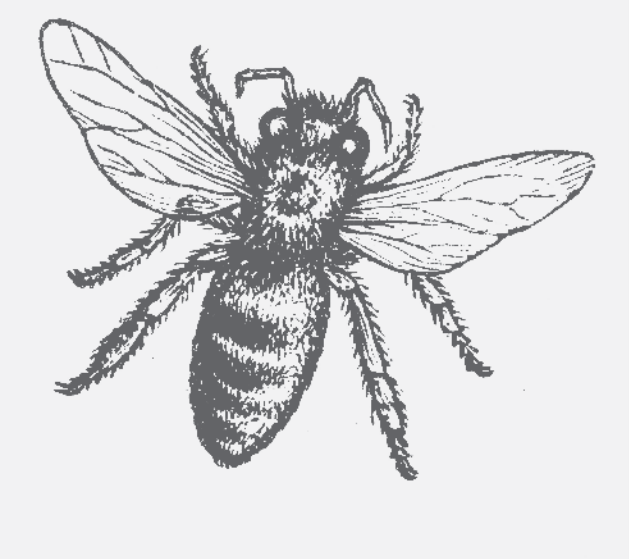
6. Conclusion

For Central Africa, NWFPs constitute a crucial issue in social, economic, cultural and nutritional terms. They have allowed the development of many activities connected not only with barter and local trade, but also, and especially since the time of colonization by western countries, with a global trading system. Their importance for food and nutritional security has been unanimously recognized since the 1980s. In this context, the Nagoya Protocol, signed in 2010, offers a real opportunity to consolidate their development in the region.

[5] See Chapter 4 for a detailed explanation of COMIFAC and its activities.

[6] See Chapter 14 for further information on COMIFAC's subregional guidelines.

[7] See Chapter 17 for information on the development of SMFEs in Central Africa.



Agricultural production in Central Africa is still insufficient to feed the rapidly growing population. This is why the direct contribution of forests to food supplies has increased greatly over the years. In lean periods or in the wake of adverse climatic or social conditions, NWFPs provide families with an immediate solution to their food needs and/or generate income to cover basic needs. The main NWFPs in the Central African region include edible and medicinal plants, bushmeat, edible insects, and rattan and other fibres to build shelters.

Chapter 3
Forests and their riches: NWFPs

Paul Vantomme and Marie Torbay

1. Introduction

How are NWFPs to be defined and how are they classified? This chapter provides some examples for those of animal origin, such as caterpillars, or plant origin, such as *Gnetum spp.*

2. NWFPs

2.1 Definition

According to FAO, "Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land or trees outside forests." They may be gathered in their natural environment or produced and harvested on forest plantations, in agroforestry areas or from trees outside forests. Although some researchers consider this definition too restrictive, it will serve as a basis for the present work.

2.2 Classification

NWFPs of animal or plant origin are divided into two groups: edible or food NWFPs, which will be the primary focus of this book, and non-food NWFPs.

Table 1
Classification of NWFPs

Products of plant origin		Products of animal origin	
Group	**Description**	**Group**	**Description**
Foods	Foodstuffs and beverages obtained from fruit, nuts, seeds, roots, mushrooms	Foods	Foodstuffs and beverages obtained from bushmeat, insects, honey
Non-foods	Fodder, medicinal products, perfumes and cosmetics, dying and tanning products, utensils, craft items, building materials, ornamental plants, exudates	Non-foods	Hides and pelts, medicinal products, dyes, various utensils

Source: Adapted from FRA, 2000

In Central Africa, where synthetic pharmaceutical medicines are not within reach of most of the population (due to high prices and the lack of supplies) traditional medicine is still at the heart of the health system. A wide range of plants and animals is used as a basis for preparing medicinal products. In some countries such as Equatorial Guinea, where traditional knowledge is gradually being lost, medicine based on NWFPs is most often practiced by specialists. In

others, such as Burundi, traditional healers are incorporated into government-recognized organizations (Walter, 2000).

3. Some examples of NWFPs of animal origin

3.1 Caterpillars

The people of Central Africa consider insects an invaluable food and medicinal and traditional resource. Their availability varies depending on season and region. Their trade provides supplementary income not only to rural, but also to urban inhabitants, especially women. Caterpillars are the most regularly eaten of these items.

Caterpillars are often gathered by hand by women and children. In other cases, gatherers shake trees to make them fall, even on occasion cutting down these trees in some regions. The presence of caterpillars is detected by the damage they cause to the host plant or tree, the characteristic odour of their droppings as these accumulate on the ground, or the fact that they collect at the foot of trees.

Once the live caterpillars have been gathered, preserving them is far from simple. They can be dried or smoked, after cooking and cleaning. The preparation of the fresh larvae entails emptying them, washing them, then boiling, frying or grilling them. They are a widely used ingredient in the preparation of various dishes and are often used as snacks.

Insects are richer in proteins and fats than equivalent quantities of meat or fish and are thus a good source of energy. Although amounts vary depending on species, caterpillars are also rich in minerals and vitamins. In some areas, they are mixed into flour to make gruel for malnourished children.

Gathering these insect larvae does not seem to affect their capacity to reproduce. However, the increasing scarcity of their host plants through forest degradation is putting them in danger (Balinga *et al*., 2004). A reduction in their numbers has been noted in some areas (FAO, 2013).

3.2 Honey in the Democratic Republic of the Congo

In the Democratic Republic of the Congo, beekeeping is managed mainly by men, while women are responsible for looking after the income, organizing post-harvest activities and transporting hives. Bas-Congo Province and the Batéké Plateau are the country's two main producing regions, with some of the honey being collected from natural hives. Honey is used both as food and for medicinal purposes. Even though the actual level of income from this activity is low, beekeeping does contribute to people's well-being. The domestication of bees and the planting of pollen- or nectar-producing trees also foster conservation of the environment and biodiversity (Ndoye *et al*., 2010).

4. Some examples of NWFPs of plant origin

4.1 *Gnetum spp.*

Traditionally consumed by communities in the forests of Central Africa, the leaves of *Gnetum* spp. (a liana that grows in shaded forest environments) are an important source of proteins and mineral elements. They are used medicinally to treat constipation, sore throats and wounds, and to ease childbirth. *Gnetum* spp. leaves are traded not only within each country in the region, but also between countries and with Europe and the United States to satisfy demand from the African diaspora.[8] However, if the demand is too high, there is a risk that stocks could run out. In some villages, gatherers already have to travel several kilometres into the forest to obtain them (Asseng Zé, 2011).

To counter this increasing scarcity of resources, initiatives to domesticate *Gnetum* spp. have been undertaken[9] under the GCP/441/RAF/GER project managed jointly by FAO and COMIFAC and financed by Germany. The objective is to improve the supply and sustainability of this precious leaf vegetable.

4.2 Rattan

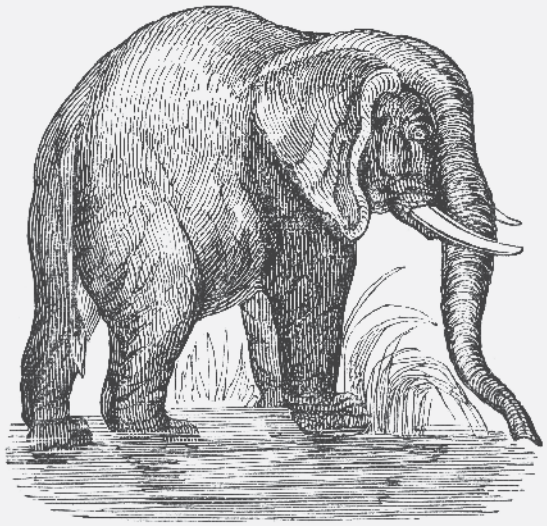
Rattan ensures the subsistence of a large proportion of the rural population and provides the basis for a flourishing building industry. While most species of rattan are used locally for multiple purposes, two species, which are the most widespread, *Laccosperma secundiflorum* and *Eremospatha macrocarpa*, are used and traded regionally. Rattan canes are long and flexible, so that they are particularly suitable for making furniture and baskets, as well as many other items such as fish traps, fishing nets or even crossbows. Donor bodies and national governments have long recognized the importance of African rattan on the world market, and also its role in the regional NWFP sector (Sunderland, 2000).

5. Conclusion

In this work, the restrictive definition of NWFPs as established by FAO has been used. These "goods of biological origin other than wood, derived from forests, other wooded land or trees outside forests ... may be gathered in their natural environment or produced and harvested on forest plantations, in agroforestry areas or from trees outside forests." NWFPs may be of animal origin (such as caterpillars) or plant origin (such as *Gnetum* spp.). They are divided into two groups: edible NWFPs and non-food NWFPs.

[8] See Chapter 8 for more information.

[9] See Chapter 15 for a detailed description of the domestication of *Gnetum* spp.



The forests of the Congo Basin and the NWFP resources are so plentiful that they are the object of increasingly intensive exploitation, leading to the overexploitation of certain resources and an increase in conflicts among different groups of users (conservationists, logging concession-holders, local people). Governments have an important role to play in establishing forest policies that balance sustainable resource management and improvement in the living standards of rural people.

Chapter 4
Forest policies

Paul Vantomme and Marie Torbay

1. Introduction

Awareness of the importance of good collective management of forest resources by the countries of the Congo Basin dates back to 1996. In that year, governments, NGOs and international organizations signed the Brazzaville Process, a declaration that anticipated regional collaboration in forest management. This first initiative was followed by the Yaoundé Forest Summit in 1999, when the heads of state of six Central African countries (Cameroon, the Central African Republic, Chad, the Congo, Equatorial Guinea and Gabon) signed the Yaoundé Declaration in the presence of representatives of the international community, the World Bank, the United Nations and the European Commission. This declaration announced the creation of cross-border protected zones and closer management of already protected areas (Muam, 2011).

2. Establishment of a COMIFAC Convergence Plan

The Yaoundé Declaration resulted in the establishment of COMIFAC, which today comprises ten Central African countries, since Burundi, the Democratic Republic of the Congo, Rwanda and the islands of Sao Tome and Principe also joined the six countries mentioned above. These states have made commitments to providing support for the conservation and sustainable management of the forest ecosystems of Central Africa, including cross-border protected areas. During the 10th Summit of the Heads of State of Central Africa in Brazzaville in February 2005, a convergence plan was adopted, presenting the national and regional actions to be undertaken, and the agreement launching COMIFAC was signed.

2.1 Status of the forest

The state has inalienable rights over the soil and subsoil, and these rights prevail over all other legislation. Forests declared to be "permanent forest estate" belong to the state. They are located on land clearly allocated to forest and encompass forest concessions, protected areas and communal forests. Community forests and private forests are "non-permanent forest estate".

2.2 Creation of conservation zones

In December 2000, the governments of Cameroon, the Central African Republic and the Congo moved on to a new stage by signing a cooperation agreement in order to establish and manage a cross-border forest complex known as the Sangha Trinational. According to the World Wide Fund for Nature (WWF), this project has the aim of improving regional collaboration and

encouraging integrated conservation management.[10] Its challenge is to ensure the future of this part of the forest, where resources were directly threatened by human activities, such as hunting for ivory and timber extraction. Since then, COMIFAC has required users to present their management plans, which must be validated by the government.

In 2003, the governments of Cameroon, the Congo and Gabon, working with WWF, the Wildlife Conservation Society (WCS) and the Programme for the Conservation and Rational Use of Forest Ecosystems in Central Africa (ECOFAC), established a second cross-border complex known as the Trinational Dja-Odzala-Minkébé (or TRIDOM). In February 2005, the ministers responsible for protected areas in the three countries signed the TRIDOM Agreement, which commits them to managing this complex and lays down the governance structures. The zone covers 178 000 square kilometres and encompasses 11 protected areas.

3. The case of NWFPs

3.1 Management difficulties

Until now, legislation on forests has focused on the harvesting of timber for export, so that NWFPs often seem to be secondary or minor products. Only a few, of recognized national importance, are even listed. COMIFAC is committed to harmonizing forest and fiscal policies, but simply a better definition of NWFPs in national legislation would allow interpretation and application of laws and development of the sector.

Today, legislation governing the extraction and marketing of NWFPs does not fully encourage their development. The existence of many lacunae in the regulations hampers the establishment of sustainable management procedures. For example, the rights of local inhabitants are not clearly enough defined, especially that which authorizes communities to "use, benefit from and exploit" forests. The interpretation and application of this regulation leads to many misunderstandings because of contradictions between legal texts for various hierarchical levels. Generally speaking, forest codes restrict rights of use to household consumption and preclude trading (Masuch *et al.*, 2011). Most small and medium-sized producers therefore operate illegally, whereas it would be preferable for them to be able to legalize their commercial status. There are other persistent legislative flaws concerning taxation on activities associated with NWFPs, the conditions for obtaining extraction permits or methods (as yet non-existent) of defining extraction quotas.

The willingness of COMIFAC member states to encourage sustainable management is genuine, especially with the adoption of the subregional guidelines concerning the sustainable management of NWFPs of plant origin in Central Africa in 2007 These guidelines were drafted thanks to the work of FAO in collaboration with experts from the subregion and the participation of international partners (the European Union, the German Government). The main objective is that each COMIFAC member state have an appropriate political, legal, fiscal and institutional framework promoting the significant contribution of NWFPs to (a) food security and full achievement of the right to adequate food, (b) socio-economic development, (c) the conservation and sustainable use of biodiversity and (d) sustainable forest management in the Central African subregion (COMIFAC, 2008). The guidelines provide baseline criteria for the sustainable management of NWFPs that can be adapted to different countries. These constitute a legal

[10] A style of management that takes account of human societies and their environment.

document that is non-binding but is a benchmark for all the states concerned. When they are applied, the guidelines will allow a contribution to implementation of the Convergence Plan.

Box 1
The institutional framework concerning NWFPs

Internationally
Several international institutions contribute to NWFP management policies. FAO is the most specialized on this subject, having had various projects under way for over ten years. Its activities are supported by other bodies such as the Center for International Forestry Research (CIFOR), the International Center for Research in Agroforestry (ICRAF), the Netherlands Development Organisation (SNV), Bioversity International, the World Health Organization (WHO), the World Trade Organization (WTO) and the United Nations Development Programme (UNDP). International NGOs and certification bodies also participate through their activities in the NWFP sector, including the Wildlife Conservation Society (WCS), the World Wide Fund for Nature (WWF) and the Forest Stewardship Council (FSC).

Regionally
Institutions playing an effective role in the NWFP sector are COMIFAC, the Conference on Central African Moist Forest Ecosystems (CEFDHAC), the Observatory for the Forests of Central Africa (OFAC) for statistical data, the Economic Community of Central African States (ECCAS) and the Central African Economic and Monetary Community (CEMAC) regarding the economic integration of the subregion.

Nationally
The ministries in charge of forests in COMIFAC member countries are responsible for instituting management procedures for forests in general and NWFPs in particular. Most of these countries have created departments responsible for NWFP issues.

Source: FAO report "Analyse du cadre juridique et institutionnel régissant le secteur des produits forestiers non ligneux en République du Congo", 2012; FAO, 2012; FAO report "Analyse du cadre juridique et institutionnel régissant le secteur des produits forestiers non ligneux en République centrafricaine", 2013.

3.2 Example of NWFP management: Gabon

In 2011, the desire of the Government of Gabon to enable sustainable management of NWFPs saw the national-level creation of a directorate in charge of NWFPs within the ministry responsible for forests, and also a national consultative committee on NWFPs. The task of the latter is to establish an expanded dialogue among all those involved with NWFPs in Gabon. These structures currently need more resources to carry out their mission properly. With FAO's support, the country has also adopted a national strategy and an action plan for development of the NWFP sector.

Legislation concerning forests and national parks takes account of the interests of the local inhabitants and customary practices. Since 2008, they have accepted the right of local communities,

either individually or collectively, to combat poverty in the rural environment by marketing small quantities of NWFPs. The government recognizes the potential of NWFPs for development of the local and national economies, but there are still many obstacles to be overcome:

- the absence of a coordinated management system for NWFP resources;
- the absence of standards for extraction methods and quotas;
- ignorance regarding the economic viability of NWFPs;
- the lack of alternative achievable solutions to offer people who have little access to NWFPs;
- insufficient promotion regarding the domestication of NWFPs in national poverty alleviation and environmental protection programmes.

The country has sought to resolve these difficulties by adopting a strategy built around four thrusts that aim at improving knowledge of the resource, establishing more appropriate institutional and regulatory frameworks, building the capacities of those involved in NWFP value chains and increasing these people's incomes, particularly through technological improvements (FAO, 2012).

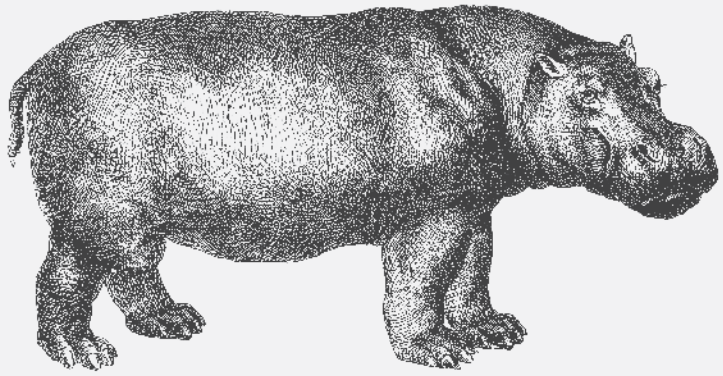
4. Conclusion

Given the overexploitation of certain forest resources in the Congo Basin and the increase in conflicts among various groups of users, governments have an important role to play in improving forest policies in such a way as to reconcile sustainable management of forest resources with improvement in the means of livelihood of the rural people who depend on forests.

In the past, forest legislation has focused on the extraction of timber for export, and legislation dealing with the extraction and marketing of NWFPs has not provided much encouragement for their development. COMIFAC has undertaken to improve the legislative framework by coordinating forest and taxation policies. The example of Gabon shows measures that are moving in the right direction, even though there are still many hurdles to overcome.

Part II
Contribution of NWFPs to forest peoples' food security

Page



People's right to adequate food is primordial in Central Africa. Poverty and food insecurity persist, while the political participation of large segments of the population in decision-making is still low or even absent at the national level. Apart from Sao Tome and Principe, all the countries of COMIFAC are among the 157 countries that have ratified the International Covenant on Economic, Social and Cultural Rights, which commits governments to progressive implementation of the human right to adequate food.

Chapter 5
A plentiful source of good-quality food

Florence Tonnoir

1. Introduction

NWFPs are a real treasure trove, both nutritionally (in terms of carbohydrate, protein, fat, vitamins and minerals) and medicinally. Depending on their variety and on food preferences, they can be eaten as a main dish, a flavouring or a tonic, and they contribute to the variety and balance of forest peoples' diet. However, the availability of many NWFPs is limited not only by their seasonal nature, but also by their overexploitation and the destruction of habitats. Thus, according to Termote (2012), the fact of living in a rich and biodiverse environment does not necessarily mean enjoying a more varied diet. Many constraining factors, such as the absence of an appropriate regulatory framework, still prevent people living close to forests from exploiting NWFPs in the best and most sustainable manner, inasmuch as these resources are neglected by agricultural and development policies.

2. NWFPs in the basic diet of forest people

Cassava, taro, yam or sweet potato, sources of slow carbohydrates and rich in starch, are the basis of forest peoples' diet. In times of scarcity, these tubers, which are generally poor in nutrients, are often the sole dietary intake, served without sauce, leading to many protein and calorie deficiencies. Among secondary foods, pulses such as peas and beans can supplement the insufficient protein input from starches. These basic foods are generally boiled and eaten with vegetables, meat and fish, when the latter are available, and accompanied by a soup or an oil-based sauce. NWFPs – in the form of leaves, vegetables, seasonings and fats – are often used in preparing sauces. In Central Africa, sauces are often made with onions and tomatoes, with the addition of salt, other seasonings and a fat base made of oil or other fatty matter, depending on the region (palm oil, peanut oil or oil from various kernels, or coconut water). NWFPs thus often have a complementary role to the basic food. In spite of their more limited consumption in urban zones, their nutritional contribution can be very important. Apart from their use in sauces, they can also serve as snacks or emergency rations.

3. Cultural perception of NWFPs: taboos and varied diets

Among some communities, tradition determines the consumption of one NWFP over another (FAO, 1995b). Taboos linked to religious belief focus especially on young children, infants in the weaning period and pregnant or breast-feeding women. Certain forest sites and certain species may also have a sacred value. In some zones bushmeat is considered to be "real meat", so that it is a "prestige food", preferred to meat from domestic herds. Such local perceptions

seldom have any basis in the nutritional value of the food. Products such as mushrooms and insects are sometimes considered a "meat" and sometimes a minor complement and not a basic food, even if they are rich in proteins and minerals.

In forest societies, medicine and food do not work separately as they do in industrialized societies. For the people of Central Africa, there are many virtues – real or imaginary – associated with foods (FAO, 1995a). If these resources are to be developed successfully, it is vital to take account of these perceptions. Some NWFPs have an image as "famine food" or "food for snakes"; in other words, they are eaten only when nothing else is available. For example, custard apples or dugors (*Annona senegalensis*), which have yellow, bumpy-surfaced fruit, suffer from this image; yet their leaves have tonic properties, their fruit has a reputation for curing sprains and their roots are given as an infusion to relieve nervousness, reduce fatigue and eliminate parasites.

National policies tend to marginalize these available resources and thus to not only ignore the food needs of those living in forest zones, but also to miss out on opportunities to develop the NWFP sector. Nutritional education programmes do not always promote locally available foods, although they are increasingly doing so.

4. Nutritional characteristics of some forest foods that constitute the basic diet

4.1 Use and composition of the main NWFPs

Vegetables used in sauces can be divided into two types: leafy vegetables, which are very popular, such as West African sorrel or mallow (*Corchorus olitorius*) or African eggplant (*Solanum indicum*), and those that are eaten when other preferred foods are unavailable, such as hibiscus (*Hibiscus congestiflorus*). *Gnetum* spp. (nkumu in Gabon, mfumbwa in the Democratic Republic of the Congo and the south of the Congo, eru or okok in Cameroon and koko in the north of the Congo) is used as a vegetable to accompany dried fish, shrimps or, more rarely, meat. Its leaves contain vitamins and minerals, especially calcium, as well as essential amino acids. Gumbo or bush okra (*Abelmoschus esculentus*) is appreciated for the viscous texture it gives to sauces (FAO, 1995a).

Children are the main consumers of forest fruit, usually eaten raw (see Table 1). Such fruit is an excellent source of vitamins (carotene and vitamins C and B1) and minerals (iron, potassium), and also fast sugars and water. The fruit of the baobab (*Adansonia digitata*) is edible, while its leaves can be powdered and added to sauces. Safou or bush pear (*Dacryodes edulis*), known as atanga in Gabon where it is particularly popular, is usually eaten in sauces in the form of oil or paste. It is available in July and August in the equatorial forest zone and is very perishable in its fresh form. It is exceptionally rich in palmitic and linoleic acid, has a high content of vitamins A, C and E and minerals, and is reputed to cure toothache. Safou is used in the pharmaceutical industry for prostate problems. It is also anti-inflammatory, analgesic and beneficial for the urinary system, and is used in combating allergies and treating malaria. Other wild forest fruits sold in markets are onzabili (*Antrocaryon klaineanum*), offos (*Pseudospondias longifolia*) and mbongo or Cameroon cardamom (*Aframomum* spp.), this last-mentioned being particularly popular in Central Africa (FAO, 2009a). Andok or bush mango (*Irvingia gabonensis*) is used

in sauces in the form of a powder or paste to accompany maize or cassava pasta, rice, tubers or roots. Its kernel can be eaten in the form of a cake known as "odika bread" after drying, grilling and milling; even so, it contains 54 percent fatty matter (Herzog *et al*., 1995).

Table 1
Nutritional values per 100 grams of the edible part

Food	Energy (Kcal)	Protein (g)	Fat	Glucides (g)	Calcium (mg)	Fer (mg)	Eau (%)
Njangsang (*Ricinodendron heudelotii*)	530	21.2	43.1	23.4	611	0.4	55.0
Andok (*Irvingia gabonensis*)	670	7.5	68.9	16.6	126	3.4	5.1
Safou (*Dacryodes edulis*)	263	4.6	23.4	14.9	43	0.8	56.2
Eru or okok (*Gnetum* spp.)	103	6.0	1.3	21.6	130	5.6	
Kola (*Cola* spp.) nuts	148	2.2	0.4	33.7	86	2.0	62.9
Baobab (*Adansonia digitata*) leaves	300	3.5	0.5	9.2	77	3.9	88.0
Okra (*Abelmoschus esculentus*) fruit	33	1.7	0.2	4.4	84	0.8	90.0

Source: FAO, 2012

Table 2
Coverage of the recommended dietary allowance (RDA) of vitamins and minerals for a child of 7–9 years per 100 grams of the edible part of forest fruit and plants

			Vit. A	Vit. B1	Vit. B2	Niacin	Vit. C	K	Mg	Fe	Ca
			(g)	(mg)							
	RDA 7-9 years		400	0.8	1.2	13.4	20	2000	220	8	500
Common name	**Scientific name**	**100 g = x fruits**	**% of RDA**								
Odjom	*Aframomum alboviolaceum*	5.9	-	19	5	7	11	52	11	10	1
Hog plum	*Spondias mombin*	17.9	59	5	2	11	80	-	-	13	6
Custard apple	*Annona senegalensis*	5.9	156	12	4	7	27	22	18	24	8
Palmyra or Borassus palm	*Borassus aethiopum*	0.2	-	5	2	2	26	-	-	13	5
Gambia tea	*Lantana camara*	45.5	23	11	7	14	21	26	14	23	10
Landolphia vine or mbungu	*Landolphia hirsuta*	3.1	65	7	12	7	12	10	6	6	1
African peach	*Sarcocephalus latifolius*	1.5	42	14	5	9	191	22	21	7	15
Black plum	*Vitex doniana*	19.6	-	18	2	4	0	34	6	9	4

Source: Herzog *et al.*, 1995

Forests contain major sources of various nuts and fatty materials, which can provide considerable energy. Karité (*Vitellaria paradoxa*) butter is a good example of a source of essential fats. The African oil palm (*Elaeis guineensis*) also provides many NWFPs: fruit, heart, sap (rich in proteins, vitamins and iron), byproducts that are rich in fats and antioxidants. The trunk of the sago palm (*Metroxylon sagu*) is used as a thickening agent. The oleaginous seeds of the njangsang fruit (*Ricinodendron heudelotii*) are eaten two or three times a week in Central Africa, particularly in Cameroon. Mixed with other flavourings (garlic, onion, pepper, basil, tomato), they are ground with a stone or a machine and sprinkled into sauces to thicken them. They are sometimes replaced by tomato, pistachio or groundnut. Lastly, carob (*Parkia* spp.) seeds are either cooked as vegetables in a sauce or fermented; in the latter case, they are called dawadawa or soumbala. In this form, they can be added to porridges and soups, and are rich in protein (40 percent of the dry matter) and fat (35 percent). Their pericarp, known as dozim, is often eaten raw or drunk as a sweet drink, and is rich in vitamin C and calcium.

Plant-based drinks can also be an important source of nutrients, for example "savannah tea" (*Lippia multiflora*), drunk mainly at breakfast, and palm wine, with a daily consumption of 0.5 to 1 litre per person in some regions. This amount covers 7 to 17 percent of the energy RDA (Herzog *et al*., 1995) and 100 percent of the vitamin C, niacin, iron and potassium RDA. The resins, saps and honey produced from nectar and pollen are rich in proteins and minerals. Gum arabic (*Acacia senegal*) can be eaten fried or mixed with a sweet liquid. Lastly, honey, which is a combination of sugars (particularly fructose and glucose), minerals, vitamins, amino acids and water (17 percent), is an energy-giving tonic with countless medicinal virtues.

With regard to animal wildlife, small invertebrates, insects, caterpillars and snails are important sources of animal protein and fat, and also vitamin B12 in the case of caterpillars, not to mention the protein provided by game (birds, mammals), bushmeat and the products of artisanal fishing, which sometimes constitutes 85 percent of the total protein intake of forest people. With regard to plant wildlife, mushrooms are very rich in minerals (phenols, flavonoids, beta-carotenes and lycopenes, alkaloids, saponins, anthraquinones, steroids, carbohydrates, proteins and cardiac glycosides) and have antioxidant and thus anticancerogenous properties. They too are excellent dietary supplements.

To be precise, it would be necessary to calculate the nutritional contribution of these NWFPs, taking into account the fact that they are usually cooked in a sauce and that they may be replaced for reasons of texture. Thus, njangsang is often replaced by groundnut and pistachio, which provide three to six times less iron. Similarly, if 100 grams of dry matter of andok (dried bush mango) is compared with a similar amount of gumbo, andok has an energy value two and a half times greater (73 percent fat content) than gumbo, but two times less protein, three times less carbohydrate, five times less calcium and two times less iron. It should also be taken into account that lengthy simmering often reduces the products' richness in vitamins, especially in the case of leaves and vegetables (tomatoes, onions).

4.2 Role of NWFPs in resolving current nutritional problems in forest Africa

Table 3
Nutritional problems and possible solutions using NWFPs

Common nutritional problems	NWFPs useful in solving these problems
Protein-energy malnutrition	Nuts, seeds, chanar (*Geoffroea decorticans*), kernels (*Ricinodendron rautanenil* and *Parkia* spp.), babassu, palmyra and koko, baobab (*Adansonia digitata*) leaves, small animals (insects, caterpillars), mushrooms
Vitamin A deficiency	Green leaves and yellow and orange fruit (bush mango), resins, unrefined palm oil
Anaemia	NWFPs rich in available iron: bushmeat, green leaves (*Leptadenia hastata*, *Adansonia digitata*), mushrooms, broad beans
Niacin (vitamin B3) deficiency, which may cause dementia, diarrhoea and dermatitis, common in zones with a maize-based diet	Baobab (*Adansonia digitata*), *Boscia senegalensis* and *Momordica balsamina* fruit, *Parkia* spp. seeds, bush mango (*Irvingia gabonensis*) and acacia (*Acacia albida*)
Riboflavin (vitamin B2) deficiency, common with a rice-based diet	Green leaves, especially *Anacardium* spp., *Sesbania grandiflora* and *Cassia obtusifolia*, insects
Vitamin C deficiency	Baobab (*Adansonia digitata*) and African plum (*Sclerocarya caffra*) fruit, *Cassia obtusifolia* leaves and *Sterculia* spp. resin, leafy vegetables
Diarrhoea, haemorrhoids	All leafy vegetables, slightly unripe fruit such as jujube, acacia pods, tamarind flowers
Constipation, stomach ache	Leafy vegetables, ripe fruit, bark and roots (acacia)
Parasites	Custard apple, various barks, such as acacia or kola nut, karité
Bone aches, coughs, asthma	Barks, especially acacia, honey

Source: FAO, 2012

5. Contribution of NWFPs to food and nutritional security

NWFPs make an essential contribution to food and nutritional security. A study in Ghana (Ahenkan and Boon, 2011) demonstrated the vital role of edible animals (antelopes, monkeys, snails), mushrooms and plant products (leaves, fruit) in forest peoples' diet and in improving the country's nutritional level. This contribution of NWFPs to diet varies according to the environment and the sociocultural and economic context. Consumption is higher in low-income households (five to six times a week), which means that NWFPs play a more important role in food security.

The study also highlighted the fact that 90 percent of the population used NWFPs for supplementary medical treatment and in combating certain endemic diseases such as malaria. A large part of the population who live far from standard health centres rely on NWFPs to treat themselves. The communities themselves prepare 67 percent of their remedies based on traditional knowledge.

Another study, carried out by Herzog *et al.* in Côte d'Ivoire in 1995 among people living in the borderlands between savannah and forest zones, showed that in this region where cash crops are grown (coffee, cocoa), seasonal plant products such as bush mango (*Irvingia gabonensis*) and Gnetum spp. are gathered on an irregular basis and immediately eaten individually, providing a significant intake of nutrients.

Shortages occur during the pre-harvest period when produce from the previous harvest may have run out. In the equatorial forests of Central Africa there is no real lean season comparable to those observed in regions with a dry climate. When a lean season is mentioned, what is usually meant is the transitional season, the result of a variation in the quality of the diet and the large amount of energy expended on farm labour. Despite the attractions of the so-called modern lifestyle, most forest people cannot afford imported food products, since they do not have enough income to break free of the local food system. Hunting and gathering NWFPs therefore make up for any lack of nutrients when stocks run out. Cassava, cassava leaves, fruit, berries, insects, game and fish sometimes replace the usual staples. The stocking of certain nuts, fruit and yams provides some food security. The poorest households are more dependent on forest foods than those with moderate or high incomes. NWFPs can therefore save lives in the case of famine or an emergency situation. Some fruit and plants with a high nutritional value are gathered by forest people, who cultivate them only if there is some environmental and climatic pressure. The overexploitation and degradation of natural resources, as well as inappropriate, destructive gathering or harvesting practices complicate and endanger the accessibility and availability of NWFPs. Difficulties over forest access also hamper extraction of these products. Paradoxically, conservation efforts have led to the disappearance of some species. Inappropriate post-harvest practices can also lead to a scarcity of NWFPs and thus have an adverse effect on dietary diversity. This is particularly the case for perishable foodstuffs, with the use of processing, conservation and storage techniques that limit the contribution of NWFPs to household food security (potential income generation, marketing, and sensory, culinary and nutritional properties).

6. Impact of the NWFP trade on nutrition and health

One of the risks associated with the NWFP trade and its contribution to income is that good-quality nutritional habits may be given up for the sake of so-called prestige purchases, such as alcohol and imported foodstuffs of less nutritional value such as sweets. In other words, an increase in income from the sale of NWFPs is not necessarily synonymous with an improvement in nutrition. Also to be noted are the nutritional losses and the health problems resulting from inappropriate storage, conservation and transport techniques. NWFPs contain many toxins, which are sometimes insufficiently known. The processing techniques used for products may be unsuitable and even harmful. Such chronic toxicity in food may cause a drop in the individual's productivity, digestive problems and an aggravation of malnutrition symptoms. Some products such as bush mango (*Irvinga gabonensis*) kernels are today the focus of quality standards, which is a first step toward standardization and the establishment of a quality scale.

Various measures could reduce the negative impact of an increased NWFP trade on nutrition and health:

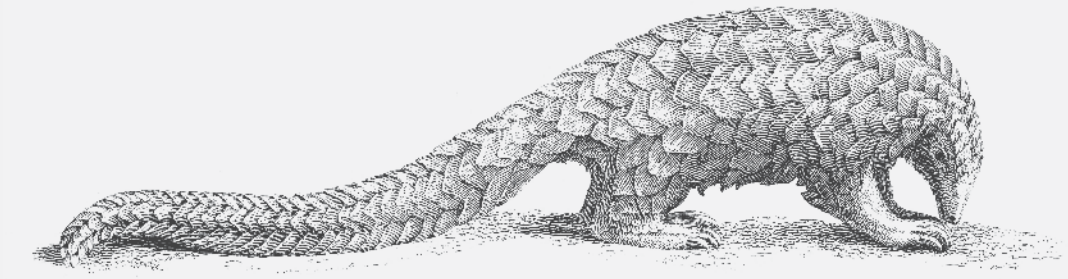
- development of participatory domestication methods[11] that take all the social players into account;
- improvement and modernization of post-harvest technologies;
- development of standards for the gathering, processing and exporting forest products of high nutritional value;

[11] Participatory methods allow the creative solution of problems by actively involving all the parties, each with his or her particular knowledge and skills.

- rationalization of markets (design of strategies, improvement in knowledge) and concentration of efforts on products of high nutritional content;
- taking into account of storage constraints when selecting species (encouraging those with a faster germination period, for example);
- adaptation of legislation to the constraints of NWFP exploitation;
- nutritional education of consumers and others in the value chain;
- taking into better account NWFPs in food and nutritional security development programmes;
- introduction of NWFPs into the urban scene and into cafeterias and canteens in order to make their consumption more popular inasmuch as they often suffer from an image as poor people's food.

7. Conclusion

Dependence on agriculture and animal husbandry is a recent development in our societies. Forest products of high commercial value have steadily assumed greater importance, to the detriment of traditional knowledge about sustainable management. NWFPs do not always receive the attention they should in programmes to combat malnutrition, whereas they could make a major contribution. Although their contribution to household food security and health is recognized, their real potential is as yet unexploited. A multidisciplinary approach based on local needs should be encouraged in order to develop adequate management of edible NWFPs and ensure their appropriate use. Technical improvements, the establishment of standards and the promotion of good nutritional practices are strategic areas and measures in which forest people have a vital role to play.



NWFPs provide communities with food, including bushmeat, and income-generating activities, thus helping to improve their livelihoods and ensure their food and nutritional security, and also their right to adequate food.

Bushmeat is the main source of protein for rural people in Central Africa. However, an imbalance between the supply and demand of bushmeat has a negative impact on the sustainability of the resource. It is important to manage wildlife resources more sustainably, promote better sustainability practices and coordinate policies in COMIFAC member countries.

Chapter 6
Bushmeat and forest peoples' quality of life

Julius Chupezi Tieguhong and Jean Lagarde Betti

1. Introduction

Bushmeat comes from a range of species of terrestrial wild animals (mammals, reptiles, amphibians, insects and birds) and is a food and medicinal commodity. In Central and West Africa, the term "bushmeat" used to refer only to wild animals that had been hunted, whereas today it refers more broadly to the meat of terrestrial wild animals that have been killed for subsistence or trade in all humid tropical zones (Africa, Asia, Latin America and the Caribbean). Some authors consider it more an African term denoting the flesh of any kind of terrestrial wild animal, from snails to elephants. Semi-aquatic freshwater animals such as frogs, turtles and crocodiles are considered bushmeat, while fish are not (Postnote, 2005).

The people of the forest regions of Central Africa hunt wild animals essentially to eat, sell or, depending on circumstances, offer (Tieguhong and Zwolinski, 2009; Nasi *et al.*, 2008; Cowlishaw *et al.*, 2004). The main income-generating activities associated with bushmeat in the region are gathering (hunting and trapping), processing (drying and packaging) and trading (on local, regional and international markets). Although these activities are causing an ongoing major reduction in the animal populations of forests, they do provide thousands of people with employment, significant income and an animal protein intake (Tieguhong and Zwolinski, 2009; Cowlishaw *et al.*, 2004; Hoyt, 2004; Postnote, 2005; Fargeot and Dieval, 2000; Bowen-Jones, 2003; Oates, 1996).

As a source of food security and income for the poorest people, bushmeat is in crisis. Increased demand from the growing urban population, top-down control and an overcentralized approach to wildlife management by government and conservation bodies are the causes, along with the poor technical and financial capacity of the institutions involved and ignorance of the needs of local communities (TRAFFIC, 2010; Van Vliet *et al.*, 2010; Redmond *et al.*, 2006; Alvard, 1995). In 1990, the population density in the countries of Central Africa, in particular those with forests, was 11.4 inhabitants per square kilometre, while it had increased to 24 inhabitants per square kilometre by 2008 (Forest Carbon Asia, 2011). The ban on hunting, the supervision of traditional hunters and the setting of limits on kills, quotas and hunting seasons have not in general led to the anticipated results (Nasi *et al.*, 2008). The phenomenon of overhunting of the most popular animals demonstrates the need to review current exploitation methods to ensure the sustainability of stocks (Bowen-Jones, 2003; Rose, 2002).

Who are the stakeholders in this value chain in crisis? How relevant are production and marketing initiatives and what account do they take of sustainability for both wildlife and local populations? What programme would promote the conservation and sustainability of the various sources of supply for the region?

2. Overview of the use of animal wildlife resources in Central Africa

A number of researchers in Central Africa believe that huge amounts of bushmeat – about 5 million tonnes – are taken from the forests of the Congo Basin each year (Fa *et al.*, 2002). The same authors' analysis also indicates the unsustainability of these amounts, which involve numbers of species in various countries. Sixty percent of the Congo Basin's mammals are hunted assiduously at approximately six times the rate considered sustainable. The size of large mammals makes them more vulnerable to all kinds of hunting, since a single slain animal provides a large amount of meat. The largest animals are also those endowed with the most precious external attributes: horns, antlers, tusks, furs, hides and feathers. The yield per unit of time and cost invested by hunters is very high for these large animals (Tieguhong and Zwolinski, 2009), which belong moreover to rarer species with slower reproduction cycles. Hence their overhunting, their low resilience and the decline in their numbers.

Primates reproduce more slowly than their size would indicate. They are also as vulnerable to hunting as larger animals and are equally in danger of extinction. Great apes such as gorillas, chimpanzees and bonobos are hunted with guns. They account for 1 to 3 percent of all species of bushmeat sold in markets (Tieguhong and Zwolinski, 2009; Fa *et al.*, 2003). Although hunters kill indiscriminately, they do seek certain animals more than others. According to Bowen-Jones (2003), the species most widely sold in markets is duikers, which account for 42 to 84 percent of bushmeat sold. More recent studies put the figures at 39 percent for duikers, 19 percent for porcupines, 8 percent for pangolins, 8 percent for antelopes, 6 percent for sitatungas, 6 percent for giant forest boars, 4 percent for cane rats, 3 percent for monkeys, 3 percent for giant rats and 7 percent for other animals, particularly crocodiles, water chevrotains, African golden cats, francolins, buffalos, mongooses and pythons (Tieguhong et Zwolinski, 2009).

3. Stakeholders in the bushmeat industry

Over the past 20 years, game hunting has lost its viability with the appearance on the scene of several players with divergent interests. These players are individuals, social groups, communities and institutions of all sizes and at all levels. They include the decision-makers, planners and administrators of public institutions and other organizations, as well as trade groups and groups of users for subsistence purposes. On the basis of studies and meetings with individuals and institutions, the players who perform the five main functions of production, consumption, supply, management and support to research in their activities of gathering, processing and marketing bushmeat are:

- traditional hunters (groups, individuals);
- rural communities;
- traders (buyers, sellers);
- urban society;
- public bodies responsible for the conservation and protection of animal wildlife;
- international and national conservation institutions;
- the donor community;
- logging and mining companies;
- decision-makers;
- future generations.

In Central Africa these players fall into two categories: internal and external. Most of the external players, such as decision-makers, funding institutions and NGOs, influence the development of wildlife management policies and strategies. Internal players, such as hunters and forest dwellers, who are less powerful and influential than external players, have less influence on the definition of national policies and strategies.

It seems clear today that measures introduced by external players will be incapable of improving the exploitation of bushmeat if they do not take into account the quality of life and the economic, cultural and nutritional interests of the internal players, who are closer to the forest and its resources.

3.1 Economic value

Among some tropical forest peoples, the distinction between use for commercial ends and for subsistence is hard to determine, since bushmeat is a source of both food and income. Several studies group household consumption and local sales of bushmeat together in the category "locally consumed portion" of total production (Tieguhong and Zwolinski, 2009). Others (Tieguhong, 2009; Takforyan, 2001; de Merode *et al*., 2004) show that most hunters in forest regions sell significant proportions of bushmeat in their villages (more than 30 percent in Cameroon and up to 90 percent in the Democratic Republic of the Congo). In a forest concession in the eastern Cameroon region, 99 hunters kill about 37 960 animals a year and sell 62 percent of them, while the remainder goes for consumption by their families and friends (Tieguhong and Zwolinski, 2009). The hunters' annual income would be considerable, especially if their net income and the value of what they themselves consume are properly calculated (see Table 1).

Table 3
Average annual income from bushmeat, per hunter

Variables measured	Average annual income (CFAF)	Place/Country	Author
Net income	444 000	Eastern Cameroon region	Tieguhong & Zwolinski, 2009
Net income	277 836	Bifa, southern Cameroon region	Ngueguim, 2001
Net income	608 000	Lobeke National Park	Makazi, 2004
Net income	350 000	Cameroon	Infield, 1988
Net income	360 000	Central African Republic	Infield, 1988
Net income	200 000-350 000	Dzanga-Sangha Forest Reserve, Central African Republic	Noss, 1998

Source: Tieguhong and Zwolinski, 2009

Although hunters engage in other economic activities, the proportion of their income coming from hunting is usually high. In the rural zone of Gabon, hunting accounts for between 15 and 72 percent of household income, with an increasing proportion in the poorest and most remote communities (Starkey, 2004). Income from hunting usually exceeds the national per capita income in most of the Congo Basin countries, except for Gabon and Equatorial Guinea (Tieguhong and Zwolinski, 2009).

Rural people who are keen to move from a subsistence economy to a market economy have very few ways of generating income. Bushmeat represents an opportunity, insofar as it is easily transported and sold, costs little to conserve and has a high value-weight ratio (de Merode *et al*.,

2004). It is very often the primary source of animal protein and the main cash product for the inhabitants of tropical rainforests (Tieguhong, 2009; Bennett and Robinson, 2000). The poorest people depend more than the better-off on selling bushmeat, since it is their sole product with a high market value and their sole source of animal protein (Takforyan, 2001; de Merode *et al.*, 2004). In 2004, de Merode *et al.* showed that bushmeat is a moderately important component of household diet but a major component of household income, especially for the poor. This goes against the conventional view that the poor use bushmeat essentially for subsistence while the rich trade it.

Economic reasons can lead consumers to prefer bushmeat over other types of meat. Some authors claim that people eat it because it is cheaper than other sources of protein, especially in remote villages in the Congo and the Central African Republic, where bushmeat costs a third of the price of any alternative source of protein, such as chicken, fish or beef (Walsh *et al.*, 2003; Wilkie and Carpenter, 1999; Noss, 1998). A study by Delvingt *et al.* (1997) qualifies this explanation by noting that certain kinds of bushmeat such as caterpillars may be dearer per unit of weight than meat from domestic animals, as is the case in the Central African Republic.

3.2 Nutritional value

Several studies present bushmeat as the main source of protein in Central Africa and one of the most important sources of income for the rural population of the region, providing up to 5 million tonnes per year (Fa *et al.*, 2003; Nasi *et al.*, 2011).

Bushmeat is in fact an important source of protein, added to the gathered products that are considered supplements to starch-based diets and provide rural communities with calories, proteins and essential fats. According to Draulans and Van Krunkelsven (2002), bushmeat provides protein for many poor rural families with no land and no access to agricultural markets, and 80 percent of all animal protein consumed by households in a large part of Central Africa. This proportion may vary depending on season and place. A case study by de Merode *et al.* (2004) in the Congo shows that bushmeat accounts for 3 percent of the household dietary ration, fish for 6 percent and wild plants for 10 percent. During the lean period, when harvests are low, the consumption and marketing of bushmeat, fish and wild plants increase by 365 percent, 233 percent and 155 percent respectively.

Even among communities that have moved from a hunter-gatherer way of life to pastoral or agricultural activities, hunting and gathering are still important for a large majority of households. Some authors estimate that hunting provides between 30 and 80 percent of all the protein intake of rural households and nearly 100 percent of animal protein in villages within forests (Koppert *et al.*, 1996; Nasi *et al.*, 2011).

The average protein content of bushmeat is estimated at about 30 grams of protein per 100 grams of meat (Ntiamoa-Baidu, 1997). According to Fa *et al.* (2003; 2015), the current daily protein intake from bushmeat ranges from 30 grams per person in the Democratic Republic of the Congo to 180 grams per person in Gabon. In Latin America, the average daily per capita consumption of bushmeat is 60 grams (Townsend, 2000). Based on the principle that the protein needs of the local population are met solely by meat, WHO recommends 52.5 grams of protein or about 170 grams of meat per day for a man of 70 kilograms. Other authors, such as Koppert *et al.* (1996), give detailed estimates of the average daily per capita protein consumption of Africans, placing it at between 31 and 69 grams, or between 100 and 200 grams of meat. On the basis of

these figures, it may be concluded that the protein requirements of the people of Gabon can be met with a sustainable supply of bushmeat. Such protein cannot be replaced by the available vegetable-origin protein such as cassava or *Gnetum* spp. leaves, because they are too poor in amino acids (Pagezy, 1996). The most neglected element of bushmeat is edible insects, which are rich in iron, zinc, calcium, phosphorous and vitamins B and D. They are made up of 50 to 75 percent protein, more than chicken (23 percent), beef (18 percent), crayfish (24 percent) or pork (17 percent) (Tchibozo *et al.*, 2011).

3.3 Sociocultural value

Although hunting provides both meat and income, it is also imbued with a sociocultural significance that is central for certain communities. Links with animal wildlife are strong and close, and hunting is associated with the basic values of social life that are linked to food and medicines coming from the forest (Ntiamoa-Baidu, 1997). Mbete *et al.* (2011) note the cultural attachment that urban households in the Congo have to eating bushmeat, which is associated with their village of origin and its rituals and festivals, and with friendship and prestige. Studies by Wilkie *et al.* (2001) in Central and West Africa show the importance of animals in rituals as luxury products for elites. Because of this strong cultural preference for bushmeat, Gabonese purchase it at 1.6 times the price of ordinary meat from domestic animals (Wilkie and Carpenter, 1999). Bowen-Jones (2003) sums it up, saying that the purchase and consumption of bushmeat in urban zones is a way of returning to one's origins (village food) and demonstrating wealth.

Wild animals and plants form the basis of traditional medicine and are the main ingredients used by traditional practitioners (Ntiamoa-Baidu, 1997). The animal parts used are the flesh, hair, skin, tail, bones, teeth, fat, glands and faecal matter. There are many afflictions treated, ranging from mental and physical ailments to antenatal care. Wild animals with spiritual and cultural uses fall into three categories: totemic species, taboo and sacrificial species, and/or ceremonial species (Ntiamoa-Baidu, 1997). The role of wild animals and the medicinal products they provide is still fundamental in Central Africa. It affects the food security of households, inasmuch as the use of traditional medicines helps families to reduce their health outgoings and save money, which can then be used to purchase food and other necessities (Ntiamoa-Baidu, 1997).

The acquisition of animal parts as cultural artefacts, personal ornamentation or hunting trophies is also still a widespread practice. In several Central African cultures, becoming a hunter is essential in order to earn respect, affirm one's virility or win a bride. Men therefore hunt even when they have alternative sources of food and income (Bennett and Robinson, 2000). These links between hunting, wildlife, religion and forest peoples' sociology must be taken into account in conservation and sustainable management plans (Nasi **et al.**, 2011). It is vital to involve the men and women at different levels in the chain (hunting, consumption, processing and trade) to ensure that women, children and ethnic minorities in the forest benefit fully from its advantages.

4. Management of bushmeat resources

Recent conservation measures propose raising wild animals such as hedgehogs and duikers in captivity as an alternative to hunting (Nasi *et al.*, 2008; Ntiamoa-Baidu, 1997). In forest concession zones, local hunters and villagers would happily eat other meat from cattle, poultry, sheep and goats (Tieguhong, 2009) if it were available and affordable. However, the alternative of

domestic animals is problematic inasmuch as they are not traditionally used to meet the daily animal protein requirements of the inhabitants of Central African forests. Rearing commonly consumed bushmeat species would thus be preferable in order to preserve the cultural value of dietary habits. The choice of species could take its lead from successful experiments in Cameroon, the Central African Republic, the Congo, the Democratic Republic of the Congo and Gabon (Tcheumetcha, 2011; Rose, 2002; Ntiamoa-Baidu, 1997).

Bushmeat from the forest costs nothing in terms of rearing. With domestication, it would be necessary to find upstream funding and organize capacity-building for local-level technical skills. This is the main challenge for conservation initiatives and development interventions in forest zones. Most of those who have access to cash or loans come from local elites and are familiar with the technology needed to benefit from this alternative to bushmeat. The choice of species for domestication must be economically viable and practical, but also socially just and acceptable (Rose, 2002).

The species selected for rearing in captivity should be of Central African origin and not species that have been successful in other countries or regions. Thus, the greater cane rat or grasscutter (*Thryonomys swinderianus*) could be the best choice for Central Africa because of its high nutritional value compared with that of all other sources of animal protein (Tcheumetcha, 2011). Greater cane rats are rodents that can measure up to 60 centimetres in length and weigh up to 9 kilograms. A rearing handbook has been produced in order to assess and establish the financial resources needed to create small- or large-scale farms (see Box 1).

In spite of a willingness to reflect on possibilities for the domestication and sustainable production of bushmeat, the trend today is still towards managing wild species in their natural habitat, ruling out the idea of protected areas and working to resolve conflicts among the various players involved in the sector. Lessons on the participatory management of wildlife resources are provided by the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe, the Administrative Management and Design Programme for Game Management Zones (ADMADE) in Zambia, the Selous Conservation Programme (SCP) in Tanzania, the Communal Area Conservancies (CAC) system in Namibia and the management of the Gebhardshain Reserve and Community Forest in Germany (Baldus, 2009).

The Bushmeat Liaison Group formed on the basis of the Convention on Biological Diversity (1992) in 2009 stresses that the preservation and sustainable production of bushmeat must be underpinned by efficient resource management that allows demand to be met (LG Bushmeat, 2009) and involves application of the law, collaboration among stakeholders in the value chain, building of national and local capacities, and implementation of methods that give wildlife resources outside protected areas (forest concessions, community hunting zones or ordinary communal lands) the same importance as those within protected areas (LG Bushmeat, 2009). According to Mapedza (2007), community management of natural resources can lead to an improvement in their exploitation and use.

A set of recommendations concerning in particular the legal framework and the organization of production and trade has been drawn up by the authors:

1. Direct incentives to sustainable resource management for the benefit of local communities should be increased. If bushmeat is to become a sustainable source of food security in Central Africa, the following actions should be encouraged:

- management and conservation of available resources by domestication and animal husbandry, and definition of codes of conduct for the various users;
- maintenance of resources within an integrated rural development system with limited depredation;
- design and implementation of appropriate exploitation methods within the framework of traditional and/or modern resource management systems;
- modification of inappropriate hunting and exploitation methods;
- proposal of alternative solutions for the main use of natural resources through the domestication of wild animals, animal husbandry and advanced management of community resources;
- improvement in harvests, animal husbandry, fish production and access to the products therefrom.

2. Organized local communities should be given more power to manage issues associated with animals.
3. More precise evaluations of cost-benefit ratios should be carried out in order to help establish a reasonable balance between agricultural activities and conservation.
4. Mechanisms should be created to provide wildlife and forest resources with added value.
5. Donor support should be increased to improve the representation of local communities and the necessity to be accountable (Mapedza, 2007).

5. Production process

Several types of action can promote sustainable management with regard to the hunting, processing, storage and transport of products (Ntiamoa-Baidu 1997; Tchibozo *et al.*, 2011):

- identification and monitoring of health problems, including those of wild and domestic animals;
- definition and application of standards with regard to bushmeat;
- evaluation of practices and improvement of hygiene during the production cycle;
- information, advice and training for the operators of this cycle;
- creation and integration of a bushmeat specialization course in higher training on animal production within appropriate training institutes.

6. Commercial aspects

The issue here is that of amending a certain number of practices in the bushmeat value chain with a view to its professionalization, through:

- increased accessibility and a greater range as new markets are developed;
- examination and improvement of local commercial practices;
- evaluation and organization of local and national markets;
- organization of subregional and international trade;
- support for women's activities in marketing smoked bushmeat, since they are pioneers in this activity;
- design of enabling policies and creation of a legal and institutional environment that takes the regional and subregional framework into account;
- evaluation of capacities and skills, and training to develop efficiency.

Box 1
Creation of small-, medium- and large-scale greater cane rat farms

To create a small-scale farm, a group of progenitors is needed, comprising three females and one male from different stock lines. Within three years, the farm can produce 42 females and 10 males. After this, the annual production can range between 150 and 170 adult greater cane rats. After five years' activity, a small-scale farmer's operating account can show a gross annual profit (after depreciation) of about CFAF 850 000 (Tcheumetcha, 2011), higher by far than the guaranteed minimum wage applicable in Cameroon.

For a medium-sized farm (250 females and 25 males at the start), an annual production of 2 500 greater cane rats and 1 214 permanent adults can be anticipated. Such a farm would need a work force of seven, comprising the farmer and six labourers.

For a large-scale farm, about 2 500 reproducing females and 350 males would be needed to obtain an annual production of 25 000 greater cane rats, with a work force of 32. The meat can meet the demand from five medium-sized restaurants and ten bars and hotels. At the end of the tenth year of operations, the operating account of an intensive production farm (after depreciation) will show about CFAF 156 million (Tcheumetcha, 2011).

7. Conclusion

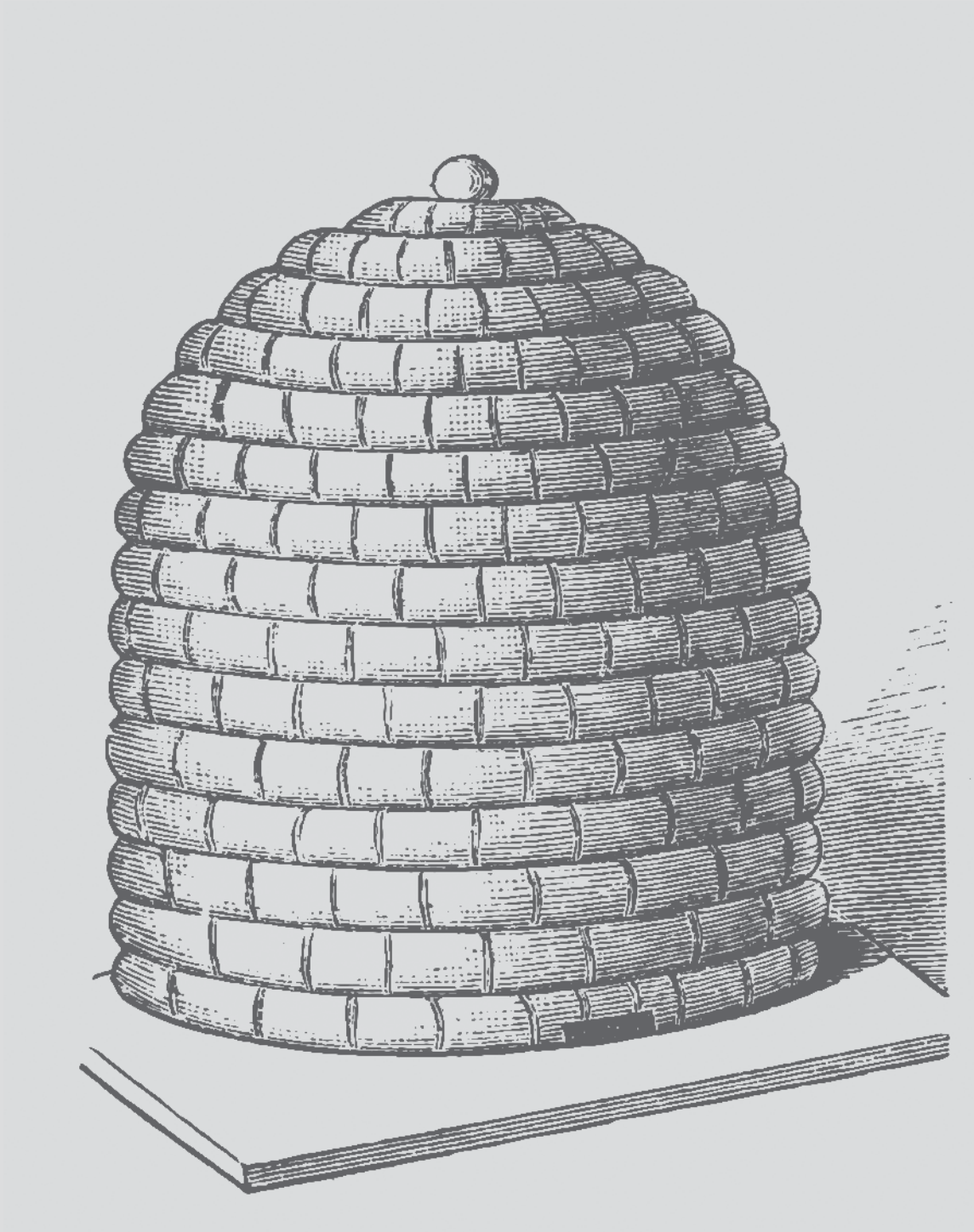
Although hunting bushmeat is seen as a threat to several wild animal species in Central Africa, it still features large in the way of life of many communities. If it reached unsustainable levels, it could constitute a very real threat to wildlife populations and to people for whom it is a source of food and income. It cannot be denied that the increased trade in bushmeat raises a problem of sustainability, which has repercussions for the ways of life of poor people who depend on forests. It might be suggested that the commercial interests of traders should be viewed separately from the regular survival activities of the local population.

Leaving aside any generalized criminalization of bushmeat, the social, economic, cultural and food importance it still has for certain peoples must be recognized and a system to monitor its exploitation and trade in Central Africa should be put in place. A viable alternative would be to increase production of the most popular species by disseminating practical domestication techniques, and also to develop the fishing sector. This would require targeted finance from conservation and development agencies in forest and grassland zones.

Apart from the issue of finance, there are still various major external challenges, including:

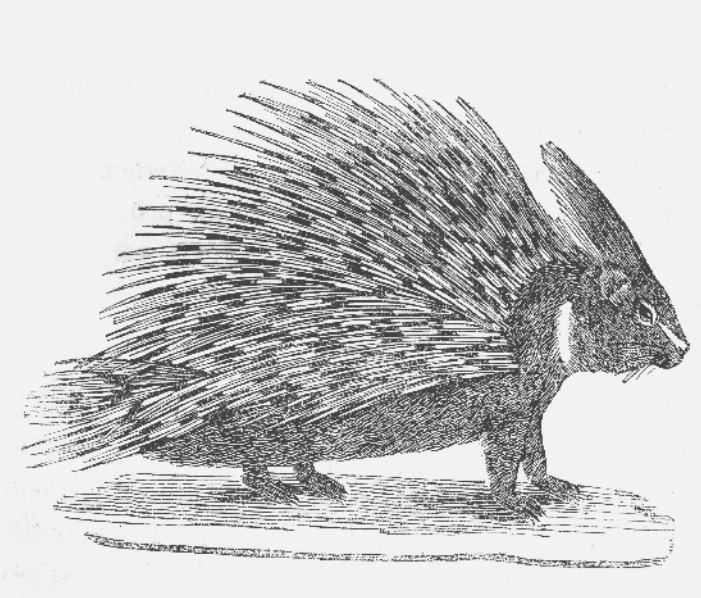
- integration of conservation and development, while reducing dependence on bushmeat;
- working with forest exploitation industries to control hunting, especially under the sustainable wildlife management project in forest concessions in the buffer zone near the Nouabele-Ndoki National Park in the northern part of the Congo (Poulsen and Clark, 2010);
- improvement in overall governance of the sector and in political will.

Such initiatives will encourage the emergence of better partnerships in wildlife management, especially in respect of renewed interest in the community management of wildlife outside conventional protected areas.



Part III
NWFPs and their economic and social importance

Page



NWFPs give many households the chance of earning significant amounts of money, which means that incomes can be diversified and basic goods and services acquired. Furthermore, most of these products are seen by the people as having a strong cultural value.

Chapter 7
NWFPs help to generate income for poor households

Verina Ingram, Awono Abdon and Jolien Schure

1. Introduction

As stated in Chapter 2, NWFPs play a central role in the lives of the people of Central Africa. They contribute to income and provide many jobs for men and women in both rural and urban areas. Many studies show that in countries where the human development index[12] ranges from 0.361 to 0.703, people living around forests obtain 60 to 80 percent of their income from natural resources (Ndoye *et al.*, 1997; Awono *et al.*, 2009). NWFPs account for an average 40 percent of annual household income, the precise proportion varying depending on region, market, the products concerned and their seasonal nature (Awono *et al.*, 2009). Worldwide, the proportion is about 25 percent (Angelsen and Babigumira, 2010). In most cases, the poorest people play the leading role in gathering and marketing NWFPs at the local level. They rely on forest resources on a permanent basis to feed and treat themselves, obtain income, build dwellings and celebrate their rituals (Eyog *et al.*, 2006).

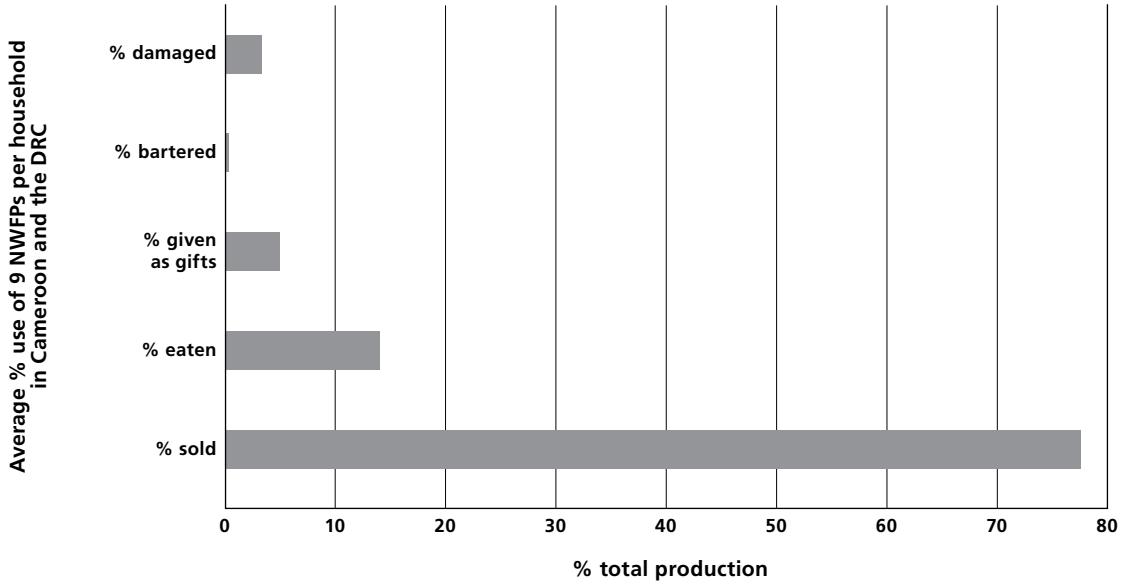
2. NWFPs: income for poor households

Assessments carried out in 2010 by the African-Caribbean-Pacific Forest Research Network (ACP-FORENET) on NWFPs in Cameroon, the Central African Republic, the Republic of the Congo, Equatorial Guinea and Gabon showed that at least 500 plant species and 85 animal species are extracted from forests in the Congo Basin. In Cameroon, for example, about 500 plant species and 82 animal species are gathered, about 67 percent of which are used mainly in food and to make cosmetic products. Products extracted from about 60 percent of the species are used by households for medicinal or food purposes, or are processed by the pharmaceutical industry. In the Central African Republic, at least 57 plant and animal species have been listed as being used for medicinal and food purposes (N'Gasse, 2010). The same source reports that about 70 percent of the inhabitants rely on plants to stay healthy. In the Congo, at least 166 plant species are used for food and 176 for medicines to treat 289 ailments (Profizi *et al.*, 1993). In the Democratic Republic of the Congo, more than 169 plant species are used for food and 166 to treat ailments (Toirambe, 2007). In Gabon 58 botanical families have been identified, 29 of which have medicinal uses and 15 of which are used in construction (Walter, 2001). The differences reported among the countries of Central Africa may be attributed to the absence of statistics in some regions rather than to real differences in the use of NWFPs.

[12] The human development index or HDI was created by the United Nations Development Programme in 1990 and is a composite statistical index for assessing the level of human development in the world's countries, based on three criteria: life expectancy at birth, level of education and standard of living.

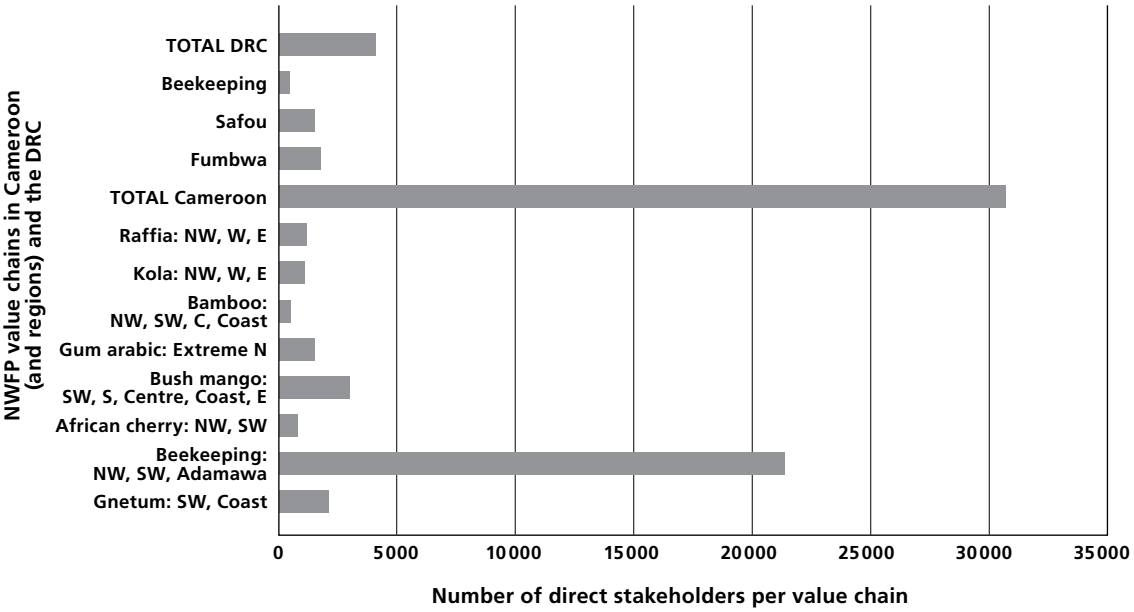
The consumption and exploitation of NWFPs depends on ecoregion and forest ecosystem, but also on ethnic group, local customs, distance from a market and alternative income-generating activities (Njiforti, 1996; Nasi *et al.*, 2008). Recent data on NWFPs in Cameroon and the

Figure 1
Distribution in volume of NWFPs gathered by households in Cameroon and the Democratic Republic of the Congo (2007/2008/2009)



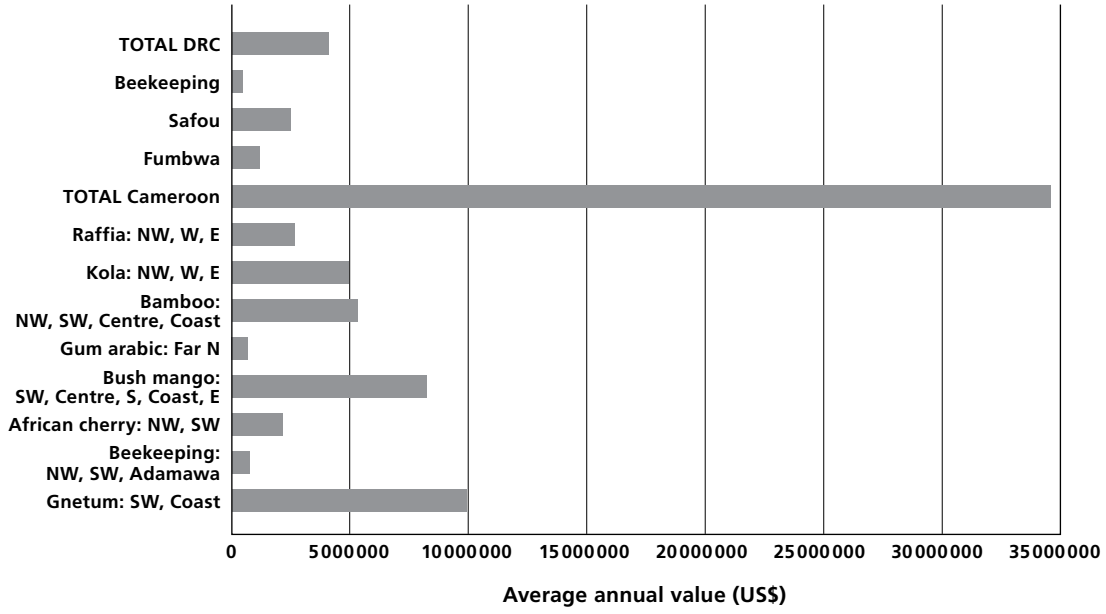
Source: Ingram, 2014

Figure 2
Average annual income of households involved in gathering NWFPs in Cameroon and the Democratic Republic of the Congo (2007–2009)



Source: Ingram, 2014

Figure 3
Valeur annuelle des marchés des PFNL en RDC et au Cameroun (2007-2009)



Source: Ingram, 2014

Democratic Republic of the Congo show that a significant percentage of the quantities gathered (an average of 67 percent) is traded (see Figure 1), while 17 to 53 percent of bushmeat is sold (Njiforti, 1996; Ayeni *et al*., 2001a; Abugiche, 2008; Nasi *et al*., 2008).

NWFPs are an important source of income and constitute a food safety net for households, especially during lean periods. The poorest people are those who depend most on income from the sale of NWFPs. On the other hand, these products are a source of extra income for those whose standard of living exceeds US$2 per day (Paumgarten, 2007; Vedeld *et al*., 2007; Delacote, 2008; Delacote, 2009; Tieguhong *et al*., 2009). The level of organization of the value chain and the mode of governance varies, depending on product and country, and this affects the volumes extracted and the division of income among the stakeholders in the various value chains. It appears, for example, that intermediaries in general tolerate more risks in most of the value chains.

The NWFP market is worth several million dollars. The annual value of the nine main NWFPs in Cameroon and the Democratic Republic of the Congo in 2007/2008 was over US$38.5 million (Figure 3). The income generated helps to raise the level of rural and even urban economies (Awono *et al*., 2009). Unfortunately, the national services in charge of statistics do not always have reliable figures on the contribution of this sector to the national economy. NWFP markets provide higher incomes to specialized wholesalers than to the many retail traders who generally invest less capital but spend more time in the markets. As Figure 2 shows, more than 31 500 people are directly employed in the nine NWFP value chains that were studied in Cameroon and the Democratic Republic of the Congo. About 350 000 other people are also involved in the chains, for transport, handling and storage. This is at least ten times the number of people employed in the timber sector in domestic and export markets (de Wasseige *et al*., 2009; Lescuyer *et al*., 2009b).

Women control over 80 percent of the NWFP commercial sector, although men predominate in the wholesale trade, which sometimes entails lengthy travel in harsh and dangerous conditions on very bad roads (Awono *et al.*, 2009).

3. The value chain of some NWFPs in Cameroon and the Democratic Republic of the Congo

This section presents the NWFPs most widely traded in two Congo Basin countries: Cameroon and the Democratic Republic of the Congo. It provides an overview of the value chain for these products, its stakeholders and its specific economic, social and ecological features.

3.1 *Gnetum spp.*

Commonly known as eru or okok in Cameroon and fumbwa in the Democratic Republic of the Congo, *Gnetum* spp. comprises two species of climbing plant or vine that are found in secondary and primary forests and on fallow land throughout Central and West Africa. Its leaves are used as medicine and a vegetable, and are known for their rich protein content. They also have the advantage of being available throughout the year. They are therefore very important for the food security of rural and urban households.

In Cameroon, 4 180 tonnes are gathered per year in the central, southwestern and coastal regions, while in the Democratic Republic of the Congo, 200 tonnes are gathered in the Mbandaka, Équateur and Bandundu provinces (Ingram *et al.*, 2010). This activity directly involves 1 885 people in Cameroon and 1 744 in the Democratic Republic of the Congo. It is a large-scale trade, with an annual market estimated at US$13.8 million in Cameroon and US$1.2 million in the Democratic Republic of the Congo. The sector provides 58 percent of the annual income of those involved in the Cameroon and 22 percent in the Democratic Republic of the Congo.

While not much fumbwa is consumed in Kisangani in the eastern province of the Democratic Republic of the Congo, it accounts for 6 percent of vegetable consumption in Équateur province. Households in Kinshasa, the capital, eat it about once a week. A plate of fumbwa costs on average US$0.76 in the Democratic Republic of the Congo, while a plate of okok or eru costs about US$1 in Cameroon. It is thus an item of everyday consumption within the reach of most households. Women dominate almost 79 percent of the eru chain in Cameroon, whereas men outweigh women in the Democratic Republic of the Congo where they make up an average of 50 to 60 percent of wholesalers and retailers. The major involvement of women in Cameroon is partially explained by the fact that for a long time men preferred growing cocoa, which was the jewel of the rural economy. During this time, apart from plantain cultivation, other income-generating activities, including NWFPs, were virtually conceded to women. This consolidated their position in the value chain, although men are now muscling into the wholesale sector (Manirakiza *et al.*, 2009).

There is growing pressure on the harvesting of Gnetum spp. Gathered in the natural environment where it has been growing for thousands of years, it is becoming rarer, while demand is constantly growing. In their concern to maximize the quantities picked, 50 percent of gatherers uproot the plant rather than cutting the liana to allow the plant to regenerate. Deforestation as a result of agricultural practices and timber extraction also contributes to the decline in the

natural stocks of eru, as 97 percent of the gatherers testify (Ingram *et al*., 2012a). The situation is similar in other regions of Cameroon (Foundoun and Manga, 2000; Awono *et al*., 2002; Bell, 2004). After several years of trials on field stations (Shiembo *et al*., 1996), domestication has taken off in this country, with the launching of the national programme to promote eru cultivation and the practical experience of the Centre for Nursery Development and Eru Propagation (CENDEP).

The market is still for the most part supplied by what is gathered in the natural environment. Access to the resource is still free in the two countries. Although 15 percent of producers in southwest Cameroon cultivate *Gnetum* spp., less than 5 percent of the amount sold comes from their fields or plantations. It is also important to note the existence of post-harvest losses (between 4 and 26 percent of total production), depending on storage or transport conditions or because of delays resulting from negotiations with the forces of order along the roads. In Cameroon, transport is carried out mainly by truck on roads that are in a very poor state, or by sea in canoes. In the Democratic Republic of the Congo, chartered aircraft carry *Gnetum* spp., especially between Mbandaka, Kisangani and Kinshasa. These risks and high costs of transport result in a major difference between the price paid to the producer and the price paid by the end consumer, with the producer receiving less than 10 percent of the price paid by the end consumer (Manirakiza *et al*., 2009).

3.2 Bush mango (*Irvingia spp.*)

There are two species of bush mango in the two countries, *Irvingia gabonensis* and *Irvingia wombulu*. The fruit of the former has a juicy, scented flesh that produces a sweet juice, while Irvingia wombulu has a smaller, bitter fruit. Their kernels are used as a flavouring and thickener in cooking, and are often preserved dried or processed in the form of a "cake". Cooking oil may also be extracted, while the juice is used in cooking and wine-making, and the pulp is used as a black dye. The peel and seeds have medicinal uses. Irvingia wood is very popular for building and as fuelwood. More than 533 tonnes of kernels from the eastern, central, southern and coastal regions of Cameroon were produced in 2007, for an estimated value of more than US$7 million. Three of these 533 tonnes were exported to Nigeria, Equatorial Guinea and Gabon. *Irvingia wombulu* is highly sought after in Cameroon's southwestern region because of its potential for export to Nigeria. A market information system was set up in 2008 and provides new harvesters, especially those living in remote areas, with access to the latest information on the value chain. In 2007, the average annual income from the sale of bush mango kernels was US$193 for producers acting as a group and US$419 for individual harvesters. The profits achieved by individuals were thus much higher. Although the average production per person in a group was greater, the groups studied were in most cases not able to forge a link with wholesalers. This may be explained not only by the poor business skills of the groups but also by the isolation of the production zones.

Households that produce bush mango kernels consume 30 percent of their production on average, with the remainder going for sale and producing about 25 percent of their income, 26 percent of which is then used to purchase essential items and 18 percent to purchase health products for the family. The value of 1 kg of kernels in the production zones varies between US$0.9 and US$1.8, while the same quantity costs between US$2.5 and US$4.6 to the end consumer. The economic value of 5 000 tonnes of kernels was US$7 855 537 in 2007. Producers receive between 30 and 50 percent of the price paid by the end consumer, with the price increasing

if the product is packaged in bundles or sachets. About 50 percent of traders and exporters in southwest Cameroon are Nigerians, who are established there seasonally. The outlook for long-term sustainable management is dependent on issues concerning legislation and harvesting permits, in a situation of growing demand from neighboring countries (Awono *et al.*, 2009; Ewane *et al.*, 2009).

3.3 *Prunus africana* or African cherry

Prunus africana, African cherry or pygeum, is a tree found in montane forests. For the past 15 years, Cameroon has been one of the major exporters of the bark of this species, with an annual average of 1 700 tonnes being exported to Europe and the United States. The international pharmaceutical industry uses the bark in the treatment of prostatic hyperplasia and hypertrophy of the prostate gland. More than 45 traditional uses have been recorded in Cameroon, ranging from anti-inflammatory and analgesic treatments to medication for stomach aches, urogenital ailments, allergies and malaria, and also for veterinary purposes. Prunus africana is the preferred wood for hoe handles and sculpture, while it is also used as fuel (Stewart, 2003). The pharmaceutical industry is responsible for its rise in value from US$0.35 per kilogram for the raw bark to US$350 for the packaged medicine. International demand over the past 40 years has caused prices to leap by over 600 percent, leading in turn to a massive increase in the numbers of gatherers and sellers. Classification of Prunus africana as a vulnerable species has then led to an international-level stiffening of the conditions for its extraction, notably in 1997 through the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), which classifies it in Annex II. However, the 2007 inventory (Foaham *et al.*, 2009) showed that most harvesting of Prunus africana still takes place in natural forests in an unsustainable manner, as is seen from the fact that bark had been removed from right around trees at least once on 52 percent of the exemplars examined, so that 60 percent of this harvesting had been carried out in an unsustainable manner (Ingram *et al.*, 2012a).

3.4 Honey

Cameroon's honey production zones, notably the montane forest and Adamawa savannah zones, have more than 250 000 gatherers, 80 percent of whom are men. Three-quarters of these are organized in 70 microenterprises. Beekeeping contributes up to 50 percent of household income, followed by other agricultural products. At least 45 organized cooperatives producing filtered honey have been identified in the country's northwestern and southwestern regions, with each member having at least 20 hives. The average price for 1 litre of honey is CFAF 1 400 (US$3). These groups also make a whole range of secondary products, such as honey wine, soap, cosmetics, candles and pharmaceutical products. The total value of beekeeping products is estimated at more than US$800 000. Beekeeping in Adamawa tends to be a family or individual activity, with an average of 100 traditional grass- and rattan-built hives per person. Regional production is high and is estimated at 2 million litres per year, sometimes of inferior quality. More than 300 tonnes of wax are also produced annually and are exported to neighbouring countries and increasingly to the fast-expanding European market (Ingram, 2014).

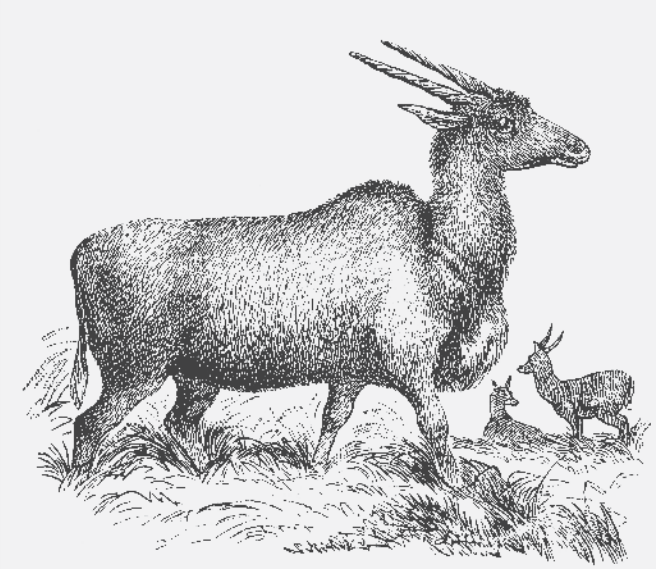
Fuelwood is used to produce wax, but other species that are important for bees are also popular for producing fuelwood. Large-scale honey production with modern or even traditional hives has increased the demand for local materials. However, NWFPs such as rattan and bamboo tend to be unavailable in the Adamawa savannah zone. Beekeepers in northwestern Cameroon are facing a fall in production and a rise in the deaths of bee colonies, probably as a result of

the very high rate of deforestation (0.37 hectares per year) and forest degradation (Solefack, 2009). A biological certification project was launched in the Oku forest in the northwestern region by an intermediary organization in the value chain and has raised beekeepers' incomes by 50 percent, with 1 litre of superior-quality white honey selling for up to US$5 in the large towns. Producers and traders are organized in groups and have formed a syndicate for exports. Quality and export standards have also been developed by the ministry responsible. The retail market for honey, wax, propolis and secondary beekeeping products is worth about US$5 million per year (Ingram, 2014).

Unlike the situation in Cameroon, honey-producers in the Bas-fleuve (Bas-Congo province) and Batéké plateau (Bandundu province) zones in the Democratic Republic of the Congo work on a small scale, with about 60 producers, mainly individuals, and an average of seven hives per person. Wild colonies are the source of 22 percent, while the remainder comes from hives producing an average of 8 to 10 litres per unit. Total annual production is about 500 litres, 83 percent of which is sold in local towns at an average of US$2.6 per litre, the price depending mainly on the place and the person. Consumers use the honey as medicine (65 percent) and food (35 percent). Processing and the use of secondary products are virtually nonexistent in these regions. On the Kinshasa honey market in 2007, the income generated by wholesalers was estimated at US$237 000 and that by retailers at almost US$67 000. The average annual income of individual producers was estimated at US$3 500 (Ingram, 2014; Awono *et al.*, 2008).

4. Conclusion: between subsistence and income-generation, the dangers of overexploitation

NWFPs fulfil many functions for the population of the forest regions of the Congo Basin, ranging from subsistence to income-generation. Studies focus basically on the NWFPs that provide food, medicines, materials and energy. Although they may not be staple commodities, some NWFPs, such as *Gnetum* spp., play a considerable role in the diversification of food sources, while others, such as safou and honey, contribute to the development of seasonal alternatives to agricultural activities. For many communities, these products also have a major cultural value. In Cameroon, for example, the kola nut is believed to strengthen ties between families during marriages. Formerly, local-level exchanges through trade or barter did not disturb forest ecosystems because the volumes gathered did not exceed the natural regeneration capacity. Management could thus be controlled and remain sustainable. When NWFPs gain in value and the volumes traded increase, the consequences of their exploitation are no longer the same. The *Gnetum*, *Prunus* and honey value chains show how stakeholders in these chains can earn significant sums, allowing a diversification in household income and the acquisition of basic goods and services. However, an ongoing lack of communication among the stakeholders should be noted, often because of unsatisfactory agreements on access to the resource and the application of sustainable harvesting techniques (especially when customary regulation is ineffective). These shortcomings result in overexploitation as certain stakeholders seek to obtain as large a short-term profit as possible.



NWFPs are important in the lives of the people of Central Africa. They help to generate income for poor households and provide employment for many men and women in both rural and urban areas. They were probably already being traded overseas to Europe and North America before independence, but the volumes grew after the ECCAS member states gained independence. The promotion of NWFPs in the West seems to increase in proportion to the size and growth of the diaspora.

Chapitre 8
Immigration and the development of food NWFP exports from Central Africa

Honoré Tabuna

1. Introduction

The international trade in NWFPs from Central Africa is growing fast. Since the 1960s, a portion of the food products extracted from the forest and savannah zones of ECCAS member states has been exported to Europe and North America (Canada and the United States), especially to areas where immigrants from the ten countries of the subregion have settled.

Immigrants in Europe, whose exact number is not known because of the wide variety in their status (diplomats, students, trainees, political refugees and illegal immigrants), are currently the source of the main demand for NWFPs. Two types of European market for food NWFPs from Central African can be distinguished, based on their numbers: main markets and secondary markets.

Main markets are the countries that host many migrants from Central Africa and were major colonial powers. In order of size, these are: France, the former colonial power in five countries (Cameroon, the Central African Republic, Chad, the Congo and Gabon); Belgium, with three countries (Burundi, the Democratic Republic of the Congo and Rwanda); Portugal, with two (Angola, and Sao Tome and Principe); and Spain, with one (Equatorial Guinea).

Secondary markets include Germany, Italy, Luxembourg, the Netherlands, Poland, Switzerland and the United Kingdom, most of which have a recent colonial past.

The main markets are dominated by France and Belgium, which are the first to receive products. Part of these products are distributed through national channels for traditional African foods, while another part is re-exported to secondary markets. The products sold on main and secondary markets come mostly from Cameroon and the Democratic Republic of the Congo. There are many of these, but those most regularly imported are the main food NWFPs (safou [*Dacryodes edulis*], fumbwa [*Gnetum* spp.] and dried caterpillars) and the secondary food NWFPs (spices and flavourings such as njangsang [*Ricinodendron heudelotii*], andok or bush mango [*Irvingia gabonensis*], calabash nutmeg [*Monodora myristica*] and such fruit as tondolo [*Aframomun* spp.] and mbungu or wild apricot [*Landolphia* spp.]).

After presenting the placement of the European trade in food NWFPs from Central Africa, this chapter describes how the trade operates (points of sale, stakeholders, distribution channels, prices, bottlenecks) and its potential for development. It is based on the first studies of

the European market (French and Belgian in particular) for African products in general and traditional foods from Central Africa in particular.

2. Placement and brief history of the trade in food NWFPs in Europe

The international trade in food NWFPs from Central Africa provides an opportunity to maximize the biodiversity of ECCAS member states. On the European market, it constitutes a part of the ethnic trade, a concept born in the United States to designate the economic activities of national minorities such as Afro-Americans, but then extended to immigrant populations such as Asians (for example, Chinese, Vietnamese and Indonesians). The products distributed along these trade channels are designated as ethnic products.

Tabuna (2000) defines ethnic products as those related to geographic and cultural origins, as distinct from exotic products, which are related only to geographic origin. According to Tabuna, ethnic products convey a culture unknown to the majority communities and the inhabitants of the host country living in large multicultural cities, not only in Europe and North America but all over the world. We can speak of an ethnic trade as much in Paris as in Yaoundé, where the trade carried on by Cameroonians can be distinguished from that carried on by immigrants, for example Chinese. Similarly, in Libreville, hundreds of traders from West Africa and Cameroon can be seen alongside Gabonese traders.

Food NWFPs from Central Africa are strongly marked by the food culture of the exporting countries. They convey a cultural identity and are primarily consumed by members of the diaspora in large European cities such as Amsterdam, Bonn, Brussels, Cologne, Lisbon, London, Lyon, Madrid and Marseilles. Their taste, preparation and consumption are unknown to Europeans.

In these large cities and others (Anvers, Birmingham and Montpellier), food NWFPs from Central Africa have been sold since the 1960s. There have been few writings on the history of this trade, but Tabuna (2000) states that this market came into existence after the first migrants from ECCAS member countries settled in Europe.

Tabuna explains that in the case of France the trade in traditional African products, including those from Central Africa, really got under way with the achievement of independence by the exporting countries. At that time, many students and trainees from the newly independent countries were attending universities, training colleges and other establishments that had already, during the colonial era, been aimed at people from colonies and overseas territories. These students would return regularly to their countries during holidays and then come back with products either for their own consumption or for friends, whether or not from Central Africa, or for selling to members of the community who were nostalgic for the flavours of their country or keen to preserve their dietary habits. In this way, the trade steadily grew from selling in homes to the current market.

3. Organization and operation of the international trade in food NWFPs

3.1 Demand

3.1.1 Types of customer

Customers for food NWFPs from Central Africa may be divided into three groups: initiates, neophytes and intermediaries.

The first are the most numerous and are members of the diaspora who have been initiated into the consumption of food NWFPs in their native region. They are familiar with the names of the products, recognize their quality and know how they are used and eaten. They buy the products out of nostalgia and to affirm their identity.

The second, the neophytes, are women and men from Europe and countries other than those of Central Africa, who have learned about the preparation and consumption of traditional and NWFP foods from Central Africa. Whether or not they are regular consumers of ethnic foods, they are looking for variety in their diet, something exotic and the discovery of other cultures through food.

The third, the intermediaries, are young second-generation immigrants. The Sopi agency,[13] which specializes in ethnic marketing in France, divides these people into five groups:

- the "positive thinkers"; these are young people of African origin who aspire to professional success and greater recognition; what they consume varies according to their environment (professional or family surroundings);
- the "boths"; they claim the culture of their parents as much as that of the country where they were born and keep company with people of the same community as well as those of other communities;
- the "I've had enoughs"; they have embarked on a process of assimilation and do not want to be considered as belonging to an ethnic group;
- the "identity rebels"; born in France, they feel that their origins are constantly being thrown in their face and therefore feel great frustration towards French society;
- the "like at homes"; they are often the result of family reunification or illegal immigration, and retain the essentials of the way of life in their country of origin; they try to consume products from "home", especially food and clothing.

The Sopi agency estimates that 75 percent of the "intermediary" consumers belong to the "like at home" group.

3.1.2 Size of the demand

Little is known about the demand for Central African food NWFPs on the international market, whether potential or real. At present, the only thing that can be certain is its links with the development of immigration from Central Africa to Europe and North America. In-depth

[13] See http://www.sopi.fr/fr/

surveys regarding consumption are therefore vitally needed, not only among the diaspora but also among consumers who are not from Central Africa and among consumers of ethnic foods.

3.2 Supply

3.2.1 Exporting countries

NWFPs are exported mainly by air, but sometimes by sea, from three main countries, Cameroon, the Congo and the Democratic Republic of the Congo. The other countries (Angola, Burundi, Chad, Equatorial Guinea, Gabon, the Central African Republic and Sao Tome and Principe) are also involved in export, but in smaller quantities, to be distributed through informal channels such as home deliveries within communities. Table 1 shows the origin of the main and secondary food NWFPs.

Table 1
Countries exporting main and secondary food NWFPs

Food NWFPs	A	B	C	Cg	G	EG	CAR	DRC	STP	Ch
Main food NWFPs										
Fumbwa (Gnetum spp.)	-	-	+++	++	-	-	+	+++	-	-
Safou (*Dacryodes edulis*)	-	-	+++	+++	+	-	-	+++	-	
Secondary food NWFPs										
Caterpillars (e.g. *Imbrasia* spp.)	-	-	-	+	-	-	+	+++	-	-
Andok or bush mango (*Irvingia gabonensis*)	-	-	+++	+	+	+	-	+	-	-
Njangsang (*Ricinodendron heudelotii*)	-	-	+++	-	-	-	-	-	-	-
Calabash nutmeg (*Monodora myristica*)			+++	-	-	-	-	-	-	-
Tondolo (*Aframomum* spp.)	-	-	-	+	-	-	-	+++	-	-
Mbungu (*Landolphia* spp.)	-	-	-	-	-	-	-	+++	-	-

A: Angola; B: Burundi; C: Cameroon; Cg: Congo; G: Gabon; Ch: Chad; EG: Equatorial Guinea; CAR: Central African Republic; DRC: Democratic Republic of the Congo; STP: Sao Tome and Principe; -: non-exporting country; +: country exporting small quantities; +++: country exporting large quantities

3.2.2 Types of product exported

Two types of exported food NWFP may be distinguished: fresh and processed, primarily dried (Table 2). In the case of dried fumbwa, for example, the fresh leaves are gathered in their habitat in the exporting countries (Cameroon, the Congo and the Democratic Republic of the Congo), then cut into thin strips by women living in the four exporting cities (Brazzaville, Kinshasa, Douala and Yaoundé), who work with the exporters.

3.2.3 Quantities traded from Central Africa to European countries

The quantities of food NWFPs traded from Central Africa to importing countries in Europe and North America are hard to determine because of the lack of published statistics in both exporting and importing countries. The absence of data is explained by the absence of a modern data collection system in exporting countries. Moreover, in importing countries, food NWFPs are not codified in the international customs system, so that flows of such items are recorded

under "other products". Tabuna (2000) has worked to fill this lacuna, taking data from food NWFP importers in Europe as a starting point. The solution would be to boost the capacities of the customs services and plant health police posts located in the places of export and to create and develop an association of exporters of traditional Central African foods and NWFPs in each country. Similarly, in importing countries, the solution would involve the creation of groups of professionals who work with traditional Central African foods. The mandate of these professional groups set up in Europe or Central Africa would include publication of the quantities of food NWFPs exported from Central Africa to European countries.

Table 2
Types of food NWFP exported

Food NWFPs	Type	Type of packaging	Mode of transport
Main food NWFPs			
Fumbwa	Fresh and dried product		Air
Safou	Fresh product	Net used by onion importers	Air
Secondary food NWFPs			
Caterpillars	Dried product	Loose or in 250-gram plastic sachets	Air
Andok or bush mango	Dried product ("dry cake")	Loose	Air and sea
Njangsang	Dried product		Air and sea
Pébè	Dried product	Loose in cartons or in plastic sachets	Air and sea

3.3 Marketing and distribution channels

3.3.1 Sales outlets

According to Tabuna (1999b, 2000), there are two types of sales outlet for food NWFPs: tropical activity zone groceries and neighbourhood tropical groceries.

The tropical activity zone groceries may be run by people from Central Africa or from Europe and Asia, and they are of two types: those specializing in African products and those specializing in products from Asia or other tropical regions. They sell traditional Central African products such as saka saka, kwanga, chikwangue or foufou (*Manihot esculenta*), plantain (*Musa* spp.), palm oil, moambe or palm nut-based sauce, ngai ngai or roselle (*Hibiscus sabdariffa*) and smoked or salted fish.

Neighbourhood tropical groceries are located outside tropical activity zones and are found in neighbourhoods with a high concentration of immigrants. In the Paris region, they are found in the Seine-Saint-Denis Department, commonly known as "93", or in such towns as Villetaneuse. In Brussels they are found in the Saint-Gilles district. They are run by immigrants from Central Africa or other tropical regions, such as Chinese or Sri Lankans, who are found in increasing numbers in the Paris region. Wherever they may be – near a railway or metro station, or in a district or town inhabited by immigrants – neighbourhood tropical groceries are less patronized than tropical activity zone groceries. However, since the start of the 2000s, neighbourhood tropical groceries have been appearing that are as well stocked as the tropical activity zone groceries. This development is the result of the frequent police presence near tropical activity zone groceries in order to check immigrants' papers, so that members of the diaspora who do

not have regular residence permits prefer to avoid these checks by patronizing neighbourhood tropical groceries

3.3.2 Stakeholders

Various stakeholders are involved in the food NWFP trade in Europe: importers, retailers, re-exporters and restaurateurs. Importers are mostly immigrants from Central Africa who have settled in the capital cities of the former colonial powers of ECCAS member states: Paris, Brussels, Lisbon and Madrid. The largest importers are located in the Paris region, from where products are forwarded to others in the value chain, such as retailers.

Retailers are grocers selling traditional African foods and food NWFPs. Some are of Central African origin, while others are from other parts of the world, such as China, Sri Lanka or the Maghreb, other regional economic communities (ECOWAS) or Europe. They are present in capital cities such as Paris and Brussels, and also in provincial towns such as Dijon, Lille, Lyons, Marseille, Montpellier, Nantes and Orléans.

Re-exporters are importers established mostly in Brussels and the Paris region. The food NWFPs they receive are re-exported to North America (Canada and the United States), and especially to various European countries such as Denmark, Germany, Italy, the Netherlands, Switzerland and the United Kingdom.

Restaurateurs are located in cities in importing countries, such as Brussels, London, Montreal and Paris. They purchase food NWFPs in groceries and use them in preparing traditional African dishes.

4. FUTURE OUTLOOK

The trade in food NWFPs from Central Africa should continue to expand because of the potential for an expanding demand for ethnic foods and traditional African foods in particular. A programme to promote the trade in food NWFPs among ECCAS member states and European and North American countries should be established by the ECCAS General Secretariat responsible for coordinating all subregional initiatives with regard to the environment and natural resource management. Such a programme should encompass research and training, capacity-building and the development of enterprises and markets. One of its objectives should be the attraction of intermediary consumers and non-African customers, whether they are consumers of ethnic foods or not. The activities to be implemented would include developing production and boosting the capacities of exporters, government officials (plant health service) and those working at export locations (ports and airports). This would facilitate the collection of statistics on the supply and demand of food NWFPs from Central Africa. As Ndoye and Tabuna show in Chapter 16, the processing of NWFPs to create jobs and greater added value should have an important place in the programme to develop the trade in food NWFPs among the ECCAS member states and between these states and European and North American countries.

The recent adoption of the Nagoya Protocol on the fair and equitable sharing of the benefits arising from the utilization of biological and genetic resources[14] is a further opportunity to develop subregional trade and the export of forest resources to the international market.

[14] See Chapter 2 for further information on the Nagoya Protocol.

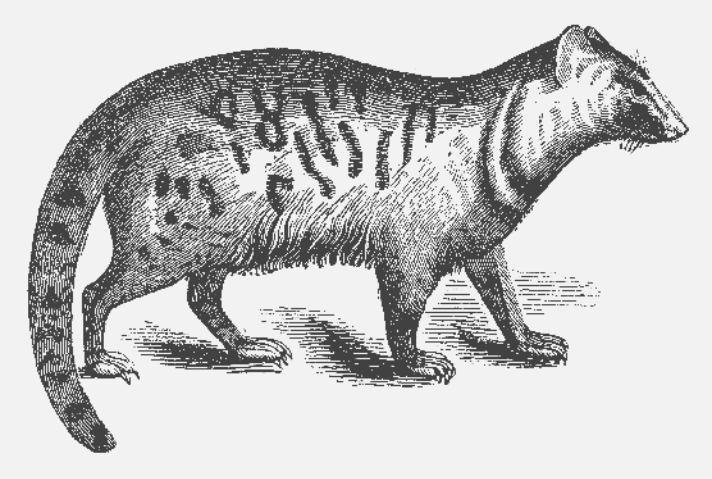
5. CONCLUSION

Their abundant biodiversity, which includes food NWFPs, means that the ECCAS member states have resources they can use to diversify their economies and participate in developing the green economy that is enjoying such a boom throughout the world.

Since international trade is involved, exporters in the subregion and importers settled in Europe who are members of the Central African diaspora and are initiating trade between Central Africa and European and North American countries must be supported financially and technically through a specific development programme.

A preliminary feasibility study on the design and implementation of such a programme is essential. Its objective would be to assess the repercussions in terms of job creation, the development of small and medium-sized enterprises, tax revenue for states and improvement in the living conditions of those involved in production in rural zones. Its results would allow states to decide whether or not to invest in developing this economy, with the help of bilateral and multilateral partners.

Part IV
Resource management: a highly complex issue



Despite the optimism over the sustainable gathering of NWFPs as a “miracle solution” to save tropical forests, it has become increasingly clear in the past 20 years that the premises underlying this model need to be re-examined.

Chapter 9
Management and conservation of NWFP resources

Terry C. H. Sunderland and Ousseynou Ndoye

1. Introduction

In the late 1980s, NWFPs were presented as a possible alternative to deforestation and other activities that convert forest land, such as timber extraction, agriculture or plantations (Falconer, 1990; Plotkin and Famolare, 1992). Since some NWFPs have considerable market value, the premise was that the long-term gains derived from the sustainable harvesting of these products could exceed the short-term gains from the conversion of forests or individual trees to other uses (Peters *et al.*, 1989; Godoy and Bawa, 1993).

This concept is interesting from the point of view of biodiversity conservation and improvement in the living conditions of local inhabitants. The latter, who live in harmony with their environment and exploit forests to satisfy their essential needs, actively protect them and use "nature's subsidies" sustainably (Hecht *et al.*, 1988). The concept of "rainforest harvest" (Prance, 1992) is firmly anchored in the extractive culture of Latin America. Such NWFPs as rubber and Brazil nuts are gathered in forest areas and sold in markets, providing a livelihood for local people. Formal recognition of reserves for extraction as legal entities is the direct result of lobbying by Brazil's National Council of Rubber Tappers (CNS), established in 1985 following a serious social crisis connected with land use in Amazonia (Richards, 1993). The appeal of this system was recognized at the end of the 1980s, with several studies published almost simultaneously, lyrically stressing the possibility of saving the world's tropical forests thanks to "sustainable exploitation", an economic alternative to timber extraction or conversion to agriculture (Hecht *et al.*, 1988; Gradwohl and Greenberg, 1988; de Beer and McDermott, 1989). This optimism was supported by the marketing potential of forest products, including medicinal plants (Farnsworth, 1988; Nepstad and Schwartzman, 1992), which would contribute to the well-being of local communities and guarantee the conservation of tropical forests by providing them with added value (Godoy and Bawa, 1993). Rainforests were then considered as having a self-financing capacity (Peters *et al.*, 1989), summed up in the popular expression "Use it or lose it" (Freese, 1997; Struhsaker, 1998; Putz *et al.*, 2001). If forests had no value in themselves, they could be converted in order to develop other more productive activities, such as agriculture. The sustainable harvesting of NWFPs was adopted as a direct way of protecting forests.

Twenty years later, the initial optimism over the prospects of a major contribution from NWFPs to conservation and development had faded considerably, mainly within the academic community (Arnold and Ruiz Pérez, 2001; Ros-Tonen and Wiersum, 2005; Belcher and Schreckenberg, 2007). It was said that the anticipated economic potential (de Beer and McDermott, 1989; Godoy *et al.*, 2000) had been assessed too simplistically (Southgate *et al.*, 1996; Sheil and Wunder, 2002). Additional complications were the limited understanding and appreciation of the complexity of

the political, economic, social and commercial issues connected with harvesting and marketing NWFPs (Dove, 1995). Doubts were also raised about the increased trade in forest products as a means of promoting conservation and development (Marshall *et al*., 2003). In particular, it has been stressed that quite a few households barely recover the costs of gathering (Southgate *et al*., 1996). Even for high-value forest products, the main share of the income goes to those who process the products, usually the richer members of society (Alcorn, 1993), local elites who control the market, and/or the state (Dove, 1993; Struhsaker, 1998; Ros-Tonen and Wiersum, 2005). Despite this, the development and promotion of NWFPs continue to undermine conservation efforts in the field, especially the implementation of integrated conservation and development projects (Kiss, 2004). The capacity of NWFPs to contribute to conservation and poverty alleviation is still being debated in contemporary writings.

This chapter examines the prospects NWFPs offer for sustainable forest management, the ecological and biological constraints, and the political and socio-economic factors that could compromise their contribution to conserving biodiversity in tropical rainforests.

2. NWFPs and the development of rural communities

Before examining the potential contribution of the harvesting of NWFPs to biodiversity conservation, their contribution to the quality of life in rural and urban environments should be stressed. A number of authors note how important NWFPs are for the local economy (Ndoye *et al*., 1997; Colfer, 1997; Belcher and Schreckenberg, 2007; Paumgarten and Shackleton, 2009; Tieguhong *et al*., 2012). In some rural localities, especially in zones lacking basic infrastructure and market access, NWFP gathering is a fundamental source of subsistence (food, medicine, shelter, tools, plants and animals of cultural value). Agricultural production is supplemented by the harvesting of wild products that contribute to long-term food security (Sunderland, 2011).

Marketing certain NWFPs represents a way – often the only one – of gaining access to the market economy (Ros-Tonen and Wiersum, 2005). The trade sometimes reaches such proportions that the chain of beneficiaries becomes complex (Belcher and Kusters, 2004). There are many examples: the marketing of Brazil nuts in Amazonia (Ortiz, 2002), the sale of Prunus africana from montane forests to the pharmaceutical industry (Ndam and Tonye, 2004), the trading of *Irvingia gabonensis* among Cameroon, Equatorial Guinea and Gabon (Ndoye *et al*., 1999) and between Cameroon and Nigeria (Awono *et al*., 2009), the export of *Gnetum* spp. from Cameroon to the Congo, Gabon and Nigeria (Shiembo, 1999) and the international trade in rattan from Southeast Asia and Africa (Sunderland and Dransfield, 2002), to name but a few. Tabuna (1999b) stresses the considerable trade in NWFPs from Central Africa intended for the African diaspora in Europe (see Chapter 8). Although NWFPs thus offer numerous economic advantages, it is important to examine the extent to which this economic or subsistence value contributes to the conservation of wild resources and biodiversity.

3. Is the harvesting of NWFPs sustainable?

The debate on the development of NWFPs is based on the premise that their harvesting is naturally more sustainable and ecologically less invasive than alternative economic activities such as agricultural conversion (Arnold and Ruiz-Pérez, 2001; Putz *et al*., 2001; Ruiz-Pérez,

2005). Sustainability is a complex concept for which there are a number of definitions (Tovey, 2009; Ostrom, 2009). In the case of NWFPs, the difference between ecological sustainability and economic sustainability must be stressed, inasmuch as they do not always go together (Hall and Bawa, 1993). Overexploitation of a resource can lead to a general decline in wild populations, while a constant demand is accompanied by a constant market value. On the other hand, increased scarcity can increase harvesting costs, raise market prices, lead to a fall in demand and possible replacement by some other product that is easier to obtain (Homma, 1992). In any case, in economic terms the effects of unsustainable extraction are more subtle and harder to detect (Hall and Bawa, 1993). This is particularly the case with very long-lived plant species such as Brazil nuts (Bertholletia excelsa), for which the low-impact harvesting of fruit can, even so, have effects on regeneration that have not yet been much studied (Ortiz, 2002). In ecological terms,[15] harvesting cannot be considered sustainable for a plant or animal species unless it has no long-term adverse effect on its reproduction and regeneration. Moreover, harvesting must not have any perceptible detrimental effect on other species within the community or on the structure or functioning of the ecosystem (Hall and Bawa, 1993). Some authors hold that there can be no truly sustainable harvesting of NWFPs (Hall and Bawa, 1993; Redford and Stearman, 1993; Peters, 1994; Struhsaker, 1998) inasmuch as long-term effects can manifest themselves in a variety of ways that are not all fully understood at an acceptable degree of probability (Struthsaker, 1998). The gathering of leaves can also increase growth because of the redeployment of stored resources, at least in the short term (Ticktin and Shackleton, 2011). Although it may not be immediately damaging, the gathering of fruit and seeds can lead to a reduction in the availability of food for fruit-eating species, affecting their future regeneration (Hall and Bawa, 1993). The hunting of predators and seed-distributing animals can also lead to regeneration problems or, in the case of pollinating species, a reduction in reproductive capacity, which can in extreme cases "empty" the forest (Redford, 1992). The harvesting of bark and other woody parts can cause the aging and eventual death of the organism (Peters, 1994; Ros-Tonen and Wiersum, 2005). This situation is often exacerbated by the absence of sufficient monitoring and application of rules where these exist, hence the low adoption of "sustainable" practices (Ostrom, 2009).

The sustainability of forest products, including wood, can be determined only by comparing the extraction rate with the harvesting rate (Godoy and Bawa, 1993). Unfortunately, very few natural science studies have measured sustainability in a direct manner. There are therefore few practical examples of measurable sustainable harvesting of tropical forest products (Prance, 1992). Dynamic data on growth and mortality are needed, but they are still unfortunately incomplete, even for the most widely studied forest resources (Boot and Gullison, 1995; Sunderland *et al*., 2004). Such data are assessed over a time-frame of years or even decades. The limited availability of most of the stakeholders on the ground, who suffer from financial uncertainty, prevents them from taking such a length of time into account. Attempts to measure sustainability also suffer from a lack of appropriate inventory techniques for NWFPs (Wong *et al*., 2001). In the face of such a wide range of living organisms, harvesting techniques and impacts, these methods are complex and hence rarely applied. To redress this lack of sufficient knowledge, some advanced forestry study courses include training on the ecology and management of NWFPs (Guariguata *et al*., 2008). A great deal of effort is thus needed to reach a better understanding of the economic and ecological sustainability of NWFP harvesting.

[15] See Chapter 12 for examples of studies on the ecological aspect of certain NWFPs.

4. NWFPs, PROTECTED AREAS AND CONSERVATION

4.1 Expansion of protected areas and annexation of forest land

Although the concept of protecting nature in its virgin state is disputed today (Willis *et al.*, 2004), protected areas are still the most commonly used means of conserving biodiversity in almost all the countries in the world (Chape *et al.*, 2005; Coad *et al.*, 2009). In the face of the current crisis in biodiversity, the number of protected areas has increased exponentially in recent years (Chape *et al.*, 2005) and the global network of protected areas currently covers 11.5 percent of the planet's surface (Rodrigues *et al.*, 2004). In Central Africa, 50.6 percent of all protected areas fall into Categories I to IV of the International Union for Conservation of Nature and Natural Resources (IUCN) classification (de Wasseige *et al.*, 2012). In theory, the majority of protected areas are therefore regulated and have restricted access, thus depriving millions of forest inhabitants of rights of use over forest land on which they often depend for their livelihoods (Cernea, 2005). If low-impact NWFP harvesting is seen as the best way of managing land in tropical areas (Prance, 1992), then why is there such an increase in the number of protected areas and appropriations of land available for extractive activities?

Redford and Stearman (1993: 252) explain this contradiction as follows:

> *Although many discussions have taken place suggesting that low-level economic activity would be compatible with biodiversity conservation, it is clear that if all the genetic diversity of species and ecosystems must be maintained in its natural abundance on a given plot of land, then (almost) no human activity should be allowed.*

This advocacy for the protection of "virgin nature" (Willis *et al.*, 2004: 402) in the absence of human activities encourages the expansion of protected areas despite the fact that the gathering of NWFPs could be compatible with implementation of conservation objectives. This contradiction is seldom accepted within the conservation community. Despite the major expansion of protected areas, they are still relatively incapable of ensuring the conservation of all biodiversity (Rodrigues *et al.*, 2004) and today the major part of the world's biodiversity is found outside protected areas, often in complex, multifunctional landscapes occupied by human beings (Putz *et al.*, 2001; Sayer and Maginnis, 2005). These are perhaps the most precious landscapes for NWFPs and those where the latter make their greatest contribution to rural people's subsistence. Hence the need for a form of management midway between natural forests and intensive forest systems that are in the final analysis less diversified, thus encouraging the conversion of natural forests rich in biodiversity.

4.2 From natural forests to agroforests

Although closed forests are highly diversified and remain major reservoirs of forest products, a large proportion of NWFPs are gathered in secondary forests, on fallow land and in plantations (Ambrose-Oji, 2003; Ros-Tonen and Wiersum, 2005; Awono *et al.*, 2009; Kengue *et al.*, 2011), referred to as "domestic forests" (Michon, 2005a: 21). The periurban agroforests that supply the flourishing NWFP economy of Belém in Brazil are a good example of this type of forest (Shanley *et al.*, 2002), as are the domesticated forests of Indonesia, which supply up to 95 percent of fruit for domestic markets and 80 percent of the resin from trees of the Dipterocarpaceae family (Michon, 2005a). Domesticated forests in Cameroon supply local, national, regional and

international markets with high-demand varieties of *Dacryodes edulis* (Eyog-Matig *et al*., 2006). These forest zones made up of planted trees may include mosaics of natural forest, forest fields and fallow land. Such agroforests are planted with a mixture of trees grown for commercial purposes, generally for NWFPs rather than timber (Jamnadass *et al*., 2011).

This transition "from nature to cultivation" (Dove, 1995: 194; Levang *et al*., 2005) takes place partly because often only very small quantities of NWFPs are found in old closed-canopy forests (Peters, 1994). The very varied nature of tropical forests means that gatherers obtain extremely low yields. Fruit production in Peruvian Amazonia (Phillips, 1993) and resin and bark production in Indonesia (La Frankie, 1994), for example, show remarkably low productivity levels per hectare, compared with timber extraction and other land uses. Harvesting in such diversified environments requires a thorough knowledge of the forest and control and monitoring of each productive body (Browder, 1992a; Phillips, 1993).

The extraction of NWFPs does not necessarily depend on a base that is rich in biodiversity, inasmuch as only a few major resources are in great demand in relatively poor and often human-disturbed forests. How great a role could sustainable methods of NWFP harvesting play in the conservation of forests rich in biodiversity? The experience of the past 20 years, with the rise of alternative conservation methods such as protected areas (Hutton *et al*., 2005), shows that it does not contribute effectively to biodiversity conservation.

5. Socio-economic and political issues

5.1 Commercialization: what is the outlook for conservation?

Calls for the promotion and development of NWFPs are based on the premise that an increase in the market value of NWFPs will contribute to a greater appreciation of forests and thus foster a reduction in poverty and increased forest conservation (Neumann and Hirsch, 2000; Ruiz-Pérez, 2005). Historically, private capital and public interventions have played a role in the commercialization of NWFPs (Dove, 1995). This process is not viable unless there is a well established regional or global market for the products. Colonial expansion was often motivated by the commercialization of various forest products (Hobhouse, 1999), which not only changed the face of the natural world, with the destruction of large swathes of forest in order to grow cocoa, coffee, tea, rubber etc., but also led to the establishment of an economic system based on commodities with short- and medium-term financial yields, which still predominates today (Brockway, 2002).

When trade becomes effective and markets expand, control by the elite increases. Within communities or regions, the wealthiest people are those in a position to invest in expanding trade, since they have access to land and can purchase the inputs needed for cultivation and/or processing (Dove, 1993; Marshall *et al*., 2003). To start with, the growing demand for forest products leads to the increased harvesting of wild resources, which leads in turn to the loss of economic viability of these resources and the encouragement of cultivation and eventually domestication (Homma 1992). The establishment of cropping systems fosters the elimination of economically viable products from natural forests, reducing the value of the latter. These more lucrative activities, particularly alternative land uses, are often destructive (Homma, 1992). Evaluations of the commercialization of NWFPs have shown that even if it does have advantages for local communities (Marshall *et al*., 2003), it is unlikely to guarantee better conservation of biodiversity (Belcher and Schreckenberg, 2007).

The NWFP trade is often part of the informal forest sector or the "hidden harvest" (Scoones *et al.*, 1992: 17). Regularization of harvesting and sales, which would allow the revenue to contribute to the formal forest sector, is a major topic ignored by NWFP research and official forest policies, making for a problematic situation (Laird *et al.*, 2010).

5.2 Land tenure system: policy and culture

The issue of the ownership of land and resources is a vital one with a view to assuring that the harvesting of NWFPs has a minimum of sustainability. Without the right of ownership, free harvesting is the almost certain guarantee of depletion of the resource (Angelsen and Wunder, 2003). Wherever the ownership of land and resources is uncertain, members of the local community choose production systems that maximize short-term yields at the expense of long-term sustainability, particularly with the production of annual crops. This is a real problem especially when landless migrants settle in a forest zone, as happens in Amazonia (Browder, 1992b) and Indonesia (Levan *et al.*, 2007), where short-term subsistence strategies prevail over more sustainable land-use practices. Sustainable production systems would be more attractive to rural communities if they had permanent rights over their lands. In the case of Africa, security of land tenure can encourage rural communities to plant NWFPs and improve their production systems (Laird *et al.*, 2010).

Unfortunately, most NWFP production systems operate within free or semi-free access systems, often leading to overexploitation of resources of economic value. Such overexploitation is exacerbated by the rapid expansion of markets for products from zones where security of tenure is limited or nonexistent (Alcorn, 1993). The case of rattan in Indonesia is a perfect example of how rapid market growth and free access combine to undermine long-term conservation objectives (Belcher *et al.*, 2004). However, even were the problems of free access leading to destructive harvesting to be resolved, the increase in the value of NWFPs might not work to the benefit of tropical forest conservation or improvement in the inhabitants' living conditions (Southgate *et al.*, 1996). Thus, as an extracted product becomes scarcer, it is cultivated outside its natural ecosystem in order to forestall its depletion in the forest, and such crop intensification often excludes the initial users of the resource. Most of the benefits then go to local elites, commercial enterprises or the state (Dove, 1993; Marshall *et al.*, 2003).

Another problem connected with land tenure is the interaction between customary law and written law. In most African countries, governments exercise de jure control over land and can often impose contradictory tenure policies in the same zone (for example, granting mining concessions in protected areas in Gabon[16] or in zones earmarked for agro-industrial development in Cameroon) (Sidle *et al.*, 2012). The overlapping of "rights" affects all forms of innovative management of NWFPs but also that of other natural resources.

Issues regarding the control of powers and resources often carry more weight than biological factors in forest management. The establishment of extractive reserves in Brazil, for example, was undoubtedly motivated more by sociopolitical than by ecological considerations (Richards, 1993). Dove (1995) describes how the development of rubber economies in Amazonia and Brazil has produced widely differing results in terms of conservation and living conditions, depending on regional historical and sociopolitical factors. In Central Africa, the instability of regimes has both positive and negative repercussions on the exploitation of forest products (Debroux *et al.*, 2007).

[19] http://www.mappingforrights.org/files/Forest%20Tenure%20in%20Gabon.pdf

In indigenous systems of NWFP management, controls to avoid overexploitation do exist for certain products (Redford and Stearman, 1993). However, traditional crops are often left defenceless in the move from a subsistence economy to sedentary agriculture and in the face of the sudden arrival of modern knowledge (Ros-Tonen and Wiersum, 2005). The number of conflicts within communities has increased everywhere over the question of the effectiveness of ancestral harvesting models in meeting development needs (health, education, market access), setting young people against local institutions and sometimes leading to a break with customary control over resource management. Confining indigenous peoples to a symbolic role in the management of natural resources or depriving them of the social and economic development linked to exploitation of the resources would be highly unjust. The long-held idea that local people are by nature essentially in favour of conservation is being called into question (Redford and Stearman, 1993), since the absence of a secure tenure system does not encourage the sustainability of resources and often leads to their depletion. Studies carried out in Cameroon conclude, for example, that there is a lack of management in the framework of traditional harvesting practices, including those for economically viable NWFPs (Malleson, 1999).

6. Discussion

Over the past 20 years, it has become increasingly clear that the initial enthusiasm over the sustainable harvesting of NWFPs, which was seen as a miracle solution to save tropical forests, was based on somewhat simplistic and generalized approaches. Even if NWFPs play a major role in the lives of rural inhabitants, this is very often because of the absence of economic alternatives and the existence of periods of agricultural difficulty or household vulnerability (Ros-Tonen and Wiersum, 2005). Today, we need to examine the "real" value of NWFPs for local inhabitants. Is this value reflected in the sustainable management of wild resources? Generally speaking, the poorest people depend essentially on forest products for their survival (Alcorn, 1993; Paumgarten and Shackleton, 2009), inasmuch as the NWFP sector has low or moderate profitability and requires little capital and very few skills. For rural communities with no access to skilled labour, markets, political power or credit, the harvesting and marketing of NWFPs are increasingly important. They provide a safety net, and the benefits drawn from forest resources help rural inhabitants to avoid sinking into poverty by providing them with income at critical moments of the year, especially periods of low agricultural production (Angelson and Wunder, 2003; Ros-Tonen and Wiersum, 2005). When products become commodities and are highly profitable, very few material benefits filter down to the original producers (Dove, 1993; Dove, 1995; Marshall *et al.*, 2003). Talking about extractive reserves in Brazil, Fearnside (1989) writes: "When the value of trade goes to the intermediaries, the original extractors remain poor, however great the volume of wealth they generate." The same picture can be seen in the tropics. NWFPs are thus seen as "poverty traps" (Angelsen and Wunder, 2003). In view of their low profitability, studies show that if alternatives to NWFP extraction are offered, many people will prefer to take up intensive farming or salaried employment (Levang *et al.*, 2007; Paumgarten and Shackleton, 2009). This compromises the potential of sustainable NWFP harvesting and the possible contribution of NWFPs to biodiversity conservation, given that agricultural expansion is one of the main drivers of deforestation.

It has been clearly demonstrated that long-term harvesting of any NWFP very often leads to depletion of the resource (Peters, 1994). Responses to depletion include exclusion by regulatory or regular controls, other legal forms of control (harvest tariffs and quotas), cultivation and *ex situ* conservation (Hamilton, 2008). Cultivation by domestication, using improved species

with higher yields than those of species found in natural forests (while preserving features that are important to consumers), could be a viable solution to scarcity. Participatory domestication,[17] which combines traditional and scientific knowledge in the gathering of germplasm, selection and vegetative propagation (Jamnadass *et al.*, 2011), has an important role to play here. From the point of view of rural gatherers, the two most common local responses to scarcity are to step up the harvesting margin and to seek a replacement, for example, replacing rattan with synthetic substitutes (Cunningham, 2000). In both cases, it is important to note the weak link between biodiversity conservation and harvesting.

Recent initiatives seeking to combine NWFP harvesting with social and environmental responsibility through such systems as fair trade and certification are still in their infancy (Shanley *et al.*, 2002) and suffer from the same problems as those analysed earlier in this chapter: insecurity of tenure, control by local elites, poor monitoring capacity, poor management capacity and poor organization of producers. Otherwise what is needed is a complete change of model, or at least major efforts and considerable expertise to put these systems in a position to contribute to biodiversity conservation and local communities' quality of life.

Favourable conditions for the sustainable harvesting of NWFPs – the right to land tenure, low population densities, the right of customary use and simple technologies – all seem to encourage the expansion of intensive exploitation systems outside high-biodiversity forest systems. Given that the ever-expanding global network of protected areas deprives many forest inhabitants who depend on NWFPs for their subsistence of their access to resources, sustainable use of resources could be promoted in multifunctional landscapes with a multistoreyed structure, rather than creating more of these areas (Putz *et al.*, 2001). However, the complexity of planning, managing and monitoring such a type of land use means that appropriate and often complex systems must be established and brought into line. There are few examples of landscape-level holistic management that produce optimal results in terms of conservation and development (Sayer and Maginnis, 2005).

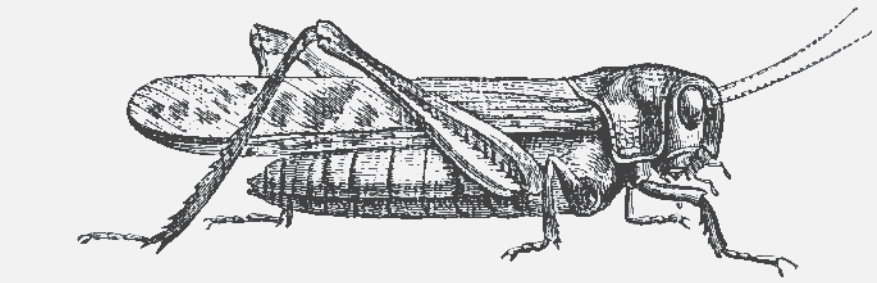
Although the academic world has already recognized the limitations of the NWFP sector and reassessed its potential more strictly, the promotion and development of forest resources are still at the heart of many initiatives. This discrepancy demonstrates the lack of communication between theoreticians and those actively involved in conservation, a state of affairs that was recently examined by Sunderland *et al.* (2009) and that produces highly questionable results for conservation or for the development of local communities' livelihoods.

7. Conclusion

Despite substantial commendable efforts to establish NWFP harvesting systems that foster the conservation of high-biodiversity forest systems, the past 20 years have seen precious few concrete cases demonstrating the feasibility of this alternative type of land use. By laying the stress on the establishment of protected areas that are not accessible for the harvesting of forest products, the primary approach to biodiversity conservation shows that confidence in the possibilities of sustainable NWFP extraction is relatively weak. Management of forest products as components of complex landscapes can certainly play a role by contributing to more diversified production systems. The possibility that NWFPs can provide a single solution to the current

[17] Chapter 15 addresses participatory domestication of NWFPs in greater detail.

crisis in biodiversity needs to be examined with considerable caution. The tendency to apply simple solutions to complex problems and the effects of passing fads (whether focusing on NWFPs, debt-for-nature swaps, green marketing, payments for environmental services or reducing emissions from deforestation and forest degradation [REDD]) must give way to a more holistic long-term approach that is multidisciplinary and equitable, encompassing human needs and biodiversity conservation.



The growing commercial exploitation of forests for timber and NWFPs makes sustainable forest management and biodiversity conservation complex issues. The forest legislation of COMIFAC member countries tends to improve with efforts to apply the subregional guidelines on sustainable management of NWFPs of plant origin. However, free access to forest products for local communities remains dependent on or limited by traditional rights of use that authorize their gathering only for subsistence purposes and not for sale. Poverty alleviation strategies and food security policies still take too little account of NWFPs. Legal and institutional frameworks to support the sector therefore need to be strengthened.

Chapter 10
A complex sociopolitical context

Paul Vantomme and Marie Torbay

1. Introduction

The rural inhabitants of Central Africa who live in direct contact with the region's forests (about 100 million people) are dependent on the resources of these forests. To a lesser extent and to varying degrees, so are urban inhabitants. In the poorest zones, NWFPs are a major source of food and income. Rapid population growth and the rural exodus are intensifying demand. A negative consequence is a growing pressure on forest products, which are perceived as sources of economic development, thus complicating the sustainable forest management. As NWFP gatherers search for ever scarcer resources, they are finding themselves in competition with one another and with forest concessions.

2. Socio-economic context

2.1 Urbanization and pressure on resources

The rural inhabitants of Central Africa, who live from farming, hunting and gathering, of necessity apply sustainable traditional rules and methods of management. The difference between "traditional" and "modern" methods lies in the way the local population views the resources. In the past, resources were seen as a precious asset, a "gift from heaven" that must be preserved. There was thus a type of respect for products, so that the harvesting of certain NWFPs was conditional on rituals. The idea of "sustainable management" was strongly rooted in the population's practices. For example, harvesting was carried out selectively, with rudimentary, non-destructive means. Since NWFPs were perishable and there were no means of conservation, resources were harvested only within the limits of consumption needs.

Today, with the major rural exodus, migrants arrive in urban centres with their own dietary habits and needs. The demand for a range of products including NWFPs rises. The trade in NWFPs has thus moved on from the village stage (where only any harvest surplus is sold) to the stage of a real economic activity. This situation is the source of frustration for forest peoples, who sometimes feel short-changed by the inhabitants of major urban centres, who generally have greater financial means. However, their local representatives do not have the legal tools necessary to regulate and control access to resources (FAO, 2011c).

With the development of trade and the opening up of roads into forest zones to extract timber, access to NWFPs is constantly being improved, with the downside that these products become scarcer as they come to be of financial interest. The issue of the domestication of certain NWFPs thus becomes more pressing (see Chapter 15).

2.2 Conflicts between communities, states and extractors

Companies that exploit the forests of Central Africa for timber sometimes employ methods that are harmful for the environment. The damage caused by felling and skidding have a detrimental effect mainly on the NWFPs that are essential to the survival of the rural population. Conflicts are on the constant rise among the various players involved, particularly local inhabitants, states and logging companies, with their opposing interests, expectations and views (Gwomb Bi Hell, 2011).

In Gabon, for example, according to a study carried out by WWF (Meunier *et al.* 2011), the logging zones of forest concessions impinge on the lands of certain rural communities. Thus villages may find themselves surrounded by a legally established logging concession. In this case, it is hard to reconcile shifting cultivation,[18] the gathering of NWFPs and exploitation of the same resource for timber. Many conflicts arise with the felling of trees that have until now been preserved by the local population for their fruit or medicinal properties. Even if the forests do not officially belong to them (they belong to the state), villagers consider neighbouring forests to be theirs. In order to avoid this kind of conflict, the government decided to set up forest zones around villages in the form of five-kilometre bands on either side of the main road in which traditional activities can be carried on without any hindrance. However, this measure, which has been applied only in some regions, has never been clearly defined in the country's legislation, so that conflicts and misunderstandings continue to exist. Local people often have to depend on nothing but the goodwill of concession holders who allow them to gather NWFPs in their concession zones (Meunier *et al*., 2011).

3. An imprecise legal framework

The forest polices of a good number of Central African countries are well enough advanced with regard to timber, hunting and, more recently, community forestry. On the other hand, policies concerning NWFPs of plant origin are still vague and poorly defined.

3.1 Difficulties over obtaining extraction permits

Management of NWFPs for commercial gain is generally defined by extraction permits. However, obtaining these is a complicated matter, with permit lengths often ill-adapted to needs and with so much red tape that harvesters are often led to operate illegally. It is thus impossible to establish good management of natural resources (COMIFAC, 2010).

Of all the mechanisms for allocation of NWFP extraction permits identified in Central Africa, the system so far used in Cameroon with regard both to resource management (thanks to extraction permits) and to revenue (with the Special Forest Development Fund[19]) seems the most successful in safeguarding the stakeholders in the sector, despite a few setbacks. This model (permits, infringements and sanctions, forest fund etc.) is proposed for application in all the countries of the Congo Basin, albeit with some improvements (Lagarde Betti, 2007a).

[18] "Shifting cultivation" is usually used to refer to any agricultural system in which fields are cleared (generally by fire) and cultivated for a brief period, before being left fallow (Conklin, 1957).

[19] The Special Forest Development Fund is a special allocation account of the National Treasury intended to cover the financing of management, conservation and sustainable development operations for forest resources.

3.2 A poorly defined taxation system

The NWFP trade in Central Africa suffers from taxation systems that are too vague and from the absence of measures encouraging their processing. Countries levy taxes on NWFPs intended for commercial exploitation. These taxes are essentially fees levied upstream on quantities extracted or to be extracted. Apart from Cameroon, where fees on quantities are applied at a flat rate on all products, all the other countries use tax tariffs that vary enormously from one product to another. Almost none of the Central African countries allocates any real part of profits to the local population. Only the Central African Republic tries to award some profit by leaving management, particularly production, in the hands of local communities.

A tax reform in the forest sector, which would include NWFPs, should contribute at the same time to the objectives of increasing budgetary receipts and protecting forest resources. Any increase or multiplication in taxes tends to be unpopular. Too many taxes encourage corruption. The objective of increasing tax revenue can be achieved by complementary measures such as strengthening tax collection tools and procedures (securing of revenue) and the competitive allocation of extraction permits (adjudication) (Lagarde Betti, 2007a).

3.3 Inappropriate roadblocks

Stakeholders in the NWFP value chain are often subjected to repeated harassment at the many roadblocks set up on their trade routes. These constitute major constraints and prevent the proper development of a private sector. Law enforcement authorities should be informed that the money they levy illegally at road blocks reduces the price paid to NWFP producers in the villages. Traders choose to pay very little to the local people who supply them with NWFPs, knowing that a portion of their profit margin will end up in the pockets of law enforcement officers (police of various types, water and forestry service agents, customs officers, local and national government officials). This phenomenon is in total contradiction with poverty alleviation goals, which are the focus in many Central African states. Moreover, those behind these rackets are not subject to any fines or sanctions (COMIFAC, 2010).

4. Inventories are impossible for lack of standards

No inventory has been carried out to give a picture of the amount of NWFPs available in the natural environment. The only inventory standards available refer solely to timber. However, such inventories are needed for various reasons:

- to gain a clear idea of where harvesting is taking place and the quantities extracted;
- to determine the growth and regeneration rate of NWFPs, so that harvesting methods can be adapted to their biological rhythm;
- to calculate harvesting quotas on the basis of the preceding data;
- to assess the sustainability of harvesting.

Formal quantification of NWFPs is relatively new and poorly developed because of a multitude of constraints, including the wide range of plants and animals concerned and the wide variety

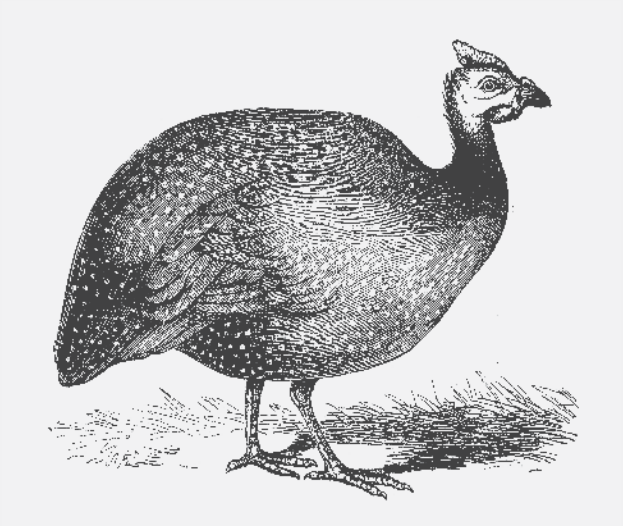
of the plant and animal parts used. Current quotas for NWFPs of plant and animal origin are for the most part arbitrary[20].

COMIFAC acts with the aim of harmonizing forest management approaches in its ten signatory countries and seeks solutions to provide all the tools needed for forest conservation, while always respecting the economic development of communities and countries. International bodies such as FAO and NGOs such as WWF support this approach. The aim is to reach a clearer understanding of the issues involved and to identify and effectively overcome constraints of every kind.

5. Conclusion

In a context of demographic growth, massive rural exodus and urbanization, there is a growing demand for NWFPs in Central Africa. Pressure on forest resources is leading to conflicts among the stakeholders in the forest value chain, and the inadequate legal and taxation systems are unable to resolve these conflicts. There are also persistent technical difficulties, such as the absence of standards for drawing up resource inventories. COMIFAC therefore has a long road to travel in encouraging its member states to take on board the subregional guidelines on the sustainable management of NWFPs of plant origin.

[23] FAO Information Note "Gestion des ressources naturelles fournissant des produits forestiers non ligneux en Afrique central", 2006.



The increased pressure on forest resources affects the food security and income of poor rural inhabitants whose livelihoods depend on free access to forests to gather NWFPs. Agriculture within forests plays a key role in safeguarding trees that are useful to the lives of forest peoples, thus making the wood and non-wood forest products they need for their well-being available to them in time and space. The multipurpose nature of trees for timber, food and medicine is the main criterion leading to their safeguarding during selective felling in forest agriculture.

Chapter 11
Coexistence of forests and agriculture: repercussions for the availability of NWFPs

William A. Mala

1. Introduction

Agriculture and forest management have often been presented as conflicting activities (ASB, 2000) and the conflict has grown sharper over the past 20 years with the increasing focus on the deforestation and degradation of tropical forests. Shifting or slash-and-burn agriculture (referred to as forest agriculture in the remainder of this chapter) is cited as one of the main causes of such destruction (Palm *et al.*, 2005; ASB, 2000). This divide is seen in a spatial, administrative and conceptual separation of areas spoken of as agricultural and forest areas as distinct management and research units (ASB, 2000; Garrity and Bandy, 1995; Zhang and PiKun, 1995; Van Noordwijk *et al.*, 2001; Palm *et al.*, 2005). Based on this biocentric, expert approach, which stresses issues connected with biodiversity conservation at the expense of the development of forest peoples, many political, institutional and technological initiatives are seeking to reverse the trend of deforestation through forest agriculture. They have been launched under various banners, one of the best-known being the research programme Alternatives to Slash-and-Burn (ASB).[21]

Under the ASB programme, systems have been developed for improving fallows with bio-fertilizing species, new varieties of plants have been introduced, and alley cropping systems have been established (Tonye *et al.*, 1994; Nolte *et al.*, 1997; ASB, 2000). However, these initiatives have not obtained any really permanent results in view of the short duration of the projects, especially in rainforest zones (Mala, 2009). These limited results are due in large part to an inadequate understanding of the dynamics and vectors of change in agroforestry mosaics and an inadequate knowledge of the place of trees in the management of these mosaics (Carrière, 1999; Mala *et al.*, 2008). The division of agricultural and forest areas into two distinct entities takes no account of the forest-crop-fallow-forest conversion cycle, although this cycle is a driving force in land-use management, nor of the land management strategy, nor of the social control of natural resources and the management of soil fertility (Diaw, 1997; Carrière, 1999; Mala *et al.*, 2008). The role of this conversion cycle and that of trees as natural capital are often ignored in the analysis and formulation of intervention initiatives for agroforestry landscapes (Diaw and Oyono, 1998; Oyono *et al.*, 2003; Mala *et al.*, 2008).

[24] ASB is a worldwide partnership of international and national organizations, agricultural research institutes, universities, NGOs, communities and farmers' groups, working together to combat climate change while improving livelihoods in the agricultural landscape of forests in the humid tropical zone. The aim of the partnership is to increase the productivity and income of rural households in humid tropical regions without increasing deforestation or undermining essential environmental services.

Given the weak impact of many agroforestry initiatives intended to transform the agriculture-forest interface, what is needed is a complementary rethink, which this time should be anthropocentric. Such a move should result in a fuller understanding of the coexistence of agriculture and forests with a view of its sociocultural and socio-economic foundations. It will be easier to see the extent to which the selective felling of trees, allowing the preservation of heritage species, lies at the heart of practices associated with agriculture and their coexistence with forest management (Carrière, 1999).

Despite the paucity of work on the coexistence of agriculture and forests, an initial body of studies does exist: on the sociocultural functions and the plant communities associated with forest agriculture in land management (Dounias, 1995; Dounias and Hladik, 1996); on traditional agricultural practices and their influence on the management of trees (Carrière, 1999); and on the biogeography and virginity of the forest stands of southwestern Cameroon (Van Germeden *et al.*, 2003). These studies constitute an initial analytical and conceptual body of work on a coexistence of agriculture and forest management centred on the availability of trees. This first body has been enriched by other studies: on social representation; on space in agroforestry landscapes (Diaw and Oyono, 1998; Mala *et al.*, 2008); on traditional arboriculture in disturbed forest landscapes (Lefroy *et al.*, 1999; Levang *et al.*, 1997); on the processes involved in the domestication of forests and trees by forest agriculture or similar practices (Wiersum, 1997a; 1997b; Mala *et al.*, 2008; Scales and Marsden, 2008); on the landscape approach in analysing forest agriculture (Robiglio, 2008; Mala, 2009); and, lastly, on the socio-cultural and bioeconomic factors involved in the transformation of agroforestry landscapes (Ngobo, 2002; Oyono *et al.*, 2003; Belcher *et al.*, 2005). These studies and those undertaken on the domestication of forests as new models for the integration of local forest communities with tropical forest research demonstrate the scientific interest of the agriculture-forest coexistence (Michon, 2005b; Michon *et al.*, 2007).

Many wood and non-wood forest products are extracted from agroforestry mosaics. The most recent national forest inventory in Cameroon (MINFOF/FAO, 2005) showed the categories of product most frequently gathered by people in forests or from trees outside forests: food (in 52 percent of the country's area), fuelwood (42 percent), medicine (41 percent), timber (34 percent) and bushmeat (28 percent). Little work has been carried out on the influence of forest agriculture on securing wooded parkland, the factors governing the choice of trees or the regeneration and composition of trees in agroforestry mosaics.

This chapter is based on a study undertaken in southern Cameroon (60 households interviewed, 137 plots sampled, covering cocoa cultivation, forest or cucumber [*Cucumeropsis mannii*] plots, preforest fallow and secondary forest). It examines the influence of traditional agricultural practices on the availability of wood and non-wood forest products. What income is generated by marketing forest products? How are these products used? What are the criteria for securing trees and establishing a wooded parkland during selective felling? What is the potential for forest regeneration in the case of coexistence with agriculture?

2. Evolution in income sources from forest products

Four groups of forest products have contributed to income generation in the study zone during the past ten years. The forest product most often cited is timber, followed by fishery products (Table 1). The general trend is for income from the marketing of forest products to represent

one-third of household income. The proportion does not vary much over time, although it is noted that it varies considerably among the three specific sites and little on the same site.

Table 1
Income from forest products during the past ten years

Period	Forest products	Ebolowa	Mbalmayo	Yaoundé	Cumulative average of the 3 sites
		% of responses*			
Today	Timber	51.7 (23)	30.9 (13)	17.1 (6)	36.9 (45)
	Fishery products	48.9 (22)	40.8 (17)	11.4 (4)	35.2 (43)
	Wild fruit and other NWFPs	42.2 (19)	35.7 (15)	22.9 (8)	34.4 (42)
	Bushmeat	51.1 (23)	26.2 (11)	22.9 (8)	34.4 (42)
5 years ago	Timber	51.1 (23)	42.9 (18)	8.6 (3)	36.1 (44)
	Fishery products	62.2 (28)	28.6 (12)	8.3 (3)	35.2 (43)
	Wild fruit and other NWFPs	46.7 (21)	30.9 (13)	22.9 (8)	34.4 (42)
	Bushmeat	53.3 (24)	23.8 (10)	22.9 (8)	34.4 (42)
10 years ago	Timber	55.5 (25)	40.5 (17)	8.6 (3)	36.9 (45)
	Fishery products	100.0 (45)	0.0 (0)	0.0 (0)	36.9 (45)
	Wild fruit and other NWFPs	51.1 (23)	42.9 (18)	8.6 (3)	36.1 (44)
	Bushmeat	55.6 (25)	35.7(15)	8.6 (3)	35.2 (43)

* The number in parentheses refers to the number of respondents.

3. Multiple uses of trees

Out of the ten targeted uses of trees, fuelwood for cooking purposes and traditional medicine are those most often reported by respondents, with 56 percent and 50 percent respectively. Three other uses then follow: timber and construction materials (31 percent) shade management, soil fertility and special uses (22.9 percent) and food needs (21.3 percent) (Table 2).

Table 2
Uses of trees in the study zone

Uses of trees	Ebolowa	Mbalmayo	Yaoundé	Study zone
	% of responses*			
Fuelwood/ cooking	68.9 (31)	59.5 (25)	34.3 (12)	55.7 (68)
Medicine	71.1 (32)	54.7 (23)	17.1 (6)	50.0 (61)
Timber & building materials	37.8 (17)	42.9 (18)	8.6 (3)	31.1 (38)
Shade management, soil fertility & special uses	31.1 (14)	26.2 (11)	8.6 (3)	22.9 (28)
Food	24.4 (11)	26.2 (11)	11.4 (4)	21.3 (26)
For the most part commercial	24.4 (11)	26.2 (11)	8.6 (3)	20.5 (25)
Tools	22.2 (10)	21.4 (9)	8.6 (3)	18.0 (22)
Hunting	8.9 (4)	11.9 (5)	8.6 (3)	9.8 (12)
Rituals	6.7 (3)	11.9 (5)	8.6 (3)	9.0 (11)
Security for the future	6.7 (3)	11.9 (5)	0.0 (0)	6.6 (8)

* The number in parentheses refers to the number of respondents.

4. Distribution and quantities of multipurpose trees in agroforestry mosaics

Thirty trees with multiple uses were considered in order to describe the coexistence of agriculture and forests (Table 3):

- 16 species (50 percent), half with timber as their leading use, but with other potential uses in traditional medicine (*Milicia excelsa*, *Spathodea campanulata*, *Lophira alata* and *Pycnanthus angolensis*) and the making of such items as balafons (*Pterocarpus soyauxii*); these species are found everywhere in cocoa plantations, with their highest density in young secondary forest zones;
- 11 species (34.4 percent) with food as their leading use; most of these are found in cocoa plantations, with *Dacryodes edulis* having the highest density (19.2 stems per hectare); generally speaking, the highest densities are found in forest fields, preforest fallows and young secondary forests; the density of *Elaeis guineensis* is high in the four land-use systems, with *Pentaclethra macrophylla* a distant second;
- 4 species (12.5 percent) – *Rauwolfia* spp., *Alstonia boonei*, *Enantia chlorantha* and *Picralima nitida* – with medicine as their leading use; their presence is very common in cocoa plantations, but their highest densities are found in young secondary forests and preforest fallows;
- tree densities are higher in forest fields than cocoa plantations, except for domesticated fruit trees such as safou (*Dacryodes edulis*), which have their highest densities in young secondary forests.

Table 3
Distribution of multiuse trees in agroforestry mosaics (stems per hectare)

	Cocoa agroforest	Forest field	Preforest fallow	Young secondary forest
NWFPs used for food				
Dacryodes edulis	19.2	8.4	5.0	5.0
Elaeis guineensis	18.6	37.1	72.2	72.2
*Trichoscypha acuminata**	4.2	4.9	0.8	11.6
Ricinodendron heudelotii	3.0	6.3	7.5	5.0
*Antrocaryon soyauxii**	3.0	0.7	3.3	5.0
Irvingia gabonensis	1.2	1.4		5.0
Pentaclethra macrophylla	1.2	17.5	24.9	16.6
*Allanblackia floribunda**	0.6	3.5		3.3
Cola acuminata		2.1	0.8	2.5
*Coula edulis**	0.6			0.8
Tetrapleura tretraptera			1.7	1.7
NWFPs used for medicines				
Rauwolfia spp.	2.4	9.1	14.9	20.8
*Alstonia boonei**	1.8	8.4	5.8	10.8
*Enantia chlorantha**	0.6	6.3	9.1	
*Picralima nitida**	0.6			
Forest products used for timber				
Distemonathus benthamianus	7.2	25.2	17,4	28,2
Lovoa trichilioides	4,2	2,1	0,8	12,5
*Milicia exelsa**	4,2	9,8	7,5	10,0
Spathodea campanulata	3,6	9,8		
Terminalia superba	3,6	11,9	4,2	7,5

Table 3 continues on next page

Table continued

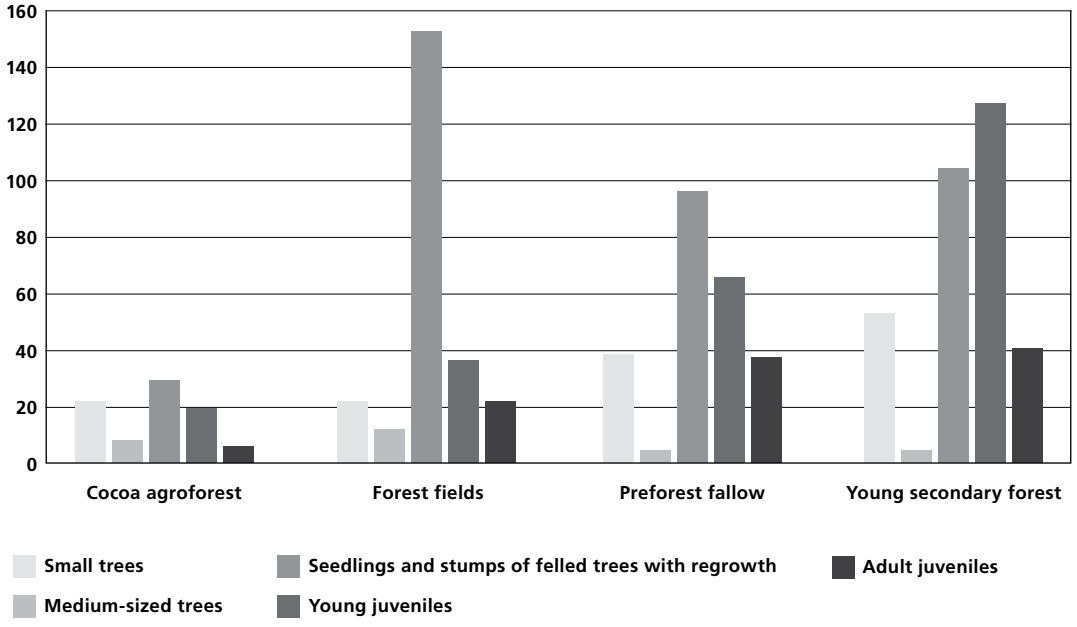
Lophira alata	2,4	4,2	8,3	19,1
*Pycnanthus angolensis**	2,4	28,7	21,6	23,2
*Pterocarpus soyauxii**	2,4	10,5	11,6	14,9
Petersianthus macrocarpus	1,8	16,1	9,1	29,9
Peptadeniastrum africanum	0,6	4,2	1,7	13,3
Diospyros crassiflora	0,6	0,7		0,8
Klainedoxa gabonensis	0,6	2,1	1,7	2,5
Entandrophragma cylindricum	0,6	4,9		
Spathodea campanulata			6,6	5,0
Triplochiton scleroxylon		9,8		5,0
Diospyros suaveolens		2,1	2,5	3,3
Piptadenia gabunensis		0,7		0,8

* Species with various competing uses.

5. Regeneration potential of multipurpose trees in agroforestry mosaics

The three main categories of tree (seedlings, juveniles and trees) are represented in each of the targeted uses. The highest densities are for seedlings and juveniles (young and adult), which account for 80.7 percent of the available trees, while large trees are poorly represented in agroforestry mosaics. Forest fields have the highest density of seedlings and/or stumps of felled trees with regrowth (152.6 stems per hectare), as against cocoa agroforests, which have the lowest density. At least half the young juveniles do not reach the stage of adult juveniles. Young secondary forests have the highest density of young and adult juveniles and also of small trees (Figure 2).

Figure 2
Distribution of trees by size in agroforestry mosaics (stems per hectare)



Source: Ingram, 2014

6. Impact of agricultural practices on NWFP availability

The results of the study carried out in Cameroon show that during the past ten years, the distribution of income from forest products has remained stable at 35 or 36 percent. On the other hand, the frequency of income varies considerably among the sites studied, a fact that chimes with the results on the biophysical and socio-economic features of the three sites (Gockowski *et al.*, 2005). The structure and distribution of income in time and space suggest that income from forest products makes a major contribution to the finances of rural households. Van Dijk and Wiersum (1999) had previously described a similar tendency, showing that the part played by forest products may be between 5 and 45 percent of rural incomes. Forest products are moreover used on a daily basis by rural households, as is seen in the use of fuelwood (55.7 percent), followed by traditional medicine (50 percent) and food (21.3 percent).

The tree stock in agroforestry mosaics is constituted of species for which the leading uses are timber, food and traditional medicine, accounting respectively for 50, 34.4 and 12.5 percent of the 30 species of tree considered. Apart from factors linked to labour and equipment constraints, these three uses would be the main criteria governing the choice of trees to be safeguarded during selective felling in forest agriculture. Alongside these criteria, there are various other considerations, such as caterpillar production and cultural uses. Examples here would be *Milicia excelsa*, *Lophira alata*, *Pycnanthus angolensis* and *Pterocarpus soyauxii*, the safeguarding of which seems to be motivated both by the high commercial value of their wood and the other possible domestic uses. This chimes with the preliminary results of Carrière (1999), Michon (2005b), Mala *et al.* (2008) and Scales and Marsden (2008), who had already noted these factors as playing a part in the safeguarding of the tree heritage in traditional agricultural systems. The same situation is observed by Robiglio (2008), who analysed the structure of the ecological landscape in environments disturbed by forest agriculture. The fact that the densities of stems of many tree species is higher in forest fields than in cocoa plantations and still higher in young secondary forests suggests that agriculture encourages the regeneration of the tree potential through a forest secondarization process. This enables good options to be found for coexistence among wild forest species, planted trees, cash crops (cocoa) and food crops. Such extremely complex combinations make agroforests one of the rare land-use systems that are akin to mature secondary forests.

Tree density decreases from the lowest category (seedlings) to the highest category (large trees), with all the categories represented in each agroforestry use. This distribution establishes the de facto existence of a regeneration potential, guaranteed both by the trees that supply seed and by the seedlings growing from the safeguarded seed and from surrounding agroforestry uses. The high density of seedlings and/or stumps of felled trees with regrowth (152.6 stems per hectare) in forest fields, in comparison with the other uses targeted (cocoa agroforests and to some extent preforest fallows), shows that forest regeneration and floristic composition are effective and take place when forest fields are established. Selective felling is a first level in the selection of trees. Selection is then refined during the forest-crop-fallow-forest conversion cycles that follow one another over time. These results are similar to those obtained by Van Geermeden (2003) and Carrière (1999), who have shown that the current floristic composition of the forests of southern Cameroon were strongly influenced by forest agriculture and its associated practices. Among the Yasa and Ntumu peoples in southern Cameroon, the floristic composition of forest regrowth made up of trees producing wood and non-wood forest products is an illustration of these practices associated with forest agriculture (Dounias, 1995). The resulting agroforestry

landscapes fit well with the social dynamics and social representations of landscapes and sociocultural and bioeconomic functions (Dounias and Hladik, 1996; Diaw and Oyono, 1998; Scales and Marsden, 2008; Mala, 2009).

7. Conclusion

An increase in income from the trade in forest products, the predominant use of trees, the distribution of categories of safeguarded trees, the criteria for selective felling and the regeneration potential: on the basis of all these established factors, it does seem that forest agriculture helps to safeguard the tree heritage on the basis of a compromise among the advantages, benefits and drawbacks of the various species. The trees, including wood and non-wood forest products, safeguarded in this traditional system will act as a basis for the dissemination of multipurpose tree species in order to guarantee forest peoples the goods and services they need and make these available to them. These aspects are crucial for the development and promotion of agroforestry innovations seeking to optimize wood and non-wood forest products in agroforestry mosaics.

Annex
Distribution of trees by size in agroforestry mosaics (stems per hectare)

Species	Seedlings and stumps of trees felled without regrowth	Young juveniles	Adult juveniles	Small trees	Medium-sized trees	Large trees
Cocoa agroforest						
NWFPs used for food						
Dacryodes edulis	3	6	3.6	6.6	0	0
Elaeis guineensis	13.2	2.4	0	3	0	0
*Trichoscypha acuminate**	1.8	2.4	0	0	0	0
Ricinodendron heudelotii	0	0.6	0	0.6	1.8	0
*Antrocaryon soyauxii**	1.2	1.2	0	0	0.6	0
Irvingia gabonensis	0	0.6	0	0.6	0	0
Pentaclethra macrophylla	0.6	0	0	0	0.6	0
*Allanblackia floribunda**	0	0	0	0.6	0	0
*Coula edulis**	0	0	0	0.6	0	0
NWFPs used for medicine						
Rauwolfia spp.	1.2	0.6	0.6	0	0	0
*Alstonia boonei**	0.6	0	0	0.6	0.6	0
*Enantia chlorantha**	0	0	0	0.6	0	0
*Picralima nitida**	0.6	0	0	0	0	0
Forest products used for timber						
Distemonathus benthamianus	3	0	0	2.4	1.8	0
Lovoa trichilioides	0	3.6	0.6	0	0	0
*Milicia exelsa**	0	0	1.2	1.8	1.2	0
Spathodea campanulata	0	1.2	0	1.2	1.2	0
Terminalia superba	0	0	0	3	0	0.6
Lophira alata	0.6	0.6	0.6	0.6	0	0
*Pycnanthus angolensis**	0.6	0.6	0	0.6	0.6	0
*Pterocarpus soyauxii**	2.4	0	0	0	0	0
Petersianthus macrocarpus	0	0.6	0.6	0.6	0	0
Peptadeniastrum africanum	0.6	0	0	0	0	0
Diospyros crassiflora	0	0	0.6	0	0	0
Klainedoxa gabonensis	0	0	0	0	0	0.6
Entandrophragma cylindricum	0	0	0	0.6	0	0
	29.4	20.4	7.8	24	8.4	1.2

Table continues on next page

Table continued

Species	Seedlings and stumps of trees felled without regrowth	Young juveniles	Adult juveniles	Small trees	Medium-sized trees	Large trees
Forest field						
NWFPs used for food						
Elaeis guineensis	29.4	4.9	0.7	2.1	0	0
Pentaclethra macrophylla	14.7	0.7	1.4	0	0.7	0
Dacryodes edulis	1.4	1.4	3.5	2.1	0	0
Ricinodendron heudelotii	4.2	1.4	0	0.7	0	0
Trichoscypha acuminata	0.7	0.7	0.7	2.8	0	0
Allanblackia floribunda	2.1	0	0	0	0.7	0
Cola acuminata	0	0.7	1.4	0	0	0
Tetrapleura tretraptera	1.4	0	0	0	0	0
Irvingia gabonensis	0.7	0	0	0.7	0	0
Antrocaryon soyauxii	0.7	0	0	0	0	0
NWFPs used for medicine						
Rauwolfia spp.	4.2	0.7	2.8	1.4	0	0
Alstonia boonei	6.3	0.7	0	0.7	0	0.7
Enantia chlorantha	5.6	0	0.7	0	0	0
Forest products used for timber						
Pycnanthus angolensis	19.6	4.9	1.4	2.1	0.7	0
Distemonathus benthamianus	18.9	2.1	2.1	1.4	0.7	0
Petersianthus macrocarpus	8.4	4.2	0	2.8	0.7	0
Terminalia superba	5.6	1.4	0.7	2.1	2.1	0
Pterocarpus soyauxii	7	2.1	0.7	0	0.7	0
Spathodea campanulata	4.9	0.7	0.7	0.7	2.8	0
Triplochiton scleroxylon	4.9	1.4	1.4	1.4	0.7	0
Milicia exelsa	3.5	2.8	0.7	1.4	1.4	0
Entandrophragma cylindricum	2.1	1.4	1.4	0	0	0
Lophira alata	2.8	1.4	0	0	0	0
Peptadeniastrum africanum	0	0.7	2.1	1.4	0	0
Diospyros suaveolens	0.7	0.7	0.7	0	0	0
Klainedoxa gabonensis	2.1	0	0	0	0	0
Lovoa trichilioides	0.7	0.7	0	0.7	0	0
Diospyros crassiflora	0	0	0	0.7	0	0
Piptadenia gabunensis	0	0	0	0	0.7	0
	152.6	**35.7**	**23.1**	**25.2**	**11.9**	**0.7**
Preforest fallow						
NWFPs used for food						
Elaeis guineensis	38.2	8.3	7.5	14.9	2.5	0.8
Pentaclethra macrophylla	13.3	4.2	2.5	3.3	1.7	0.0

Table continues on next page

Table continued

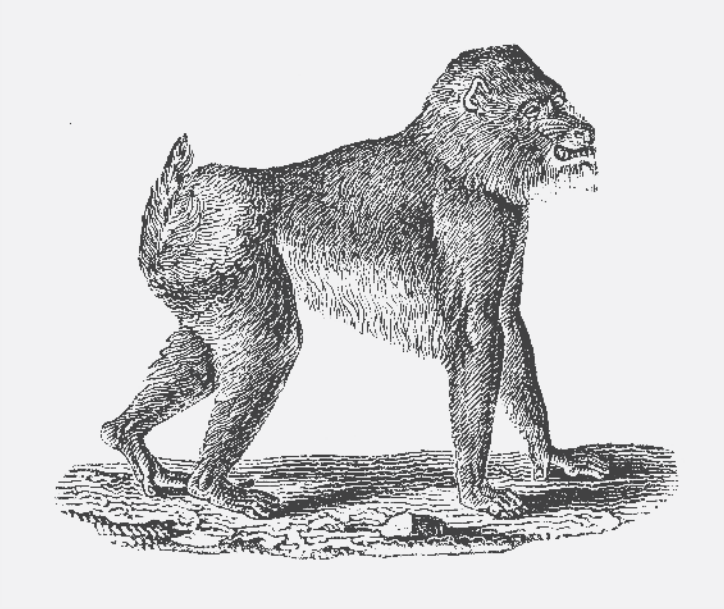
Species	Seedlings and stumps of trees felled without regrowth	Young juveniles	Adult juveniles	Small trees	Medium-sized trees	Large trees
Ricinodendron heudelotii	0.8	1.7	2.5	1.7	0.8	0.0
Dacryodes edulis	0.0	0.8	1.7	2.5	0.0	0.0
Antrocaryon soyauxii	0.8	1.7	0.8	0.0	0.0	0.0
Tetrapleura tretraptera	0.8	0.8	0.0	0.0	0.0	0.0
Cola acuminata	0.0	0.0	0.8	0.0	0.0	0.0
Trichoscypha acuminata	0.8	0.0	0.0	0.0	0.0	0.0
NWFPs used for medicine						
Rauwolfia spp.	5.8	5.0	2.5	1.7	0.0	0.0
Enantia chlorantha	3.3	2.5	1.7	1.7	0.0	0.0
Alstonia boonei	0.8	2.5	0.8	1.7	0.0	0.0
Forest products used for timber						
Pycnanthus angolensis	6.6	10.8	3.3	0.8	0.0	0.0
Pterocarpus soyauxii	2.5	5.0	1.7	2.5	0.0	0.0
Distemonathus benthamianus	3.3	6.6	5.8	0.8	0.0	0.8
Petersianthus macrocarpus	4.2	3.3	0.0	0.8	0.8	0.0
Lophira alata Banks	5.0	0.8	0.8	1.7	0.0	0.0
Milicia exelsa	1.7	3.3	1.7	0.8	0.0	0.0
Spathodea campanulata	0.8	4.2	0.8	0.8	0.0	0.0
Terminalia superba	1.7	1.7	0.8	0.0	0.0	0.0
Diospyros suaveolens	0.8	0.8	0.0	0.8	0.0	0.0
Peptadeniastrum africanum	0.8	0.8	0.0	0.0	0.0	0.0
Klainedoxa gabonensis	0.0	0.0	0.0	1.7	0.0	0.0
Lovoa trichilioides	0.0	0.8	0.0	0.0	0.0	0.0
Young secondary forest						
NWFPs used for food						
Elaeis guineensis	44.0	14.9	0.8	11.6	0.8	0.0
Distemonathus benthamianus	10.8	10.8	5.0	1.7	0.0	0.0
Pentaclethra macrophylla	4.2	4.2	4.2	4.2	0.0	0.0
Antrocaryon soyauxii	1.7	1.7	0.8	0.0	0.8	0.0
Dacryodes edulis	0.8	2.5	0.8	0.8	0.0	0.0
Irvingia gabonensis	0.0	5.0	0.0	0.0	0.0	0.0
Ricinodendron heudelotii	2.5	0.8	0.8	0.0	0.0	0.8
Diospyros suaveolens	0.0	1.7	1.7	0.0	0.0	0.0
Allanblackia floribunda	0.0	1.7	1.7	0.0	0.0	0.0
Cola acuminata	0.0	1.7	0.8	0.0	0.0	0.0
Tetrapleura tretraptera	0.0	0.8	0.0	0.8	0.0	0.0
Coula edulis	0.0	0.0	0.0	0.8	0.0	0.0
Diospyros crassiflora	0.8	0.0	0.0	0.0	0.0	0.0

Table continues on next page

Table continued

Species	Seedlings and stumps of trees felled without regrowth	Young juveniles	Adult juveniles	Small trees	Medium-sized trees	Large trees
NWFPs used for medicine						
Rauwolfia spp.	3.3	7.5	5.0	5.0	0.0	0.0
Alstonia boonei	0.8	6.6	1.7	1.7	0.0	0.0
Forest products used for timber						
Petersianthus macrocarpus	8.3	13.3	0.8	6.6	0.8	0.0
Pycnanthus angolensis	2.5	10.0	5.8	4.2	0.8	0.0
Lophira alata Banks	13.3	5.0	0.8	0.0	0.0	0.0
Pterocarpus soyauxii	3.3	5.0	4.2	1.7	0.8	0.0
Peptadeniastrum africanum	1.7	5.8	3.3	2.5	0.0	0.0
Lovoa trichilioides Harms	0.8	10.0	0.8	0.0	0.8	0.0
Trichoscypha acuminata	2.5	7.5	0.0	1.7	0.0	0.0
Milicia exelsa	2.5	5.0	1.7	0.8	0.0	0.0
Terminalia superba	0.0	0.0	0.8	6.6	0.0	0.0
Spathodea campanulata	0.0	4.2	0.0	0.0	0.8	0.0
Triplochiton scleroxylon	2.5	0.0	0.0	2.5	0.0	0.0
Klainedoxa gabonensis	0.0	1.7	0.0	0.0	0.8	0.0
Piptadenia gabunensis	0.0	0.8	0.0	0.0	0.0	0.0
Subtotal	**106.2**	**127.8**	**41.5**	**53.1**	**6.6**	**0.8**
Grand total	**382.0**	**250.3**	**108.9**	**140.5**	**33.6**	**4.4**

Part V
Building knowledge and maximizing the NWFP sector



Throughout Central Africa, NWFPs are used in homes and markets for food, medicine, tools and cultural activities. If NWFPs are not to disappear but are to remain beneficial for forests and rural and urban people both locally and globally, essential knowledge should be kept up to date, capitalized on and disseminated locally, nationally and regionally. This knowledge and these traditions about NWFPs are useful to all the stakeholders, not only the government with its tasks of policy-making and regulating, but also traditional authorities, scientific institutions, civil society, individuals and private-sector organizations involved in marketing NWFPs, and support organizations.

Chapter 12
Creating an information pole with the use of available scientific resources

Verina Ingram

1. Introduction

Folke (2004) stresses that ecosystems are complex structures whose governance requires updated knowledge and flexible methods. NWFPs originate in ecosystems that are also subject to this rule. Constant testing, learning and understanding are needed in order to cope with changes and uncertainties. This means an ongoing, dynamic learning process.

The harvesting and use of NWFPs is a practice dating back more than a thousand years in Central Africa (Mercader *et al.*, 2000; Kusimba, 1999), while their trade dates back several centuries. Products such as elephant ivory *(Loxodonta africana*), kola nuts (*Cola* spp.), gum arabic (*Acacia* spp.), African tree rubber (*Funtumia elastica*), bush pepper (*Piper guineensis*) and honey have fed a highly lucrative international trade in Africa and throughout the world. Some of these products were so precious that they motivated the European colonization of Central Africa during the "scramble for Africa" in the mid-18th century. Many of these NWFPs are still traded today.

Development of the sector has had its ups and downs. Some NWFPs have been more extensively domesticated than others as their value has increased. Those such as ivory, for which there is still considerable demand, are highly regulated, while others, such as gum arabic, are regulated only when exported from Africa. Still others, such as bush pepper, are currently not subject to any specific regulations. The development of regulations has brought with it an overall improvement in knowledge, especially in the areas of marketing, management and governance.

For some NWFPs, knowledge (species, products, uses and marketing) is greater today thanks to scientific and popular writings. Nevertheless, most knowledge and practices are still in the hands of indigenous and local people: traditional healers, gatherers, small farmers, processors and vendors. NWFPs play an important role in the local economies of Central Africa. It is estimated that half the population of the region gathers NWFPs to feed themselves, treat themselves and obtain income (Ndoye *et al.*, 1997; Ngwasiri *et al.*, 2002). Part of this knowledge is still only oral and has been handed down in the form of stories, songs, traditions, practices and recipes. With social and demographic changes and urbanization, there is a danger that this knowledge will be lost.

2. Why should knowledge about NWFPs be developed?

2.1 To improve forest governance

Increasing the level of information on NWFPs would enable alternative approaches to be developed and proposed to farmers, business people, policy-makers, scientists, conservationists and managers, with a view to improving forest governance. Information can also help small forest owners to improve their management and generate economic profits at the local level (Sizer *et al.*, 2005). The ability of national programmes to ensure sustainable management and combine the conservation of ecosystems with improvement in the quality of life depends on both research and traditional knowledge (Sizer *et al.*, 2005). Local traditional knowledge often uses different time-scales from those of scientists and policy-makers, and can provide a complementary approach to evaluation of the status of NWFP resources (Rist *et al.*, 2010). It is also indispensable in making conservation and development actions more relevant and socially acceptable (Folke, 2004).

2.2 To improve marketing

A good knowledge of the NWFP sector is also crucial as soon as forest products leave their original locality to be traded on a large scale (see Box 1). With globalization and intensified exploitation of NWFPs from the Congo Basin (Vliet *et al.*, 2011; Tabuna, 1999b; Schure *et al.*, 2011; Ingram *et al.*, 2012b), demand could rise considerably. Good information would ensure the sustainability of the value chain thanks to the possibility of taking socio-economic and ecological impacts into better account.

Box 1
NWFP value chains

A value chain refers back to the activities needed to bring a product out of the forest. These activities include: harvesting/gathering, cleaning, transport, processing, packaging, marketing, distribution and support services such as finance, transport and technology. The chains may be local or global, and activities may be carried out by a variety of people: primary producers, gatherers, processors, traders and service providers.

2.3 To improve the resilience of communities

Poverty, dependence on natural and forest resources, and climate change (Sonwa *et al.*, 2011; Nkem *et al.*, 2012): in the face of all these issues, it is important to produce and share knowledge on how NWFPs contribute to the nutrition, health and quality of life of the people of Central Africa. The effects of climate change are likely to affect the poorest most severely – women, children, certain ethnic groups, communities living in remote forest areas and urban people who depend on the NWFP trade. Their living conditions and food security are under threat. It is vital to gain a better understanding of possible mechanisms of resilience, adaptation or at least mitigation of the negative effects of climate change on NWFPs.

2.4 To improve policy-making and the regulatory framework

Even when local or scientific data on NWFP resources do exist, they are not generally used to clarify decision-making or to make their regulation, exploitation and management more sustainable. Despite progress made in incorporating NWFPs into national forest legislation and attention from such organizations as COMIFAC, NWFP value chains are still essentially informal and are not taken into account in national statistics and policies. It is therefore hard to assess their contribution to national economies, so that policies for sustainable development based on their marketing and consumption are lacking.

3. THE STATE OF KNOWLEDGE

A review of knowledge about NWFPs throws light on the existence of distinct groups, according to locality, subject and harvesting period.

3.1 The geography of knowledge

As Dounias (2000) stresses, specialized writings on Central African NWFPs are dominated by publications from Cameroon. This may be due to the fact that the country is seen as an "Africa in miniature". Cameroon also possesses social, political and logistical advantages that make it a crossroads for a range of botanico-geographical items and equally varied peoples: the Baka'a or Bantu of Adamawa-Oubangui and Chad. The country's colonial heritage and its very stable political environment facilitate access for French- and English-speaking researchers and many national researchers and academics from research institutes and universities. Its forests and resources are therefore among those most studied in Central Africa. Some regions are particularly well studied, especially the southwest, the south, the rainforests of the centre and east, and the montane forests of the northwest and southwest. In Gabon, studies have focused around Makokou, the site of the National Research Institute for Tropical Ecology (IRET). In the Democratic Republic of the Congo, they have concentrated particularly on the eastern province around Kisangani and Yangambi, where the University of Kisangani is located, and in Bas-Congo at Luki and Kisantu, where the National Environmental and Agricultural Research Institute (INERA) and the botanical gardens are located. In the Central African Republic, studies have been carried out around Bangui; in the Congo, on the preferred sites of the Marien Ngouabi University of Brazzaville at Dolisie, Ouesso and Pointe-Noire; and in Equatorial Guinea, on Bioko Island.

3.2 Subegional and national knowledge since the 1990s

The very first studies of Central Africa stressed the importance of the forest-rural-urban link for forest products (Trefon, 1994; Ladipo, 1998). Regional studies and collections of national data were published in 1998, 1999, 2001 and 2004, synthesizing data on NWFPs, focusing on issues relating to the resource (harvesting and marketing) and using the available statistics (Clark *et al.*, 2004). These regional overviews have since been supplemented with studies of exports from Central Africa to Europe of NWFPs (Tabuna, 1998), of bushmeat (LeBreton *et al.*, 2006; Wilkie *et al.*, 1999) and of NWFPs for use as food (Bikoué*et al.*, 2007). Two good bibliographies on NWFPs and their uses were available by 2001 (Maille, 2001; Dounias *et al.*, 2000).

At the start of the 1990s, stakeholders in the value chain recognized the need for a regional and cross-border approach to NWFPs. A series of studies and initiatives followed, focusing on the

political framework (Wilkie *et al.*, 2001) and its potential (Jetz *et al.*, 2004), the link between indigenous knowledge (Tchatat *et al.*, 2006; Eyong, 2007) and indigenous rights (Eyong, 2007), data collection and regional- and national-level monitoring (Groupe de spécialistes des plantes médicinales, 2007) and the establishment of an adequate legislative and institutional framework (Lagarde Betti, 2007a). In the mid-2000s, attention was gradually given to the institutional framework of NWFPs at the national and regional levels. COMIFAC laid the stress on needs and on recommendations for a broad coordination of regulatory frameworks and fiscal and institutional monitoring at national and regional levels (Ebamane, 2008; Lagarde Betti, 2007a; Lagarde Betti, 2007b).

The socio-economic aspects of NWFPs were studied in 2008 (Noubissie *et al.*, 2008). Recent studies on the value chain and the market provide detailed socio-economic and environmental information on the NWFP trade in Cameroon, the Central African Republic, the Republic of the Congo, the Democratic Republic of the Congo and Gabon.[22] Systematic inventories of NWFP species used and traded in each country of Central Africa were produced in 2010 (Ingram *et al.*, 2010; N'gasse, 2010; Loumeto, 2010; Mutambwe, 2010; Mbomio, 2010; Ngoye, 2010; FORENET, 2010), complementing two national studies of Cameroon and the Democratic Republic of the Congo (FAO, 1999a; Nkeoua *et al.*, 1999).

3.3 Species, uses, places and issues: knowledge groups

Four main knowledge groups can be distinguished:

1. Studies of a single species, especially widely marketed species such as *Irvingia* spp., *Raphia* spp., *Gnetum* spp., rattans and *Prunus africana* (for example, Muhongya, 2012, on rattans in the Democratic Republic of the Congo; and Van Eijnatten, 2010, on *Gnetum* spp. in Cameroon). These have been carried out primarily in Cameroon and the Central African Republic, often by ethnobotanists from universities.
2. Studies of specific geographical sites. These are associated with conservation projects in zones seeking recognition or protection (Dja, Takamanda, Campo-Maan, Korup, Mont Cameroun and Kilum-Ijim in Cameroon, Mont Cristal in Gabon, Bioko in Equatorial Guinea, and ethnographic studies in the Democratic Republic of the Congo on the use of forests in the Ituri region at Salonga and Luki). Whereas low-altitude and montane rainforest zones are well covered, the geographical cover is still incomplete, inasmuch as the ecosystems of coastal forests, savannah and wetlands are still largely understudied. The emphasis on virgin forests that are rich in biodiversity and have a high conservation value means that these sites may not be representative of the species or of the level of availability and use of NWFPs in Central Africa. The studies show that especially in regions where the local people do not have a close or historical link with forests, as with the Tikar of Cameroon's grasslands (Dounias, 1996; Zapfack and Nkongo, 1999), the knowledge and use of forest products are less important than among ethnic groups living in forests, such as the Baka'a pygmies, or near forests, such as the Bantu of Dja and Campo-Maan and the Mbuti and Efe peoples of Ituri. They show that NWFPs are found in more degraded and peri-urban landscapes with low biodiversity and in agroforestry areas around communities, even if this is not sufficiently mentioned in the literature.
3. Studies of specific uses, such as food and medicine (Vasisht and Kumar, 2004; Focho *et al.*, 2009; Jiofack *et al.*, 2009; Jiofack *et al.*, 2008), and also socio-economic uses.

[22] www.fao.org/forestry/enterprises/nwfp-centralafrica-eu/en/ and http://www.fao.org/forestry/nwfp/55079/en/

Food and medicinal uses are predominant in the Democratic Republic of the Congo and Gabon, perhaps because of the high levels of poverty and the remoteness of some localities, factors leading to a higher dependence on local resources.

4. General studies on NWFPs (evaluation of values and volumes of NWFPs, ways of life, sustainability and regulatory issues). The "key" or "priority" NWFP species of plant origin were identified by Wilkie in 1999.[23] However, the criteria for selection are unclear, insofar as although Wilkie's 19 key species are based on the criteria for selection of key species used by Clark and Sunderland (2004), they include some whose volumes used for household consumption and marketing are low. Two general studies subsequently confirmed and summarized the existing figures (FAO, 1999a; Mbolo, 2002). These key NWFPs are now lodged in popular thinking and in development and forestry circles (Noubissie *et al.*, 2008). However, these key NWFPs are not firmly rooted in real or current economic, social or environmental values. Researchers from the African-Caribbean-Pacific Forest Research Network (ACP-FORENET) corrected this weakness by clarifying the term "key NWFPs" and surveying them in six Central African countries. A more accurate definition was proposed in a chapter of The forests of the Congo Basin. State of the forest 2010 (Ingram *et al.*, 2012b).

4. Gaps in knowledge

Despite this wide range of data, there are still lacunae. Most of the knowledge is available only in the form of unpublished manuscripts or in inaccessible journals. Research institutes and universities publish only a paper version and often only in one language (French or English), which represents a problem for English speakers or French speakers. "Grey literature" is more easily available than peer-reviewed scientific data. Central Africa follows the continental trend, with a low level of scientific publications (Pouris, 2009), which throws doubt on the independence, reliability and objectivity of certain data. Some types of knowledge are under-represented: on locally sold species; on species used as building tools and materials, such as bamboo and raffia; on geographical zones outside conservation areas; on protected areas of parkland; and on the forests of Central Africa's humid and dry savannah zones. The value, quantities and marketing channels of certain NWFPs are not well known beyond the regional level and the collection of data is generally very sporadic. There are very few data on regional trade and trade outside Africa, with only a single study in more than ten years (Tabuna, 1999b). A recent exception is Prunus africana, which has been the object of market studies and management guidelines based on inventories (Ingram *et al.*, 2009).

National-level systematic coordination of the activities of public research, development and conservation bodies has been too weak to enable the government services responsible to gain access to data and make use of them (République du Cameroun, 2008), or even to specify what is needed in terms of knowledge. Initiatives for collecting and facilitating access to data, such as the Internet site Cameroun Forêt (http://data.cameroun-foret.com/) are therefore vital. Even so, at the regional level, with the COMIFAC expert working subgroup on NWFPs, there has been a clear improvement in dialogue and exchanges among state and non-state players and national consultative committees on NWFPs (committees up and running in Cameroon, the Central African Republic, the Congo and Gabon, and currently being set up in the Democratic Republic of the Congo). COMIFAC envisages the creation of national consultative committees

[23] See Tables 1 and 2.

in Burundi, Chad, Equatorial Guinea, Rwanda, and Sao Tome and Principe. Despite these developments, there is still not enough research and information (biological, ecological and socio-economic) to allow the formulation of strategies for the sustainable harvesting of NWFPs that are the most widely traded today (Sunderland *et al.*, 1998; Clark *et al.*, 2004; FORENET, 2010; Debroux *et al.*, 2007).

Box 2
Definitions by variable geometry

A common definition of NWFPs in Central Africa does not exist.

In Equatorial Guinea, the 1997 forest law contains a definition complete with a list of 24 priority NWFPs.

In Cameroon, the 1994 forest law does not define NWFPs, but groups both wood and non-wood products together under the terms "special products" or "secondary forest products".

In the Central African Republic, the 2008 forest law defines NWFPs as "similar products from forest zones or ecosystems other than wood".

In the Congo, the 2000 forest law refers to "secondaary forest products".

In the Democratic Republic of the Congo, the 2002 forest code defines NWFPs as "all other forest products: rattans, barks, roots, leaves, fruit, seeds, resins, latex gums and medicinal plants".

In Gabon, the 1993 forest code mentions "forest products other than wood" and uses the term "NWFP", with a list of 15 groups of products and species.

Box 3
Reasons for the lack of sufficient information on NWFPs

Lack of visibility. NWFPs are for the most part small products with scant visibility, so that they are are harder to detect than roundwood or sawnwood. Once they have been processed, it can be hard to tell if they were cultivated or gathered in the wild.

Great diversity. While most exported wood comes from 10 species (Cerutti *et al.*, 2009) and the value chain has about 80 species traded on a smaller scale (Koffi, 2005), NWFPs encompass more than 700 species.

Lack of standards of value. The standard units of measurement for timber cover both processed roundwood and sawnwood. Most NWFPs, on the other hand, have no standard unit of sale. They can be worth less than US$1 and weigh less than 1 kilogram, with unit prices varying, depending on market and season.

Difficulty in establishing data collection points. Wood is visible and, more important, it is for the most part exported through ports and along main roads. The more varied and scattered transport channels used for NWFPs, for which trade is more informal, make the choice of data collection points difficult and expensive.

Lack of information sharing. Where data on NWFPs are collected, the task of collection is divided among ministries of the environment and trade, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and customs authorities. There would appear to be little sharing of data between local and national government departments.

Inaccurate idea of exports. Timber is easy to identify and track. A single log can generate significant returns for the state (and individuals). By contrast, most NWFPs are harder to track, resulting in an erroneous perception according to which only a few NWFPs are exported in significant quantities (Tabuna, 1998).

Too many to count. The NWFP sector employs many more people than the timber sector. There are only a few forest concessions and logging companies, which makes them easier to count. In Cameroon, there were 93 forest management units in 2010 and 169 sales of standing timber between 2000 and 2008, supplying most of the timber (91 percent in 2007) (Cerutti *et al.*, 2010), with about 13 000 people in the formal sector in 2006 and 150 000 in the informal sector (de Wasseige *et al.*, 2012). These figures are very low compared with those for NWFPs: in Cameroon, a mere nine NWFP value chains employ at least 283 000 people (Ingram, 2011).

Lack of coordination. Coordination among research, development and conservation bodies is inadequate (République du Cameroun, 2008).

The study by Timco *et al.* (2010) highlights the lack of sufficient socio-economic data, especially in sub-Saharan Africa. It attributes this to two main factors: first, the multiplicity and diversity of definitions of NWFPs, as shown in Box 2, a factor recognized at the political level

(Walter and Mbala, 2006) and now under study by COMIFAC and FAO; second, an absence of common measurements to assess the influence of NWFPs on standards of living in rural areas. Other political, social and practical reasons are also highlighted by the comparison between non-wood and wood products in Box 3.

5. Closing the gaps in knowledge

The widely recognized deficit in information on NWFPs and on the many forms of trade in them represents a real challenge for policy-makers, who have the task today of prioritizing and sustainably managing this range of products with such particular characteristics. An examination of the literature and market studies (Ingram, 2014) shows, for example, the existence in Cameroon of at least 706 animal and plant NWFP species, 32 percent of which are traded, many more than earlier studies had indicated. Of the 585 plant species used, at least 21 percent are traded (this figure would in fact be higher, as some fungal products and herbs are not counted). At least 121 animal species are used as NWFPs and 83 percent of these are traded. Of the 162 mammal species identified in rainforest zones (Brummett, 2005; Essama-Nssah and Gockowski, 2000), 51 have been identified as NWFPs. Here too, the figure would be higher, since birds, bats and small rodents have been omitted, as have several species in savannah zones. More than 951 plant species have been recorded as NWFPs in the Democratic Republic of the Congo, 429 of which are used and 212 traded. At least 171 animal species are exploited as NWFPs, basically for local use and trade, with the exception of such items as grey parrots and elephant ivory. Given the scarcity of data on the various types of ecosystems in the Democratic Republic of the Congo, it is highly likely that the number of NWFP species is much higher there.

In order to close these gaps in knowledge, NWFPs must be made a priority in Central Africa. Such prioritizing can be based on holistic criteria, as presented in Box 4. Classification according to economic, social and environmental values would make it possible to determine the most popular NWFPs, which would have the greatest need of governance and management measures. Economic value can be assessed on the basis of the market value of raw and processed products. However, for some products (for example, *Irvingia* spp.) and in some cultures, the use of NWFPs in trade or barter or as gifts can account for between 11 and 30 percent of the total quantity harvested (Ingram, 2009). The social value of the product can be deduced on the basis of its consumption or use by those harvesting it or in barter, its cultural value and its classification by local people as an important product. The social and economic value is higher if the species has many uses and if several of its parts are used (Ingram *et al.*, 2012b). The environmental value can be calculated on the basis of the level of threat bearing on a species or its vulnerability. It reveals if demand is greater than supply and whether its extraction is or is not sustainable, together with its level of cultivation or domestication. Studies show that only 11 percent of species are cultivated on a small scale, 3 percent are domesticated and 2 percent are incorporated into agricultural or agroforestry systems. These figures indicate a very slow, low degree of cultivation and a high dependence on wild species. Another measurement of environmental value is based on the status of the species in terms of threat or protection, for example whether or not it is classified as a protected species by national laws, whether or not it is included in the IUCN's Red List of threatened species, and its classification by CITES. A prioritization carried out by researchers and policy-makers in Central Africa is presented in *The forests of the Congo Basin. State of the forest 2010* (Ingram *et al.*, 2012b) (see Box 4).

Box 4
A definition of priority NWFPs

"Priority" or "key" NWFPs have been defined as follows:

1. those that have a high **economic value** or that are important for **household consumption** (i.e. value for living conditions);
2. those for which demand is greater than supply, for example, and **extraction is unsustainable**; this depends on the priority status of *in situ* conservation and the degree of domestication;
3. species with **multiple uses**, including conflicting uses;
4. species of which **several parts** are used;
5. species classified as ecologically vulnerable or protected (on the Red List or the CITES list and/or protected by national laws) because of their rarity or threats to their ecosystems.

These criteria encompass the economic, sociocultural and environmental aspects of value.

Source: Clark *et al.*, 2004; Zapfack *et al.*, 1999

6. Creation and use of knowledge

The sustainable use and marketing of NWFPs depend on a certain number of factors. Marketing them certainly generates income, but unsustainable extraction of a species can contribute to a reduction in biodiversity. Sometimes, depending on market conditions and the attitude of certain players, extraction even exacerbates poverty (Ambrose-Oji, 2003; Ndoye, 1994). Supposing that prioritization of NWFPs has been carried out, the next stage consists of assessing the sustainability of their marketing.

6.1 Carrying out more inventories

The first stage is to determine the availability of the species from which the NWFP comes. Databases are essential for the sustainable harvesting of wild plants and animals (Wong, 2003; ETFRN, 2000; FairWild Foundation, 2010; Clemente Muñoz *et al.*, 2006), since they help to establish the conservation status of a species. An inventory provides a database and serves as a benchmark at a given moment and in specific places. It is thus possible to determine what proportion of the population of a species can be harvested without affecting the stock, thanks to an appropriate inventory and an analysis of the distribution and density of the species in a representative zone. It is then possible to extrapolate to harvesting zones or to an appropriate spatial scale. The status of the species in its wild and its cultivated states must also be assessed, since cultivation practices vary considerably in Central African countries.

Studies and inventories already carried out in Central Africa include studies on pygeum or African cherry (*Prunus africana*) in Cameroon (see Ingram *et al.*, 2009) and Equatorial Guinea (Clemente Muñoz *et al.*, 2006), medicinal trees and plants (Focho *et al.*, 2009; Degrande *et al.*, 2006), bushmeat (Fa *et al.*, 2006; Fa *et al.*, 2005; Van Vliet and Nasi, 2008) and NWFPs in general

(Sunderland *et al.*, 2002; Zapfack *et al.*, 1999). These works demonstrate the variety of methods that can be employed for inventories: standardized recording of routine observations, fixed-point photography, linear transects, group surveys and the collection of socio-economic data such as market surveys. Economic data can be collated with biophysical data and are of proven utility in studies of plant and animal wildlife. The task of sampling by zone can be supported by estimates of the likelihood of occurrence, formulated on the basis of data and knowledge collected from local communities, gatherers and hunters.

Each method has its advantages and disadvantages. The costs often differ widely in terms of time and resources, without forgetting problems of ownership of the results and conflictual relations between those exploiting the resources and those managing them. Based on experience in the region and elsewhere in the world (Danielsen *et al.*, 2000; ETFRN, 2000; Wong *et al.*, 2001), the adoption of a combination of methods is strongly recommended, combining scientific studies with harvesters' and other stakeholders' evaluations. The combination of participatory evaluations (involving users and communities) and scientific inventories has had the greatest success so far, especially where management is decentralized and communal (Vermeulen *et al.*, 2009; Ayeni *et al.*, 2001b; Mbile *et al.*, 2005; Sunderland and Tchouto, 1999). Neba (2007) stresses that it is vital to take account of the rights, needs and priorities of communities and the users of the resources. This is especially true if there is a risk that the dissemination of traditional knowledge to the wider public could have a detrimental effect on people's lives and lead to conflicts and illegal exploitation of resources, contrary to the objectives of conservation, development and governance.

6.2 Study of uses

The second stage is to know all the uses of a species, insofar as a single species is often used to supply several products in Central Africa. At least one third of the NWFP species in Cameroon, for example, have multiple uses, as can be seen in Table 1. Such multiple uses bestow a holistic value on the species and the forest ecosystems that host it (Guariguata *et al.*, 2011; Asseng Ze, 2008; Shackleton *et al.*, 2011). The use with the greatest value often takes precedence if the same group of users is involved. *Prunus africana*, for example, is used mainly for its medicinal bark and no longer for sculpture or as fuelwood or charcoal. Competitive use of a species by different users can also lead to conflict. For example, the combined use of wood and non-wood products from 39 species, including moabi or African pearwood (*Baillonella toxisperma*), sapelli or West African cedar (*Entandrophragma cylindricum*), ayous or African whitewood (*Triplochyton scleroxylon*) and essong or African oil bean (*Pentaclethra macrophylla*), has caused conflicts between logging companies and those living alongside concessions (Guariguata *et al.*, 2011; Asseng Ze, 2008). These conflicts can be aggravated by the overlapping of customary and formal governance systems with different definitions of ownership, access and the rights of the various users. This is why Gabon issued a decree in 2009 forbidding the felling of five multiple-use species: afo (*Poga oteosa*), bush mango or andok (*Irvingia gabonensis*), douka (*Tieghemetla africana*), moabi or African pearwood (*Baillonella toxisperma*) and ozigo (*Dacryodes buettnerii*).

Table 1
Number of uses of animal and plant species as NWFPs in Cameroon

Number of uses of one species	Cameroon			
	Animal species		Plant species	
	N°	%	N°	%
1	93	79	361	51
2	7	6	121	17
3	1	1	81	12
4	2	2	26	4
5	0	0	12	2
Multiple uses (2 to 5 uses)	10	8	240	34

* Insufficient data indicate that not all the uses of the species are known.
Source: Ingram, 2014

6.3 Carrying out of inventories of the parts of species used

The third stage is to know the individual parts or the whole of a species that can be sustainably harvested (individual yield). NWFPs in Cameroon come from ten different parts of plants and eight parts of animals, as can be seen in Table 2.

Table 2
Parts of animals and plants harvested for use as NWFPs in Cameroon and the Democratic Republic of the Congo

Part used	Cameroon		Democratic Republic of the Congo	
	Number of species	% of total species	Number of species	% of total species
Plant species				
Bark	189	32	13	3
Leaves	188	32	163	38
Fruit	116	20	197	46
Timber/logs	105	18	112	26
Stems	95	16		
Seeds	97	17		
Roots	50	9	47	11
Resin	40	7		
All	11	2		
Sprouts/shoots	1	0		
Animal species				
Flesh	107	88	171	99
The whole	13	2	3	1
Fur	1	1	1	1
Horns	1	1	1	1
Feathers	2	2	3	2
Skin	1	1	2	1
Spines	1	1	1	1
By-product	3	3	1	1

Note: In the case of certain species, several parts are used.
Source: Ingram, 2014

6.4 Assessment of the impact of harvesting

The fourth stage is to assess the impact of harvesting on species and the length of time that a species can be repeatedly harvested while remaining healthy and productive (the regeneration period). This would make it possible to ensure a sustainable yield and conditions (for example, the minimum age for harvesting and the season), depending on the ecology of the species and harvesting practices. Table 2 shows that for a large number of species, vital parts are removed. This raises the issue of the resilience of a species, its vulnerability to harvesting and ultimately its sustainable exploitation. Harvesting practices are more destructive and less sustainable when the parts harvested affect the potential tolerance of the species to harvesting (Ticktin, 2004). In order to assess the susceptibility of a species to intensive harvesting, its life cycle and the parts harvested must be evaluated jointly (Cunningham, 2001). Harvesting the fruit of a tree with a long life-cycle, for example, is less of a threat than harvesting the seeds of an annual plant: if the seeds cease to exist, so does the plant. The impacts of harvesting are complex for some plants. Slow-growing trees that produce only a few large fruit are more vulnerable to excessive harvesting. The species most vulnerable to excessive harvesting are those with a specific habitat and slow growth, and for which harvesting is destructive for the plant, the bark or the root, or if the whole plant is harvested (Cunningham, 2001). This is the case for eru or okok (*Gnetum* spp.), iboga (*Tabernanthe iboga*) and mondia (*Mondia whitei*). Removing bark can also cause disease and death, even if the harvesting of small amounts may not affect productivity, as is the case for essock (*Garcinia lucida*), pygeum or African cherry (*Prunus africana*), bush mango (*Irvingia* spp.) and yohimbe (*Pausinystalia yohimbe*). The gathering of leaves entails risks of excessive harvesting, which may be harmful or fatal for populations and individual plants (Ticktin, 2004). The harvesting of seeds and fruit, especially from trees, is generally benign and non-destructive, with harvesting limits relatively higher than for leaves. However, Guedje *et al.* (1998) and Ndoye and Ruiz-Pérez (1999) do stress that it may have long-term effects on the structure of the population and the trees. On the other hand, very high levels of fruit or seed harvesting from certain trees may encourage the long-term continuity of the population, while having harmful effects on local populations. With those species that have several methods of reproduction, like wrapping leaves (*Aframomum* spp.) – which reproduce through their seeds or through rhizomes – and in cases where only the fruit or the leaves are harvested, populations are not seriously endangered by harvesting (Cunningham, 1997). Tolerance of harvesting also varies according to the length of the plant's life. Perennial plants, such as *Sansevieria trifasciata*, *Trachyphrynium* and *Sarcophrynium* spp. may be more resistant to high harvesting rates than trees, which tend to have a slower growth rate and a longer life (Clark and Sunderland, 2004).

Selective harvesting of parts of plants may be sustainable at the individual or population level. However, it requires an understanding of the ecological impact, the reproductive features and the harvesting techniques, together with management practices that can mitigate negative impacts and/or promote positive impacts. Unfortunately, most of this basic information is incomplete for most of the taxa in the region (FAO, 2009b; FAO *et al.*, 2008). Data on the impact of NWFP harvesting in Central Africa are scanty. A number of studies do, however, provide good examples of how such knowledge can be obtained, writing, for example, about essock (*Garcinia lucida*) (Guedje *et al.*, 2007), pygeum or African cherry (*Prunus africana*) (Stewart, 2007, 2009; Nkeng *et al.*, 2009; Stewart, 2001), eru or okok (*Gnetum* spp.) (Clause, 2010; Shiembo, 1999), bushmeat (Abernethy and Obiang, 2009; Mayaka *et al.*, 2004) and fuelwood (Dubiez *et al.*, 2010). Local indigenous knowledge about harvesting techniques varies from one NWFP species to another, so that successful, sustainable techniques are not often shared. This was the case for the

Gnetum spp. cultivation techniques used in southwestern Cameroon, which were still widely unknown before the recent training sessions and exchange visits organized in Cameroon, the Congo and Gabon.

6.5 Evaluation of sustainable harvesting

The last stage in significantly improving knowledge is to evaluate all the data from inventories and all the information about uses, parts used and the impact of harvesting, in order to determine the amount of a species that can be harvested sustainably over a given period. A sustainable harvesting system is defined as one in which all or part of a plant or animal can be harvested indefinitely in a given region with no detrimental impact on the structure and dynamics of the populations harvested (Clark *et al.*, 2004; Ticktin, 2004).

This evaluation makes it possible to fix an estimated quota of the nature and volume of an NWFP that can be harvested sustainably over a given period in a given zone. These quotas are currently defined by law in Cameroon and the Democratic Republic of the Congo (see Chapter 10).

7. Improvement of knowledge through monitoring and evaluation

Monitoring complements the evaluation process, which is often fragmented and piecemeal, so that decision-making can be guided according to a plan–do–check–adjust approach (see Box 5). It is one of the conditions for developing a framework favourable to the sustainable governance of forests and NWFPs.

Table 3
Plan-do-check-adjust cycle

Identify	Identify the problems, questions, analysis
Plan	Formulate strategies, priorities, objectives, action plan
Develop	Funding, monitoring system, indicators
Do	Execution of activities
Check	Monitor
Adjust	Mid-term evaluation
Evaluate	Final/Post-evaluation

Once an initial benchmark has been established, the monitoring of indicators (yields, mortality, density, distribution, volumes harvested and traded, harvesting distances and cultivation rates) will provide an overview of changes that have occurred since the benchmark was set. Evaluation of the impact of changes on uses, marketing, management and governance is then possible.

This need for monitoring, improvement and analysis of knowledge about NWFPs has been recognized and adopted as one of the missions of the Observatory for the Forests of Central Africa (OFAC). This observatory was created on the initiative of the members of the Congo Basin Forest Partnership (CBFP) to gather the available knowledge and data needed to monitor the ecological, environmental and social aspects of the forests of Central Africa. It was set up following the immense information-sharing efforts that led to the 2006 Report on the State of the Forests and the biennial reports that followed. The 2010 Report on the State of the Forests

of the Congo Basin (Billand, 2012) highlights the increasing need to improve knowledge about NWFPs. The OFAC is a response to one of the objectives of the COMIFAC Convergence Plan: to provide a steering and data-sharing tool in order to promote the better governance and sustainable management of forest ecosystems. It is currently revising the indicators developed in its annual reports on the state of forests and defining new indicators. Data on indicators to be revised are collected from national groups and focal points, and recorded online. The OFAC also works to gather updated knowledge about species. The challenge for it and its partners and members is to coordinate regional and local actions in order to ensure the availability of resources and the development of expertise for all the stakeholders in the NWFP sector.

COMIFAC has carried out consultations with a view to revising and harmonizing laws on forests and wildlife in Central Africa, with particular stress on the regulatory framework for NWFPs. This revision process is an excellent opportunity to monitor key species to be incorporated into the policy and regulatory framework.

A good basis for orientation has been provided by detailed proposals for monitoring and harmonization frameworks drawn up since 2006 (Walter and Mbala, 2006; Lagarde Betti, 2007b; Bonannée *et al*., 2007):

- For plant species, the OFAC provides support and assistance to regional organizations and specialized networks, such as the Central African Botanists Network (REBAC). The objective is to establish a detailed base of bibliographical references for the region.
- For animal species used as bushmeat, a national and regional monitoring network, the Central African Bushmeat Monitoring System (SYVBAC), has been running since 2008. It is steered and coordinated by the Wildlife Trade Monitoring Network (TRAFFIC) and a group of stakeholders from the bushmeat and wild species sector. The participatory process chosen for the establishment of the SYVBAC seeks to consolidate the institutional framework for monitoring and control, particularly through regular exchanges with the focal points and ministries concerned with bushmeat, COMIFAC, development projects, NGOs and civil society. It is supported by technical workshops and working groups involving the private sector (logging concessions and consultants) and institutional partners (NGOs, companies, local government agencies) in the bushmeat heartlands. The objective is to draw up a list of 64 indicators of context, pressure, state and response. The main categories of indicator comprise governance, economic, sociocultural and ecological indicators, pressure and threats (to the resource and to markets) and also the status of the resource. Trials are also carried out of indicators to measure the reaction to management interventions and to alternative supplies such as substituting other sources of protein for meat, the quality of communication and awareness-raising, and control and application measures. The SYVBAC emphasizes the importance of communication and uses national and international networks, national focal points (working groups including ministry staff) and local partners, the media and the Internet to provide information on its progress and actions. The SYVBAC is currently in a trial phase in pilot countries in order to validate indicators and disseminate information. Studies show that the criteria used to draw up the list of species to be monitored and protected need to be reviewed in two areas: the level of vulnerability (using the Red List) and the level of catches for marketing and consumption. If these two criteria are applied, at least seven animals that are not currently included in the two main protection categories (Classes A and B) under the 1994 Cameroon law on forests and wildlife should be included in the list, since they are classified as vulnerable species

according to the Red List of threatened species. The OFAC indicates that although the SYVBAC is concerned with only one kind of animal NWFP (bushmeat), these indicators can easily be adapted to other NWFP species of plant origin, which would constitute the next trial phase at national and regional levels.

8. Conclusion and recommendations

Reliable, updated knowledge is essential at the local, national and regional levels in order to ensure that forest products that allow the survival of rural and urban people do not disappear. This knowledge is indispensable, not just to the government in its mission of enacting regulations, but also to traditional authorities, scientific institutions, civil society, individuals and private-sector organizations involved in marketing NWFPs, and not least support organizations. Several recommendations may be made with a view to building up this knowledge.

8.1 For NWFPs of plant origin

1. Introduce (where it does not exist) or clarify the definition of NWFPs in national laws and define the relationship between customary usage and marketing.
2. Revise lists of special forest products (those requiring a permit) in order to determine the key species and separate NWFPs from wood products.
3. Ensure the monitoring of all the NWFPs on the revised list of regulated species, for example special forest products.
4. Make a regular inventory of key products.
5. Issue harvesting permits for key items produced from wild plants and trees, on the basis of quotas and inventories.
6. Differentiate the sources of forest products (plantations, agroforestry zones or natural forests) and give priority for permits to the extraction of wild products from natural forests.
7. When issuing permits, differentiate national and international trade.
8. Draw up and disseminate guidelines and practical standards for harvesting NWFPs, driven by research, training and extension, not forgetting systematic monitoring and control.
9. Develop NWFP management plans.
10. Improve the sharing of information from transporters, control posts and the main cross-border customs posts, and make sure that these data are incorporated into national systems.

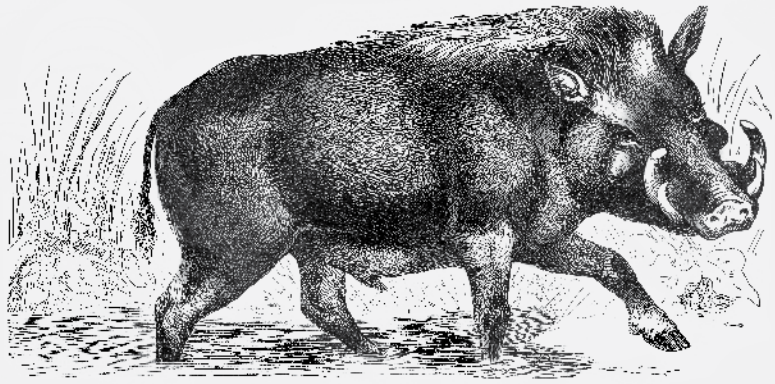
8.2 For NWFPs of animal origin

1. Revise the system for issuing hunting permits in order to increase the availability of data, improve surveillance and streamline procedures for obtaining permits.
2. Establish coordination between the local and central authorities of the ministry of forests regarding the issuing of permits, monitoring, control and data collection at all levels.
3. Strengthen the monitoring and control of the bushmeat trade and of markets in protected species.
4. Increase basic knowledge on the biology of forest animals that can be hunted and on the consequences of hunting. This would allow production rates (the growth rate as against

replacement rate) to be correctly estimated and would assist in estimating hunting quotas and permits compatible with sustainability.
5. Revise the categories of animals protected by national laws to include species on the Red List and CITES list.
6. Assess the vulnerability of key species that are not protected but are traded and consumed, and revise their status and classification on this basis.
7. Review the level and methods of protection and surveillance of the main protected species that are widely hunted.

8.3 For all NWFPs

1. Fresh research is needed on the way NWFPs contribute to meeting nutrition, health and energy needs, on the effects of climate change and on mitigation strategies.
2. Since many players (researchers, NGOs, civil societies, donors, government services and traditional healers) are currently making a contribution to knowledge about NWFPs, it is important to ensure that initiatives to coordinate these sources continue.
3. It would be of real assistance to stakeholders and decision-makers in the value chain to identify relevant common issues, allowing a joint search for solutions to persistent problems such as the sustainable harvesting of key species and products, harvesting rates, the optimal and most effective management of rare species, and management and governance methods.
4. Governmental and regional organizations such as COMIFAC can continue to play a major role in formulating issues that must be addressed and in coordinating knowledge, both present and future.



The management of forest resources is based on traditional knowledge of the names of plant and animal species, their bio-ecology and their socio-ecology. This traditional knowledge and local cultures are the points of reference on which forest peoples base the management of resources in their area. With the emergence of collaborative management approaches and prospects for adaptation, traditional knowledge and local cultures are key resources for any research and development process being carried out in the space where they live.

Chapter 13
Building on traditional knowledge and local cultural practices regarding forest and NWFP management: the case of southern Cameroon

William A. Mala, Coert J. Geldenhyus and Ravi Prabhu

1. Introduction

Despite major investment and concerted efforts over the past 20 years to put tropical forest management on a rational basis, progress and change are still very limited and basically localized (Sunderland *et al.*, 2008; Sayer and Wells, 2004; Shepherd, 2004). These poor results can be ascribed to a lack of relevance of the ecological scale used to assess their sustainability and to an inappropriate definition of the indicators of change and transformation, with regard both to the balance of forests and to the living conditions of forest peoples (Sunderlin *et al.*, 2005; Armitage, 2003; Colfer *et al.*, 2001). In Central Africa, forest management is based predominantly on an approach that focuses on the risks of deforestation and ecosystem degradation. This approach stigmatizes traditional natural resource management practices and management and development choices for forested areas. As a result there is a failure to take sufficient account of traditional knowledge and an overlapping of the dynamics of concessions (logging, communal, community and conservation) with local cultural survival dynamics (Masuch *et al.*, 2011; Mala *et al.*, 2010; Assembe Mvondo and Lema Ngono, 2007; Mala and Oyono, 2004; Oyono, 2002; Bahuchet,1997; Diaw, 1997; Diaw and Oyono, 1998; Leplaideur, 1985).

There are many consequences of this overlapping: (i) heightened conflicts of outlook and language over issues regarding the rights of forest peoples and points of view on conservation and development; (ii) clashes among the various ways of representing ecological dynamics; (iii) socio-economic stagnation or even regression of rural communities living near conservation and logging concessions (a notable drop in the human development index); and (iv) a certain weariness among forest peoples while waiting for the progress and development promised by players in the forest sector (Sayer and Wells, 2004; Diaw *et al.*, 2009). Current knowledge systems and conventional approaches to forest management are being questioned: based as they are on the predominant approach, do they take sufficient account of the bioecological reality and the interactions between forest communities and their environment?

For the past 20 years, community resource management by forest peoples has been a result of reforms introduced in the various countries of the Congo Basin. These reforms have radically changed the division of forest areas and methods of access to and optimization of forest resources. However, they have not succeeded in transforming forest peoples' view of the world, nature and forests, nor the management practices that act as the foundation for their socio-economic organization and for maintaining their lifestyle (Mala *et al.*, 2010; Oyono, 2002; Bahuchet, 1997; Diaw, 1997).

The reforms were themselves preceded by agricultural innovations at the start of the 20th century, especially the introduction of cash crops such as cocoa and coffee (Santoir, 1992; Leplaideur, 1985; Guyer, 1984), and to some extent the more recent introduction of oil palms. Forest peoples then put their knowledge to good use by establishing cocoa-based agroforestry and defining rules for the control of, access to and management of such land, alongside customary tenure of forest land (Diaw and Oyono, 1998; Diaw, 1997; Dounias, 1996). Their ability to adapt to innovations suggests that the choice of management methods for natural resources should take their values and knowledge into account. This capacity to adapt demonstrates the resilient nature of traditional natural resource management systems (Oyono *et al*., 2003; Carrière, 1999; Diaw, 1997).

Traditional knowledge about managing forests and their resources thus foster all the changes taking shape in forests, and local communities depend on it for any change or development in their livelihoods (Diaw, 1997; Mala, 2009). More than in the past, this situation requires the design of approaches based on the adaptive capacity of forest stakeholders rather than authoritarian approaches that privilege the rights of the strongest and an ideology of domination (Diaw, 1997). To ensure the long-term effectiveness of these changes, the traditional knowledge that governs decision-making in the management of natural forests and resources needs to be systematically recorded. This is the thrust of this chapter, showing how forest people use traditional knowledge in order to adapt to shocks, uncertainties and surprises in their natural environment. The task thereafter will be to identify ways of building on this knowledge and promoting the combination of conservation with local development concerns.

2. The case of southern Cameroon: the Pahouin

This chapter focuses on a group that has fascinated many researchers and been the object of several hundred studies since Zenker's (1893, 1895) and Tessman's (1913) studies were published. These are the Pahouin, better known as the Fang-Beti-Bulu. It is hard to delimit the area of study of these people because of the complexity of their migrations and the fact that they only recently became settled. For several centuries, the Pahouin have occupied a huge forest zone stretching across latitudes from the mid-Sanaga in Cameroon (4°30'N) to the mouth of the Ogooué in Gabon (1°20'S), and longitudes from the Atlantic (9°30'E) to the mid-Sangha (14°E),[24] an area of more than 300 000 square kilometres spread over Cameroon, Equatorial Guinea, Gabon, the Republic of the Congo, and Sao Tome and Principe.

Three subgroups can be distinguished on the basis of their geographical positions, differences in dialect and particular traditional and genealogical features: the Beti (in the north, perhaps more "Pahouinized" than Pahouin), the Fang (in the south) and the Bulu (between the two) (Franc, 1905; Dugast, 1949; Alexandre and Binet, 1958; Mveng, 1985). The identity of the Pahouin[25] is based on

[24] The Sanaga is a river in central Cameroon, the Sangha is a river on the border between Cameroon and the Congo, and the Ogooué is a river in Gabon.

[25] The Pahouin have a segmentary lineage society. Their communities are organized into families, lineages and clans, without any higher jurisdiction. All heads of family are independent and on an equal footing, and they owe their social prestige to the number of dependents they have under their authority, which depends on their personal charisma. Traditional power rests basically on women and the power to acquire them and impregnate them. The more women the family head has at his disposal, the more male dependents he can acquire. Women are the coin with which a man buys the work and support of other individuals. A rich man has to earn forgiveness for his wealth by distributing it to others. He must show that he is generous, which acts as a brake on the accumulation of wealth. Fertility is an important element and is seen in operation in the kinship system.

a language and mode of social organization, with the three subgroups being distinguished only by certain rituals. A sign of the mutual recognition and respect among these peoples belonging to the same cultural area is that the Pahouin do not accept any distinction being drawn between the Fang, the Beti and the Bulu (Ndong Tsira, 1970; Balandier, 1982). These people's traditional agricultural practices, approach to land tenure, forest management and knowledge have undergone a series of technological, religious and cultural influences that have been superimposed on their original view regarding the environment and natural resource management (Mba Abessole, 2006; Mba, 2002). These influences have had their effect in several spheres:

- In economic terms. Urbanization linked to the economic boom of the late 1970s brought with it a demand for food, preceded by internal migrations and sedentarization, leading to a diversification in food crop production, agroforestry and market gardening (Diaw, 1997; Dounias, 1996; Leplaideur, 1985; Santoir, 1992; Balandier, 1982). Agricultural production is focused on a number of cropping systems: groundnut (*Arachis hypogea*) fields, macabo or arrowleaf elephant ear (*Xanthosoma sagittifolium*) fields, plantain (*Musa paradisiaca*) fields and egusi-itoo or white-seed melon (*Cucumeropsis mannii*) fields. These diverse cropping systems and products form one of the bases of agro-ecological resilience and food systems (Mala, 2009; Leplaideur, 1985; Guyer, 1984; Weber, 1977). Food crop production is enriched with cocoa and coffee plantations and the more recently introduced village palm groves. Production strategies remain very versatile and include NWFP gathering, hunting and fishing (Dounias, 1995; Diaw, 1997; ASB, 2000).
- In terms of land management. Evolution here followed the Fang-Beti-Bulu migratory waves of the 18th and 19th centuries (Vermeulen and Carrière, 2001; Diaw, 1997; Dounias, 1996). Rules of access to and control over land were established. Land ownership is organized according to cropping cycles: primary forests belong to the clan, secondary forests to the clan-lineage, old fallows to the lineage or segmentary lineage, young fallows to the household, forest fields to the household/man/woman, cocoa fields to the household/man and food crop fields to the household/woman (Diaw and Oyono, 1998; Guyer, 1984). In general, customary law governs both croplands and forest land. Rights over land are only usufruct rights, while attachment to the land is symbolic or emotional (Mba, 2002; Vermeulen and Carrière, 2001; Diaw, 1997; Leplaideur, 1985). It is by belonging to a lineage that a person has access to a plot of land, following established rules. In the case of a dispute, a discussion is organized at the family level under the supervision of the household head or the village council. Once a forest is opened up by "axe right" – the right of the first occupant to develop the land – the man who was the origin of the opening and his descendants retain a primacy over what will become fallow (Joiris and Bahuchet, 1993).

Forest peoples' cosmogony is a good indicator of their traditional knowledge, their perception of forests and their resulting forest resource management practices. Ethnographic studies also address this perception of forests and the symbols conveyed in the epics of the "lords of the forest". The analysis developed in this chapter is based on ethnographic tools and methods.[26]

[26] The objective of ethnography is to identify the practices, myths and beliefs that form the culture of a given people. The myths, legends and beliefs express a reality that is other than the individual reality. Along with the language and the body of artefacts, they constitute the semiological system of the culture. By interpreting the meaning of the artefacts, ethnographers identify the cultural determinants that govern the group studied in the context studied. Ethnography seeks to describe the rules of social interaction in a given context, through participatory observation.

3. Forest peoples' world view

3.1 Perception of the universe

The Fang-Beti forest peoples' world view is based on their spiritual beliefs. It has been described by many writers (Owono, 2011; Mviena, 1970) and comprises four main principles:

1. Belief in a supreme, all-powerful God, maker of the universe. Forest peoples call him by names that place him at the heart of the universe and sometimes represent him as a deity with human traits, father of the ancestors. This God, who is present in many myths and legends, governs human life through prohibitions or taboos. The presence of God is manifested through the land and the sky, the sun and the moon (whose movements govern the performance of many rites, including propitiatory rites for hunting and fishing), lightning and the rainbow. Just as lightning is feared for the way it strikes, the rainbow is admired as following storms and bringing peace. Another manifestation of the divine is the number 9, a symbolic number for many forest peoples, which appears in rituals and grants access to fullness, making it possible to reach the absolute (Tabi, 1974).
2. Dualism between the visible and invisible world. Forest peoples have words to indicate this and practise rituals that highlight the supreme power or the justice-bringing action of the ancestors. They consider that for the most part the invisible world is the foundation of nature, the true representation of life (Assoumou Ndoutoume, 1986; Owono, 2011). Dreams, for example, are seen as messages sent to a person by the ancestors. A part of this dualism is expressed in the myth of the evu (see Box 1).

Box 1
Myth of the evu

This myth occupies a central place in the Fang understanding not only of the world, beings and things, but also of women, human nature and evil. In it, taboo underlies the concepts of generation, power and hierarchy in society. The creator god Okomboto reserves to himself the right to enjoy the forest. Only his wife refuses to occupy the place she has been assigned. He forbids her to go into the forest to find the evu creature, the symbol of desire and devourer of animals. Transgression of the prohibition serves as mediation between the village and the forest.

OAn object to be dominated for Okomboto and an object to be conquered and subdued for the evu, the woman is pursuing desire and searching for her centre. Her nature is not a model. The Fang consider that one must learn to control oneself, to dominate others and nature (the forest), to become master of the evu (desire) and thereby to affirm one's wisdom. The principle of evil is to be sought not in the social environment but in the evu.

The village-forest opposition evokes that between spirit and matter. The relationships between village and forest, culture and nature, reflect the Fang's relationship with their environment, but also their typology of existing things. It is the reference to the invisible world, the first of the worlds, that allows understanding of the visible and the apparent order of things, events and beings.

Source: Owono, 2011

3. The pervasive presence of the ancestors in life, considered the first men of the clan, the tribe, the family, who "have gone to the other side of life". For many forest peoples, death is not the end of a person, but rather a passage. The ancestors live in the village and are the founders of lineages. They watch over the social order and ensure respect for tradition, balance and harmony in the community (mvoë). Each Fang lineage has its real or fictitious ancestor from another generation than that of the living. In this Fang representation of the universe, God governs the overall pattern of existence, but the ancestors are responsible for the production of good things and the reproduction of life (Aubame, 2004).
4. The presence of genies. These spirits and ghosts live in trees, water courses and even the gables of houses. Among the Pahouin, they represent dangerous invisible forces that must be protected against or mastered, for the good and certainly for the evil. Some genies, domesticated by humans, are incarnated in wild animals such as snakes, panthers, eagles and hawks (Trilles, 1909; 1912; Mve Ondo, 1991).

3.2 Perception of forests

This perception is threefold:

1. The representative perception sees the forest as a gift of God, a mystery, but also a hiding place, a shelter that inspires respect for the divine and attracts the presence of genies.
2. The descriptive perception relates to the plant and animal wildlife species of the pre-forest fallows through to mature secondary forests. For example, the African oil palm (*Elaeis guineensis*) and Siam weed or triffid (*Chromolaena odorata*) are species indicating a secondarization process in areas where humans have intervened.
3. The utilitarian perception sees the forest with its social and cultural functions and its uses. It encompasses human activities in the forest – hunting, fishing, gathering – that produce food (availability and access), capital (guaranteed important resources for life) and money (from marketing the resources).

These different ways of seeing the forest are summarized in Table 1 below.

Table 1
Perceptions based on the discourse about the forest

Orientation of the discourse	Content	Declination elements
Descriptive	Space with resources	Animal and plant species
Utilitarian/functional	Gift of life Man's dominating power through work Instrument to read the weather	Work Food Building Money Hunting Fishing
Representative	Gift of God Mystery/hiding place/ shelter	Relationship between creator and creation Abode of genies

Source: Adapted from Mala *et al.*, 2010

4. Traditional knowledge of forest management

This knowledge can be divided into three types: knowledge of the names of plants and animals; knowledge of soil classification and fertility indicators; and knowledge of agroclimatology and resource management (description of the stages of ecological sequences and their social control, wildlife management and the spatialization of uses and gathering and extraction systems).

4.1 Traditional systems of nomenclature and classification of plant and animal wildlife

Strictly speaking, there is no traditional nomenclature or classification comparable to those used in botany. Forest peoples are able to name each living being (plant and animal wildlife) in the forest with a distinct name. As throughout Africa, the name initially has a meaning before it becomes a reference (Owono, 2011). According to Owono (2011) again, "To signify something is to bring it into existence; to name is to create." This premise, applied to forests whose resources are considered to be manifestations of the divinity, confirms the unique, highly personalizing and individual character that forest peoples attribute to their plant and animal wildlife resources.

Traditional knowledge of the names of plants is handed down and was known even to the children interviewed, who describe forests through certain trees, the most recurrent of which are: *Ceiba petandra* (dúm), *Irvingia gabonensis* (andok), *Milicia excelsa* (abang), *Musanga cecropiodes* (aseng), *Guibourtia tessmanii* (essingan), *Chlorophora macrophyla* (azobé), *Vernonia cinerea* (abangak), Termilia superba (akom), mebenga, *Petersianthus macrocarpus* (abing), *Entandrophragma cylindricum* (assie), mevini, *Erythrophleum ivorense* (elone) and *Dacryodes macrophylla* (atom). The names given to trees allow them to be classified by distinguishing male trees from female trees: abing (*Petersianthus* spp.) hosts caterpillars, while nnom abing (*Petersianthus* spp.) does not; the same is found with eteng and nnom eteng, andok beti (*Irvingia gabonensis*) and andok ngoue (*Irvingia wombulu*), and assas (*Macaranga* spp.) and esob (*Macaranga* spp.).

The traditional classification of plants allows all plant forms to be distinguished, together with their uses (medicinal potential, toxicity, as with *Erytroploeum guineense*, or possible shelter for genies, as with *Guibourtia* spp). Knowledge about trees and wild plants (cultivated today), their biology, their use and their possible coexistence and association, has contributed to their domestication over hundreds of years. Knowledge about interactions between wild species and cultivated plants has, for example, been used as the basis for creating agroforestry mosaics in Central Africa.

Traditional knowledge about animal wildlife consists in the first place of naming animals, from the smallest to the largest, and learning about their behaviour, their sociobiology and their ecology. It is an important asset for forest peoples not only for the organization of hunting, fishing and snail collecting, but also for the interpretation of the weather and changes in the environment. The movement of edible insects of the Isoptera order (literally, equal wings), for example, is used to analyse the sequence of the seasons. The same insects have given the names of drought (*eseb*) and rains (*oyon*). The sequence of the seasons can be read and interpreted from the falling of the leaves of certain forest trees and the movement of such insects as dragonflies, edible termites (*seb*, *sil*, *kab*) and driver ants. There is a closeness between the names of seasons and the semiology of termites: the name eseb comes from seb, asil from sil, which correspond to two very clear seasonal breaks or the transition from one season to another. These bioecological indicators announce the passage from one season to another, or the harshness of one of them.

The behaviour of certain animals, such as the cries of gorillas, chimpanzees, birds (partridges, hornbills) or insects, are indicators of time – not of the hour, minute or second, but of the main moments of the day: sunrise (*kikirigi*), midday (*zan amos*), nightfall (*ngegole*) and midnight (*zang alu*). All this knowledge about the functions of plants and animals is decisive in the management of plants by forest peoples, including those of the Fang-Beti group.

4.2 Traditional soil management systems: classification and fertility indicators

The management of soil fertility is based on a combination of the traditional system of soil classification according to use and the perception of this fertility. In traditional practice, two combined classification grids are used:

1. The first is associated with types of forest or land use. Forest peoples distinguish four classes: *si mefane* (forest soils), *si bikotok* or *bikorogho* (fallow or pre-forest fallow soils), *si elobé* (lowland soils) and *si minkol* (upland soils).
2. The second grid is based on the physical and chemical properties and colours of soils. It comprises four distinct levels: *evele si* (red soils), *evindi si* (black soils), *ekon si* (clay soils) and *nselek si* (sandy soils). Appropriate types of crops are associated with each category of soil. The classifications are not always exclusive: sometimes the coloration of black soils and types of forest match, and sometimes they are do not in areas where there are abundant bioecological indicators of soil fertility or other characteristics based on texture and structure.

Apart from these traditional classification systems, there is a consensus on knowledge about the symbiotic effects of trees. Interpretation of the symbiotic effects of certain trees, bushes, plants and grasses on soil properties also provides a classification, with differences and similarities. For example, some trees have negative effects, inhibiting the restoration of soil fertility. Some 40 plant species have been identified for their use as indicators of the perception of soil fertility; most of them are trees (75 percent), while the rest are bushes and leafy vegetation. With regard to arborescent species, the dominant families are pulses, followed by the spurge and mulberry families. The species most often used to interpret the spatial demarcation of soil fertility on village lands include *Pycnanthus angolensis*, *Musanga cecropioides* and *Terminalia superba* in cocoa plantations, *Musanga cecropioides*, *Ficus* spp. and *Pycnanthus angolensis* in forest fields, and *Chromolaena odorata* in groundnut fields.

The management of soil fertility is based on the interpretation and knowledge of interactions among plants, knowledge of soil biofertilization, soil bioclassification and the reading of certain physical and chemical properties according to soil colour, texture and granulation.

5. Traditional knowledge of NWFP management

Three major factors, separately or in combination, govern the management of NWFPs: household uses, rights of access and gathering, and commercial value. Traditional knowledge about the most sought-after and shared NWFPs in forest communities concerns their dietary, medicinal, aphrodisiac and utilitarian (tool-making) uses.

In the case of NWFPs for medicinal use, such as *Rauwolfia* spp. (medjanga medjanga), *Alstonia boonei* (ekuk), *Enantia chlorantha* (mfol), *Picralima nitida* (tid mot) and *Entandrophragma cylindricum* (essingang), which are traditionally used to treat malaria, access is generally free at the community level. Pharmacopeial knowledge is very widespread, since all women of a certain age know and use plants that can treat infants' minor ailments such as intestinal worms and diarrhoea.

Collecting fuelwood to cook food is a daily activity. Wood is stored when trees are selectively felled. Trunks are placed around fields to protect them from predatory animals (porcupines and hedgehogs) and are regularly carried to the village. Traditional knowledge tells which species provide the best energy, such as *Macaranga* spp. (asas), which is particularly sought after. Other species, such as *Pentaclethra macrophylla* (ebaye), are less favoured for reasons associated with the belief that they can shelter genies that bring bad luck or family quarrels. The list of species is given in Table 2.

Table 2
List of some species used as fuelwood

Common name among the Fang-Beti	Scientific name	Perception of value as fuelwood
Abengak	*Anthocleista spp.*	Tree appreciated as fuelwood
Andzitsing	*Eurypetalum tessmannii*	Tree appreciated as fuelwood
Asam	*Uappaca spp.*	Tree appreciated as fuelwood
Asás	*Macaranga barteri*	Tree considered as "good fuelwood"
Aséng	*Musanga cecropioides*	Tree appreciated as fuelwood
Atúiñ	*Harungana madagascariensis*	Tree appreciated as fuelwood
Ebae	*Pentaclethra macrophylla*	Species to be avoided
Dúm	*Ceiba pentandra*	Tree appreciated as fuelwood
Ebébéng	*Margaritania discoidea*	Tree appreciated as fuelwood
Edom	*Cylicodiscus gabunensis*	Tree appreciated as fuelwood
Elón	*Erytroploeum guineense*	Tree appreciated as fuelwood
Ewome	*Coula edulis*	Tree appreciated as fuelwood
Ewórgo	*Bridelia micrantha*	Tree appreciated as fuelwood
Meban	*Funtumia africana*	Tree appreciated as fuelwood
Ngún	*Irvinga grandifolia*	Tree appreciated as fuelwood
Efobolo	*Tetrorchidium didymostemon*	Species to be avoided
Olong	*Zanthoxylum heitzii*	Used in the absence of other fuelwood
Oyang	*Xylopia aethiopica*	Tree appreciated as fuelwood
Sene	*Albizia adianthifolia*	Used in the absence of other fuelwood

Source: Adapted from Gelabert *et al.,* 2011

Access to NWFPs can be open or closed. This depends both on the nature of the resource (fixed or moving), its status (planted/domesticated, or wild) and the methods used to harvest the product (picking, gathering, extraction). With planted trees such as safou (*Dacryodes edulis*), for which the harvesting method is gathering the fruit, access is restricted. It is similar for wild fruit trees such as bush mango when found in a space affected by human activity and where NWFPs are gathered. The greater the commercial value of an NWFP, the more access is restricted and determined in function of the ecological niche and of land use. Gathering *Gnetum* spp., for

example, is restricted when it is found on a cocoa plantation or on fallow land. Access is open in forests because of the effort needed to gather it. Similar degrees of access and restriction are applied to bush mango (*Irvingia gabonensis*).

For moving forest products such as game and fishery products, traditional rights of access are restricted in human activity areas and open for hunting outside these. Rights of access are rarely influenced by hunting tools and techniques. For fishing, rights of access are connected with fishing practices and techniques: if fishing is carried out with a line or some trapping technique, access is free, but if fishing is carried out at a dam, access is restricted.

6. Discussion

Management of forests and their resources is governed by a view of the world and nature that is unique to each people. In Central Africa, this view sees nature as a gift from God, a capital asset and a source of well-being. In contrast to the dominant discourse on forests, which stigmatizes the impact of traditional methods of managing forest resources, the information given in this chapter indicates that such management is based on real knowledge of plant and animal wildlife, which governs its exploitation in space and over time.

This traditional perception of forests takes into account their divine nature, but also the value of work and the idea of time. This representation complements the predominant definitions, which favour such parameters as the minimum size of trees, the areas of ecosystems and environmental services (Gyde Lund, 2002; Helms, 2002). When this traditional perception is analysed, a striking factor is the forest-work relationship, which demonstrates the importance of work in optimizing forests and their elements to ensure social reproduction (Diaw, 1997; Vermeulen and Carrière, 2001).

Classification of the species of the animal and vegetable kingdoms by forest peoples through precise names provides a frame of reference that is important not only for the task of drawing up an inventory of plant and animal wildlife, but is also recognized in scientific and technical literature (Letouzey, 1979; Tailfer, 1990). It provides a basis for interpreting bioecological functions (biofertilization, inhibitors of biofertilization) and symbiotic functions of plants and animals with food and medicinal uses, and for improving the management of species and land-use management (Carrière, 1999; Mala, 2009). For example, women sow several (four, five or six) plants at once in their food crop fields. This strategy provides them with an almost continuous succession of harvests. Cassava roots, tubers of the arrowleaf elephant ear (*Xanthosoma sagitifolium*) and potatoes (*Ipomea batatas*) can also be harvested for several months and act as their "storehouse" to be drawn on according to need.

Apart from strategies to organize agroforestry production, the traditional use of names for trees is also significant when taking decisions about soil fertility management. Soil fertility is a key parameter for determining the choice of plots, using a multicriteria approach that combines soil classification, floristic indicators of soil fertility and the available pool of fallow land (Levang *et al*., 1996; Mala, 2009). While there is a certain consensus regarding species, the critical factor is the pool of fallow land possessed by a household or a family – allowing them to regulate the length of the fallow on plots they control and thus guarantee the work of the household. The act of working is a factor justifying the management of its rights over the soil inherent in the right to produce, in order to establish its place in the social order (Mviena, 1970; Laburthe-Tolra,

1981; Diaw, 1997). It is this conception of life that structures forest peoples' knowledge of ecology and the reproductive biology of plants and animals. Fertility is managed by cumulative effects of the length of the fallow period, the physical and chemical characteristics of soils, knowledge of cropping precedents, previous vegetation and requirements regarding time and social management of the land.

As an activity supporting improvement in livelihoods thanks to their multiple uses (especially dietary and medicinal), the exploitation of NWFPs draws on knowledge of the names of the various species and formulas allowing effective exploitation (Dounias, 1996; Carrière, 1999). Forest peoples' traditional knowledge allows them to work with nature while accommodating agricultural and/or state forest mosaics and exploiting the diversity of forest products as in forest-savannah transition zones (Fairhead and Leach, 1994). This clearly shows the role of these practices in the diversity and floristic composition of forest areas (Van Germeden *et al.*, 2003; Carrière, 1999; Mala, 2009; Gelabert *et al.*, 2011)

7. Conclusion

This chapter set out to document traditional knowledge of forest and NWFP management. The world view and perception of forests of those who live there have been described and characterized. This knowledge influences the exploitation and use of resources, and governs the interpretation of soil fertility, climate and environmental changes. On the basis of this potential, the search for a compromise between conservation and development should be envisaged in the form of the joint construction of innovations in resource management. The relevance of such an approach would lie in the fact that it takes into account the knowledge systems brought into play in the processes of adaptation to changes in the forest area, using the issue of the sustainability of livelihoods and environmental sustainability as a lever.

© ARMAND ASSENG ZÉ

Extracting a bush mango (Irvingia gabonensis) *kernel in southern Cameroon*

© BRUNO DE SEMBOLI

Planting a tree means promoting life. World Tree Day in the Central African Republic

© TERRY SUNDERLAND

Involving even the very young in every stage of the resource management process

© OUSSEYNOU NDOYE

Congolese natural honey from the hexagonal SMFE

ARMAND ASSENG ZÉ

Mushrooms

© ARMAND ASSENG ZÉ

Palm tree larvae, highly valued locally, on sale in the Mokolo market, Yaoundé

© ICRAF

Garcinia cola, Cola acuminata, safou

© FAO

Stock of Gnetum *spp. awaiting delivery in Cameroon*

© JULIUS C. TIEGUHONG

Game brought back from the bush by a hunter in Lobaye, Central African Republic

© JULIANE MASUCH

Palm sap

© ARMAND ASSENG ZÉ

Caterpillars drying in the sun in the Central African Republic

© FAO

SMFEs in Bobo-Dioulasso, Burkina Faso, beneficiaries of the MA&D approach in 2008

© TERRY SUNDERLAND

Between forests, agroforests or domestic forests, periurban zones supply the NWFP market in Cameroon

FÉLIX KOUBAOUNA

Propagator for Gnetum *spp.*

© ARMAND ASSENG ZÉ

Transporting Gnetum *spp. to marketing centres in the Central African Republic*

WILLIAM MALA

Irvingia gabonesis *(bush mango or andok) and nuts in Cameroon*

OUSSEYNOU NDOYE

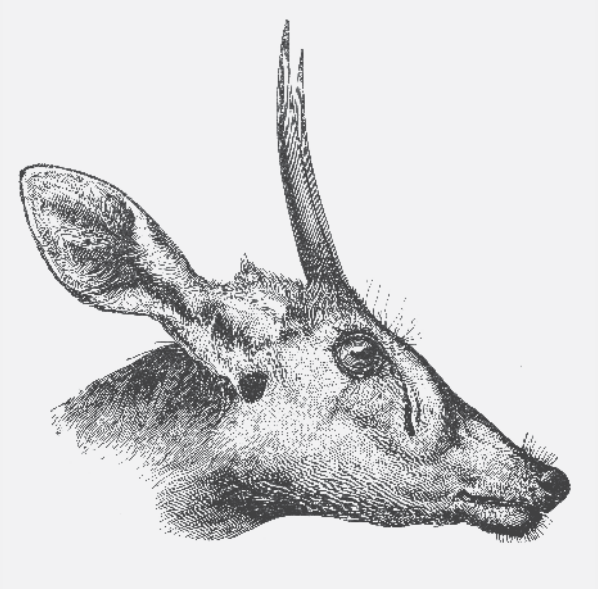
Retailers cutting Gnetum *spp. leaves*

Participatory domestication of NWFP species

*Njangsang (*Ricinodendron heudelotii*)*

Part VI
Encouraging sustainable management of NWFPs

Page



Noting the lack of attention to NWFPs in national policies, COMIFAC drew up subregional guidelines with FAO's support on the sustainable management of NWFPs of plant origin in Central Africa. This initiative aimed to help the ten COMIFAC member countries to set up a political, legal, fiscal and institutional framework that would improve food security and be based on the right to food, socio-economic development, the conservation and sustainable use of biodiversity, and sustainable management of the forests of Central Africa.

Chapter 14
Promoting sustainable management of species to conserve NWFPs

Paul Vantomme and Marie Torbay

1. Introduction

Despite their importance, NWFPs are not taken into sufficient account in the policies of Central African countries. There are persistent difficulties hampering economic development of the sector: access to resources limited to household consumption for local inhabitants, taxation systems and administrative procedures ill-suited to small and medium-sized enterprises, and the complete lack of extraction quotas (Masuch *et al.*, 2011).

2. Sustainable NWFP management at the subregional level

Subregional guidelines on the sustainable management of NWFPs of plant origin in Central Africa were drawn up by COMIFAC with the support of FAO, with a view to enabling each country in the region to equip itself with a political, legal, fiscal and institutional framework. These guidelines were intended to foster a substantial contribution from NWFPs to food security and fulfilment of the right to food, socio-economic development, conservation and sustainable use of biodiversity, and sustainable forest management.

2.1 Principles of sustainable management

Sustainable NWFP management means the absence of any negative impact on the environment in the case of exploitation of this resource (see Chapter 9). Biodiversity must be conserved, species extracted must be renewed and species in danger of extinction must be protected. However, sustainable management also has a social function: it must contribute to the alleviation of poverty and food insecurity, fulfil the right to food, facilitate the marketing of NWFPs and their participation in the local and national economy, and also support local communities in their traditional use of resources. Such management must take account of the interests of the various stakeholders in the sector and ensure their participation in decision-making (COMIFAC, 2008).

2.2 An improved legal framework for a more sustainable management: the pitfalls targeted by the subregional guidelines

Better management of NWFPs will entail the establishment of a more clearly defined legal, institutional and fiscal framework that is more appropriate for the situation on the ground. The

subregional guidelines encourage countries to focus on the following issues[27]:

- **The right of use.** This shall no longer be confined to the right to household consumption. Those living in and near forests may trade or barter NWFPs that are not in danger of extinction; such NWFPs shall be defined in advance by each country. In order to prevent possible conflicts with forest concessions, the authorities responsible shall put in place the necessary measures to reconcile the rights of each party, particularly through three-party agreements.
- **Harvesting permits and their content.** The government department responsible for NWFPs, which draws up plans in time and space, shall handle the allocation of harvesting permits. Such allocation shall be based on an assessment of the resources and be carried out in a transparent, participatory manner. In the case of endangered NWFPs, the government department shall base the allocation of permits on the results of an appropriate inventory and on quotas fixed on the basis of this inventory. The regular inventory of NWFPs shall remain a prerogative of the state. However, the state may subcontract this inventory, while retaining the duty of supervising it and checking the results. The department responsible shall ensure that harvesting permits bear the identity of the beneficiary, the dates of issue and expiry, the extraction zone, the products authorized and, in the case of endangered NWFPs, the quotas set.
- **Extraction, storage and transport.** The government department responsible shall define or boost the standards for NWFP extraction and storage, making sure particularly to prohibit any practice that could destroy species and any harvesting method causing damage to other forest species in the zone, and to promote the curbing of post-harvest losses. With regard to transport, the state shall take all necessary measures to facilitate the circulation of NWFPs legally harvested in forests, both within the country's boundaries and when they are exported. It shall promote transport conditions that are compatible with the conservation of products and the safety of persons, and shall require every transporter to hold a transport document issued in his or her name by the government service in charge of NWFPs, indicating particularly the nature, weight or quantity, origin and destination of the products transported, and the means of transport to be used.
- **Processing.** The state shall establish the necessary incentives to promote the local processing of NWFPs, particularly with regard to the importing and/or building of the equipment to be used for such processing and also with regard to the production and marketing of products with a high added value.
- **Taxation.** Apart from the right of use, the exercise of which shall not give rise to the payment of related taxes, the exploitation of NWFPs for commercial purposes shall be subject to the payment of forest taxes. This taxation shall take account of the vulnerability status of each species, its economic importance and the need to promote little-used species.
- **Offences and penalties.** Each state shall establish or strengthen its system of disciplinary measures regarding the use and management of NWFPs, paying special attention to endangered species. Depending on circumstances, the penalty may be criminal, civil, administrative, financial and/or disciplinary. It must be proportional to the seriousness of the offence and sufficiently severe to deter those tempted to flout the rules of sustainable NWFP management, despite the profits anticipated from illegal activities.

[27] For further information, see COMIFAC, FAO and GTZ (2008), Directives sous-régionales relatives à la gestion durable des produits forestiers non ligneux d'origine végétale en Afrique centrale. Available on line at http://www.fao.org/3/a-ak414f.pdf. (So far only in French.)

- **Monitoring and control of activities in the sector.** The state shall set up a monitoring and control system for activities in the sector, and shall make sure that its officers have the knowledge and means to detect violations and apply or have others apply the penalties laid down.
- **Institutional provisions.** The state shall establish specialized structures with an overview of the NWFP sector within the ministry in charge of forests. It shall be responsible for clarifying and making known the spheres of intervention of all the government services contributing to the management of NWFPs. This will prevent any overlapping of mandates and any abuse of power. It shall also set up a mechanism coordinating all the partners for sharing information, making and implemening decisions, and promoting partnerships.
- **Organization of professional structures and capacity-building for all the stakeholders in the value chain.** The state shall encourage and support the organization of professional structures for NWFP value chains and shall promote information-sharing and partnerships among professionals at the subregional, African and global levels. The ministry responsible for forests shall boost the capacities of its staff responsible for NWFPs and all the other stakeholders involved through the organization of information, awareness-raising and training campaigns. Such capacity-building shall focus particularly on the knowledge and practical application of laws, rules and regulations, and on inventory, extraction, conservation and processing techniques for NWFPs.
- **Statistics.** The government department responsible shall organize ongoing, regular collection of, use and dissemination of statistical data needed for sustainable management of NWFPs.

3. Community forest management: a solution for sustainable resource management?

3.1 What is a community forest?

The term "community forest management" refers to management methods that are able to provide environmental sustainability while allowing local communities to profit from the benefits they can draw from the resources. These management methods can be adapted according to the socio-environmental features of the places where they are being implemented. There are two guiding principles in community forest management: the first is the elimination of direct and indirect causes of forest degradation, while the second is the return of forest management to the communities living there, on the premise that these communities are the main parties interested in conserving forest resources.[28] According to a definition drawn up by FAO in 1978, community forestry should encompass three main elements: the supply of fuel and other materials indispensable to meeting the basic needs of families and rural communities; the supply of food and the environmental stability necessary for ongoing food crop production; and, lastly, the creation of income and jobs in the rural community. The participation of communities in decision-making concerning forest management has thus been seen as important for a long time. In practice, however, there is still a way to go before communities are fully incorporated into the forest management process.

[28] Mouvement mondial pour les forêts tropicales (World Rainforest Movement), 2004.

Box 1
FAO conceptual framework regarding forest management

FAO has been involved in the NWFP sector for more than ten years and proposes a conceptual framework that reflects the guiding principles of its actions in the sector. These actions have the following objectives: to improve food security, to alleviate poverty and to contribute to sustainable forest management. The proposed framework is based on three fundamental principles: (1) respect for human rights; (2) the right to adequate food, corresponding to states' legal obligations; and (3) sustainable forest management. A number of practical tools are proposed that can help steer initiatives in Central Africa to develop NWFP value chains, revise legal and regulatory frameworks, and formulate national strategies for the sector:

- The toolbox on NWFPs, food security and the right to adequate food, which provides guidelines encouraging a multistakeholder, multisectoral approach. In a practical manner, technical aspects of food security are complemented by legal aspects concerning human rights. Every individual is recognized as the holder of rights and not simply as a beneficiary.
- The concept of sustainable forest management, which encompasses the economic, environmental and sociocultural aspects of the use of forest resources. The development or decline of sustainable forest management in a country can be defined, evaluated and monitored on the basis of a certain number of principles, criteria and indicators (PCIs). Sustainable management of NWFPs is only partially reflected in the PCIs taken into account, which means that additional measures and the definition of other PCIs are needed. The latter should reflect the specific nature of the use of NWFPs by local communities and small-scale enterprises, and be based on customary law and the application of laws and regulations governing the harvesting, processing and marketing of NWFPs.
- The subregional guidelines on sustainable management of NWFPs of plant origin in Central Africa, which were adopted by COMIFAC in 2008. These guidelines are intended to improve and coordinate the political, legal, fiscal and institutional frameworks of COMIFAC member countries by proposing common bases and a more specific inclusion of NWFPs within these frameworks.

Source: The elements cited above are presented in greater detail in FAO Information Note 6, available on the FAO website at http://www.fao.org/docrep/015/an231e/an231e00.pdf

3.2 Community forests in law and in practice: the examples of Gabon and Cameroon

In Gabon, a 2001 law recognizes communities' right to use forest resources for their needs. This law states that a community forest is part of the rural forest belonging to the community, in which the latter may carry on its activities and undertake a dynamic process of sustainable natural resource management through the use of simple management plans. The government hopes to encourage the development of forest communities through this law. However, no community forest has yet been legalized.

Also in Gabon, the Development of Community Alternatives to Illegal Logging (DACEFI) Project, launched in 2006, has helped communities to make progress toward the legalization of their community forests and also highlighted the difficulties entailed. Administrative procedures are sometimes too complicated. The establishment of sustainable management plans requires human and financial resources and skills that small communities do not necessarily possess. Moreover, competition with logging concessions, which cover more than half of Gabon's forests or about 12 million hectares, still hampers the creation of community forests. The zones granted to these concessions sometimes overlap with those dedicated to community forests, so that conflicts of interest break out, often to the disadvantage of the communities (Meunier *et al*., 2011).

Box 2
Example of the Korup Forest in Cameroon, 1998

Sustainable forest management depends closely on an in-depth understanding of the role of forest products in the local population's livelihoods. The study carried out in the Korup Forest in Cameroon in the 1990s showed that communities are divided into many socially and economically distinct groups with concurrent and often conflicting lifestyles. For example, there was a conflict of interests on issues concerning land and forest resources between young people and elites (the most eminent members of rural communities at the regional level), which include government officials, business people and political and religious figures. Many young people criticized influential village members for selling land to "outsiders" (non-villagers) and granting logging permits according to their own personal interest rather than the general interest. It was very hard to reconcile the interests of the various parties and find a method of forest management and development involving all the parties. This problem could be solved in two stages: first by strengthening the existing local institutions that contribute or can contribute significantly to forest management and development; and then through a greater participation of certain groups of forest users whose interests had scarcely been taken into account until then. In order to ensure sustainable management of forest resources, it is crucial to involve the inhabitants of the Korup Forest more fully in decision-making. Without their involvement, projects have little chance of achieving their objectives.

Source: Malleson, 1999

In Cameroon, according to information available on the Information Network for Sustainable Development in Central Africa (RIDDAC) website, community forests are among the mechanisms envisaged in the 1994 forest law to facilitate not only the participation of local communities in sustainable and equitable management of natural resources, but also their access to the social and economic benefits of these resources. This law and its 1995 implementation decree define a community forest as part of the non-permanent forest estate, in other words forest land that may be allocated to uses other than forest, measuring up to 5 000 hectares and being the object of a management agreement between a village community and the Forestry Service.[29] However, RIDDAC does recognize obstacles encountered in establishing these community forests. By 2003, ten years after promulgation of the law, only 76 applications had been approved out of

[32] http://www.riddac.org/content/view/240/108/

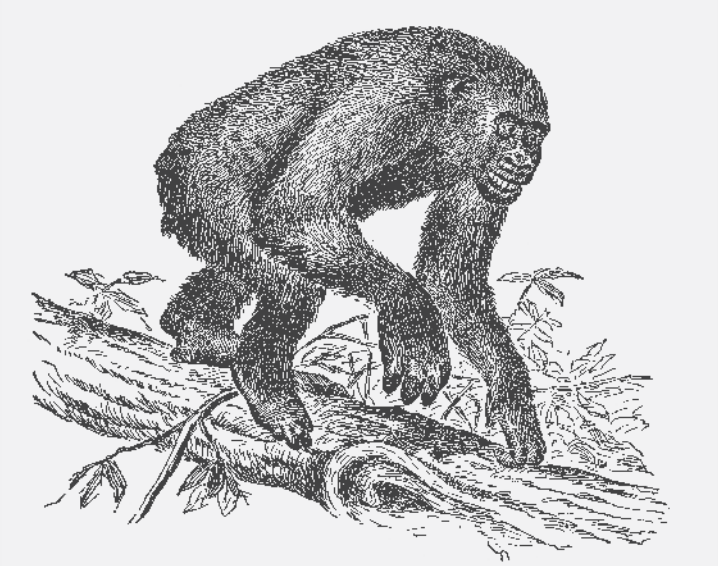
326 applications for the allocation of community forests. Today there are about 167 community forests, again according to RIDDAC. The red tape involved in allocation procedures, in both technical and administrative terms, is pointed to as the cause. On the prompting of NGOs, the procedural manual is being revised.

4. Other methods of managing the resource: certification and domestication

The certification and domestication of NWFPs can promote a more sustainable management of these products. These two methods are examined in the following chapter and also in Chapter 18.

5. Conclusion

With support from FAO, COMIFAC drew up subregional guidelines for the sustainable management of NWFPs of plant origin in Central Africa. The legal framework promoted by these guidelines covers: the right of use; harvesting permits and their content; processing; extraction, storage and transport; taxation; offences and penalties; supervision and monitoring of activities in the sector; institutional provisions; professional structures; capacity-building for these structures; and statistics. Apart from such regulations, community management, certification and domestication represent options for enabling sustainable forest management.



Sustainable management of NWFPs makes it possible to improve rural people's livelihoods and guarantee the availability of resources for future generations. Participatory domestication of NWFPs makes it possible to ensure sustainable harvesting of NWFP-bearing resources in their natural environment and to encourage their incorporation into agricultural zones. All these things guarantee an ongoing, regular and efficient production of NWFPs. Ultimately, participatory domestication is an approach that contributes to the establishment of social balance and the conservation of genetic resources.

Chapter 15
Contribution of participatory domestication to NWFP cultivation: the case of farmers' groups in Cameroon's humid forest and savannah zones

Alain Tsobeng, Zacharie Tchoundjeu, Ann Degrande, Ebenezar Asaah, Bertin Takoutsing and Thaddée Sado, International Center for Research in Agroforestry (ICRAF)

1. Introduction

The Congo Basin contains the world's second-largest closed tropical rainforest after Amazonia, accounting for 12 percent of all tropical forest cover (CARPE, 2001). Added to this vast extension is an exceptional biological diversity (Tchatat and Ndoye, 2006), with 31 recorded bird species, 35 mammal species and 3 000 plant species. The region therefore has many advantages for the development of agriculture, despite the persistence of pockets of poverty.

In this huge geographical complex, NWFPs constitute a sector whose importance no longer needs demonstration. The emergence some years ago of markets for certain products generated increased enthusiasm for these resources, giving a major boost to the rural economy (Ndoye *et al.*, 1997; Tchoundjeu *et al.*, 2006). Under the pressure of demand, NWFP gatherers have sought to maximize their profits by using extraction methods that are generally deemed to be unsustainable (Tchoundjeu *et al.*, 2008a).

In this context, the participatory domestication tested by ICRAF in Cameroon represents a possible way of protecting resources. How does it work? What is the difference between this method and the traditional extraction method? How is it to be applied in practice, for example in the exploitation of *Gnetum africanum*? How can a maximum number of producers be involved?

2. Traditional method of harvesting NWFPs

In recent years, population growth in most countries in the Congo Basin has led to considerable pressure on natural resources and the environment (see Chapter 1). Natural resources are steadily eroded with increasing human activity in the form of urbanization, industrialization, agriculture and logging (Tchoundjeu *et al.*, 1998; FAO *et al.*, 2004). Destructive, excessive harvesting methods are further factors in degradation (Clark and Tchamou, 1998), as happens with the harvesting of such woody species as Gnetum africanum, where the lianas are systematically ripped off by gatherers in order to gather the leaves. There is a similar problem with medicinal species (*Prunus africana*, *Garcinia lucida*, *Annickia chlorantha* and *Pausinystalia yohimbe*), as gatherers strip the bark off the whole circumference of a tree, thereby preventing the circulation of sap and killing the tree. Less often, certain fruit trees are chopped down in order to pick their

fruit. In Cameroon's Lékié and Nyong-et-So'o Departments, it is not unusual for people to cut large branches off *Dacryodes macrophylla* trees to pick their fruit, rather than waiting for it to fall to the ground (Tanly, 2011). It has thus become imperative to conserve diversity in order to ensure long-term food, health and economic security (Chadha *et al.*, 2000).

It is important to preserve the inter- and intra-specific diversity of NWFP trees in order to increase production and ensure market supplies. The quantity and quality of NWFPs gathered in their natural state do not always meet market expectations. In the case of the single species of Dacryodes edulis, for example, consumers prefer fruit with thick, sweet pulp, whereas processing enterprises require fruit with thin pulp for drying and thick pulp for extracting oil. A study undertaken by Kengue in 2002 noted a variety of *Dacryodes edulis* known as "off-season" whose fruit costs more than three times as much as that from the normal production period.

The judicious exploitation of NWFPs has become a strategy for conserving natural resources while at the same time allowing an improvement in the local population's standard of living (Guedje, 2002). Domestication ensures ongoing, regular, efficient production of NWFPs outside forests, so that it is recognized today as a means of reducing pressure on natural forest resources (Leakey, 2004; Schreckenberg *et al.*, 2006).

3. Participatory domestication of NWFP species

3.1 What is participatory domestication?

Participatory domestication consists of taking wild species and introducing them into controlled conditions (Simons and Leakey, 2004). According to Leakey *et al.* (2005), domesticating a species means improving it so that it corresponds more closely to people's wishes and market expectations.

Conventional domestication is distinguished from participatory domestication as tested by ICRAF (Akinnifesi *et al.*, 2008). The distinguishing feature of the latter is that it involves all social players. Its objective is to help farmers acquire a sustainable approach to the use of tropical forests (Tchoundjeu *et al.*, 2006) and it takes into consideration the needs of small-scale producers, their resources and their production systems (Leakey and Tchoundjeu, 2001).

3.2 What are the stages?

- Identification of priority species and selection of the best varieties
- Collection and conservation of germplasm
- Development of vegetative multiplication techniques
- Incorporation of trees into agroforestry systems

3.2.1 Identification of priority species and selection of the best varieties

This first stage in the domestication process requires the participation of rural households in order to identify farmers' preferences and market requirements. The forests of the Congo Basin brim with about 3 000 different plant species. Each species is then divided into a considerable number of varieties, which do not all enjoy the same market popularity because of their different morphological properties (taste, yield, fruiting season, nutritional value, etc.) (Franzel *et al.*,

1996). Producers carry out the initial identification of trees that meet the criteria required by the market, after which the morphological and genetic qualities defined by researchers come into play. A number of authors have described the methods used for the morphological characterization of *Dacryodes edulis*, *Irvingia gabonensis* and *Ricinodendron heudelotii* (Waruhiu *et al.*, 2004; Atangana *et al.*, 2001; Ngo-Mpeck *et al.*, 2003), while those used for genetic characterization of *Allanblackia floribunda* have been described by Russel *et al.* (2009) and Atangana (2010).

3.2.2 Collection and conservation of germplasm

The aim of collecting germplasm is to obtain a sample that is as representative as possible from the genetic point of view (Dawson and Were, 1997). Germplasm can be a seed, a cutting, layering material or a graft that can be used to regenerate the tree. ICRAF uses two types of collection depending on the specific objective: random collection and targeted collection. Random collection consists of going out into the field and collecting germplasm from targeted species, selecting the subjects randomly, while respecting the strategy described by Dawson and Were (1997). Targeted collection is carried out on subjects selected at the start on the basis of properties desired by the applicant. In the latter case, the collection of seeds is justified by the hope that the heritability of the mother-tree will be great enough to allow a full transfer or at least the transfer of most of the properties sought.

The germplasm collected is used to create sustainably managed seed banks, in which the material needed for the production of plants of genetically appreciable quality will be regularly collected. In this bank, which may be a gene bank or a clone bank, successive crosses can lead to the development of new varieties (Makueti *et al.*, 2012a; 2012b).

3.2.3 Development of vegetative multiplication techniques

According to Hartmann *et al.* (1990), vegetative multiplication is a reproduction method that uses a vegetative part of the plant to produce a new individual similar to the original individual without any sexual intervention. This method is increasingly promoted today. It offers the possibility of exploiting the genetic variability of forest species and improving tree populations through the selection, testing and exact multiplication of individuals with desirable genetic qualities (Leakey and Simons, 2000). Vegetative propagation techniques are used for this, such as grafting, layering, cuttings and tissue culture.

3.2.4 Incorporation of trees into agroforestry systems

The plants resulting from the previous stage must be incorporated into production systems with a view to their optimal exploitation. Such incorporation must meet the farmers' needs and match their capacities, while reducing management costs. It must allow optimal use of vertical and horizontal space. Various agroforest models may be adopted, such as multistorey systems created through the combination of species and varieties on different levels and with fruit production staggered throughout the year.

Table 1
State of domestication of priority species

Main type of NWFP	Species		Characterization carried out (if yes, reference)	Propagation techniques already developed (ref. ICRAF)
	Scientific name	Local or common name		
Fruit Medicine	*Irvingia gabonensis*	Andok, bush mango	Phenotypic (tree, fruit, kernels) (Atangana et al., 2001)	Seed, grafting, cuttings and layering
	Dacryodes edulis	Safou	Phenotypic (tree and fruit (Waruhiu et al., 2004)	Seed, cuttings and layering
	Garcinia kola	Onie, bitter kola	Not known	Seed, grafting and cuttings
	Dacryodes macrophylla	Atom	Phenotypic (tree and fruit) (Tanly, 2011)	Seed and layering
	Trichoscypha accuminata	Amvut	Not known	Seed
	Coula edulis	African walnut	Not known	Seed and grafting
	Prunus africana	African cherry, pygium	Not known	Seed and cuttings
	Annickia chloranta	Yellow moambe	Not known	Cuttings
	Pausinystalia johimbe	Yohimbe	Not known	Cuttings
	Garcinia lucida	Essok	Not known	Seed, grafting and cuttings
	Cola spp.	Kola	Not known	Seed, grafting, cuttings and layering
Oil	*Allanblackia floribunda*	Nsangomo	Phenotypic and genetic (Atangana, 2010)	Seed, grafting, cuttings and layering
	Allanblackia gabonensis	Nsangomo	Genetic (Russel et al., 2009)	-
	Baillonnella toxisperma	Moabi	Not known	Seed and cuttings
	Pentaclethra macrophylla	Ebaye	Phenotypic (Tsobeng et al., 2012)	Seed and cuttings
Spice	*Ricinodendron heudelotii*	Njangsang	Not known	Seed, grafting, cuttings and layering
	Piper guinneensis	Bush pepper	Not known	Cuttings
	Monodora myristica	Calabash nutmeg	Not known	Cuttings and grafting
	Afrostyrax lepidophyllus	Bush garlic	Not known	Cuttings and grafting
Vegetable	*Gnetum africanum*	Eru, okok	Phenotypic (IRAD/ICRAF, unpublished data)	Bouturage
Resin	*Acacia senegal*	Gum arabic	Not known	Cuttings

Note: several parts are used for certain species.
Source: Ingram, 2014

3.3 History of participatory domestication

The initial steps in participatory domestication were taken in 1997 under ICRAF's West and Central Africa Regional Programme. The priority species for local inhabitants were identified as follows:

- species already listed by Franzel *et al.* (1996) as priority species for West and Central Africa; in order of importance: *Irvingia gabonensis* (bush mango), *Dacryodes edulis* (safou), *Garcinia cola* (bitter kola), *Chrysophyllum albidum* (star apple, cherry) and *Ricinodendron heudelotii* (njangsang);
- other species that have proved as important in some zones: leafy vegetables (*Gnetum africanum*), medicinal species (*Prunus africana*, *Annickia chlorantha*, *Pausinystalia yohimbe* and *Garcinia lucida*), fruit-bearing species (*Cola* spp., *Allanblackia* spp., *Baillonnella toxisperma*, *Dacryodes macrophylla*, *Pentaclethra macrophylla*, *Coula edulis* and *Trichoscypha accuminata*), spices (*Piper guinneensis*, *Monodora myristica* and *Afrostyrax lepidophyllus*) and resins (*Acacia senegal*).

Morphological and genetic characterization of some of these species has been carried out and multiplication techniques are currently being developed (Table 1).

Some of these species have been used to develop a range of ways of incorporating them. Some cocoa plantations in the Mefou-et-Afamba Department have been characterized in a participatory manner. Their structure (specific diversity, distribution in terms of height and diameter categories etc.) has been studied, together with the importance or necessity of retaining some particular species. At the end of the study, the less useful species were replaced with those judged more important by the agroforestry operators, while anticipating the various possible types of aerial competition (Mbile *et al.*, 2009). A diagram of the structure of a balanced cocoa plantation is given in Figure 1.

Figure 1
Recommended structure for an agroforest

Source: Mbile *et al.*, 2009

On the other hand, studies of root distribution (density of thick roots and length of fine roots) have been initiated on Dacryodes edulis in order to identify associations offering the fewest risks of underground competition (in terms of space occupied by roots and of nutrients) (Asaah, 2012).

Comparative studies of plants produced from different types of propagule (generative and vegetative) have been carried out. Such aspects as yield and time of fruiting were among the aspects studied. The results were in line with the literature (Hartmann *et al.*, 1990; Kengue, 2002): a good performance by plants produced from vegetative material with regard to the gain in the

genitor's characteristics and early fruiting. These results were obtained for *Dacryodes edulis*, *Ricinodendron heudelotii* (layering, produced on average three years after planting, against an average of five years for seeds) and *Allanblackia floribunda* (for which it was observed that grafted plants bore fruit at the end of three or four years, whereas those grown from seed had still not borne fruit after seven years). With regard to carbon sequestration capacity, Asaah (2012) has demonstrated that on ten-year-old plantations plants produced vegetatively are apparently stronger with a greater store of carbon than plants grown from seed (26.74 Mg C ha^{-1}, 21.74 Mg C ha^{-1} and 13.10 Mg C ha^{-1} respectively for plants grown from layering, cuttings and seed).

After this characterization, the question arose of the cost-effectiveness of permanent cropping systems enriched with domesticated trees. A study was carried out by Jaza Folefack *et al.* (2015) to determine the financial profitability of cocoa agroforests enriched with domesticated trees. Eight scenarios, representing different theoretical combinations of cocoa (*Theobroma cacao*) and three improved species (*Dacryodes edulis* [safou], *Ricinodendron heudelotii* [njangsang] and *Irvingia gabonensis* [bush mango]), were assessed in terms of current net value and internal rate of return. Optimization and sensitivity analyses were also carried out. The results showed that most cocoa-based agroforests in the zone will be uneconomic unless other tree species are combined with them. Moreover, the system combining cocoa, safou, njangsang and bush mango seems the most promising combination.

4. Domestication of NWFP species: the case of *Gnetum spp.*

4.1 Context

Gnetum africanum (Welw) and *Gnetum buccholzianum*, known as eru or okok, are important commercial staples in Central Africa. Gathering the leaves of these plants and selling them in local and regional markets generates considerable income (Shiembo, 1998). The volume of these species exported has been rising steadily. Between 1997 and 1999, the quantities exported from Cameroon to Nigeria and Europe rose from 203 tonnes to 365 tonnes (Tabuna, 1999a). In 2000, approximately 3 600 tonnes were exported from Cameroon to Nigeria, Gabon, the Congo, some European countries and the United States of America (Nkefor, 2000; Asaha *et al.*, 2000). The quantities of *Gnetum* spp. exported annually to Nigeria generate profits of between CFAF 1.1 billion and CFAF 1.5 billion (Besong *et al.*, 2001). According to Ingram *et al.* (2012a), more than 11 000 people are involved in this lucrative trade in Cameroon and Nigeria. A study by Kanmegne *et al.* (2007) showed that the monthly income of households of *Gnetum africanum* leaf gatherers in the Lékié area is between CFAF 13 500 and CFAF 27 000, or about 81 percent of total household income. The same study showed that gathering and marketing involve a total of 87 percent of gatherers and 93 percent of traders in the markets of the main towns in Lékié Department.

In response to the high demand from markets and households, *Gnetum* spp. gathering has spread to the most remote regions, so that in coastal forests, such as those in southwestern Cameroon, this once abundant resource has become rare and gatherers now have to travel long distances to gather marketable quantities (Peters, 1999). The uncontrolled harvesting of *Gnetum* spp. (uprooting and intensive gathering of lianas) and its steady disappearance from natural forests mean that it is now severely endangered (Ndam *et al.*, 2001). To preserve it,

ICRAF, the Agricultural Research Institute for Development (IRAD) and the Limbé Botanical Gardens have set themselves several objectives:

- to characterize *Gnetum* spp. populations;
- to collect and conserve germplasm;
- to develop strategies for the large-scale production of *Gnetum africanum* seedlings;
- to develop various incorporation alternatives.

4.2 Characterization of *Gnetum africanum* populations, and collection and conservation of germplasm

Apart from the populations of *Gnetum buccholzianum* from the southwest already planted in the Limbé Botanical Gardens, four populations of *Gnetum africanum* in the central region – in Lékié-Assi, Boumnyebel, Mbalmayo and Mfou – have been identified and morphologically characterized. A range of parameters was defined jointly by researchers and gatherers/producers. Table 2 shows that for the leaf dimension criterion, specimens from Boumnyebel and Lékié-Assi would appear to be the most productive. Gene banks of each of these populations and clonal logyards are being set up on the ICRAF research station at Mbalmayo, subject to determination of genetic variability.

Table 2
***Gnetum africanum* characterization data**

Population	Boumnyebel	Lékié-Assi	Mbalmayo	Mfou	General average
Length of lianas (cm)	164.25	171.05	161.71	160.70	164.43
Number of nodes per liana	14.99	15.83	14.83	15.61	15.31
Number of branches per liana	12.07	14.28	18.15	13.19	14.42
Number of inter-nodes per liana	13.99	14.83	13.83	14.61	14.31
Number of leaves per liana	34.36	42.07	63.20	36.65	44.07
Length of leaves (cm)	9.14	8.31	7.73	8.64	8.45
Width of leaves (cm)	3.83	3.39	3.00	3.30	3.38
Length of inter-nodes (cm)	11.11	10.95	10.81	10.39	10.82

Source: IRAD-ICRAF, unpublished data

4.3 Development of propagation techniques

Two techniques to produce *Gnetum africanum* seedlings are being developed today: the collection of wild shoots (not always sustainable) and the use of cuttings or fragments of one-leafed lianas (more advised in terms of sustainable management).

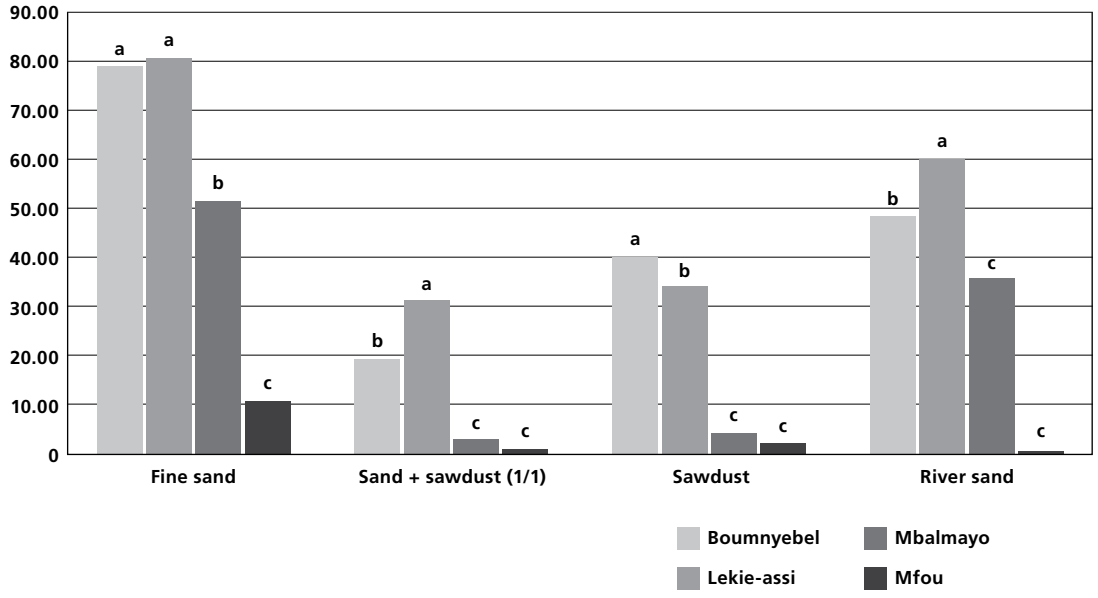
The collection of wild shoots entails going out to where the species grows naturally, pulling up seedlings 20 centimetres or more long, removing half their leaf surface and keeping them in favourable conditions until they are brought back to the nursery, where they are put into pots before being placed in frames for rehabilitation for about seven to ten days. The success rate for this method is between 80 and 90 percent (Oyono, 2006). It may not be sustainable inasmuch as collecting wild shoots reduces the stock of young plants in the original population. However, it is conservative when the plant receives better management in its new environment than in its original location and can therefore develop and grow.

The practice of propagation through cuttings consists of cutting pieces of leaved lianas and placing them in a rooting frame developed by Leakey *et al.* (1990). These cuttings develop roots after two to four weeks, becoming full, independent plants.

In the light of Table 2, a single liana can provide about 15 cuttings with widely varying rooting rates depending on the factors studied. Figure 2 illustrates the effect of the rooting environment and the origin of the cuttings on the rooting rate. It would seem that plants coming from Boumnyebel and Lékié-Assi are more likely to take root, and this is even more the case if the rooting environment is made up of fine sand. An 80 percent rooting rate can easily be achieved.

The technique of multiplication through seeds is difficult, because most of the embryos that develop after the seed falls die. This is due to the later physiological maturity of the seed as against its physical maturity. *Gnetum* seeds generally take 11 to 12 months to germinate (Maheswari and Vasil, 1961). Various seed germination trials carried out in nurseries have met with failure. Multiplication through seeds has therefore seldom been used to produce plants in nurseries (Ndam *et al.*, 2001).

Figure 2
Effect of origin (a, b, c) and rooting environment on the rooting of *Gnetum africanum* cuttings



Source: IRAD-ICRAF, unpublished data

4.4 Development of *Gnetum africanum* incorporation options

Various ways of incorporating *Gnetum africanum* are at present being assessed. The models tested tried to imitate its natural habitat, with the shade needed for the plant to develop well (30 to 40 percent light) and uprights to support the liana. In the Mfou zone in Cameroon's central region, there are fields of *Gnetum africanum* under calliandra, where *Calliandra calothyrsus* trees, planted in a 1 metre by 2 metre configuration, not only create shade and act as uprights, but also fertilize the soil. Experimental farmer fields have also been established in Lékié (5) and Awae (3) in Cameroon and in the Bas-Fleuve region of the Democratic Republic of the Congo (2),

where *Gnetum africanum* has been planted in various land-use systems (secondary forest, open field, combined with *Acacia auriculiformis*, *Calliandra calothyrsus* or *Inga edulis* trees) in order to determine its optimal growth and yield.

Another model was inspired by the trials being carried out in the Limbé Botanical Gardens. Shelving made of local materials and about 1 metre high is set up under artificial shade. Yarn is used to lead *Gnetum africanum* lianas along the cross pieces of the shelving, which facilitates their development. Using this method, producers can easily produce more than double what they could harvest in the natural environment, which has been estimated at 77 kilograms of biomass per hectare (Mbolo, 2002). However, the need for an artificial shade house hampers rural inhabitants' access to this technique.

5. Development of the participatory domestication method through relay structures and resource centres

Dissemination of participatory domestication in Cameroon started in 1998, with the establishment of experimental nurseries in pilot groups, supported by local NGOs (see Table 3). These nurseries initially acted as experimental units in which multiplication techniques for various tree species were evaluated with farmers. They quickly came to be used as locations for training other farmers in vegetative multiplication techniques. This is where the idea of "relay structures" and "agroforestry resource centres" was born. Resource centres are relay structures with more fully developed, professional and far-sighted training structures that have greater possibilities of carrying out more effective and sustainable actions (Tchoundjeu *et al.*, 2008a). The term "resource centre" refers to an agricultural extension approach that focuses on building innovation capacities all along the chain, from agricultural production to the marketing system. A resource centre has at least a nursery, demonstration fields, an administrative office and a classroom. Depending on needs and on its promoter's capacities, the centre may also have a dormitory, a reading and multimedia room, and a processing unit for agricultural and agroforestry products.

By the end of 2007, there were 16 relay organizations in Cameroon, including 8 resource centres that were active in training farmers in domestication. It is a growing movement, with 15 relay organizations, including 8 resource centres, involved in 2012 in the dissemination of participatory domestication, and more than 150 farmers' groups practising one or more aspects of domestication (Table 3).

With a view to having greater autonomy and beng more competitive on the market, these resource centres formed a national network, which received official recognition and is known as the National Association of Agroforestry and Sustainable Agriculture Resource Centres (ANACRAD).

Table 3
The various relay structures in Cameroon

Resource centre	Zone covered (department, district)	Status in 2012
Northwestern region		
MIFACIG	Boyo	Resource centre
	Mechum	
	Ngoketunjia	
RIBA	Bui	Resource centre
SIBADEV	Mezam	Relay
PROWISDEV	Momo	Resource centre
Western region		
AJP CEDES	Noun	Relay
APADER	Ndé, Haut Nkam	Resource centre
PRO-AGRO	Nkoung Khi	Resource centre
	Haut Plateau	
PIPAD	Menoua	Relay
Coastal/Southwestern region		
CIMAR	Njombe, Tombel	Resource centre
FOEPSUD	Limbé, Idenau	Relay
Central region		
GICAL	Obala, Okola	Relay
CVC	Nlong	Relay
Southern region		
FONJAK	Ngoulemakong	Resource centre
SAGED	Ma'an	Relay
Eastern region		
AAFEBEN	Southeast Cameroon	Relay

Source: IRAD-ICRAF, unpublished data

6. Future outlook

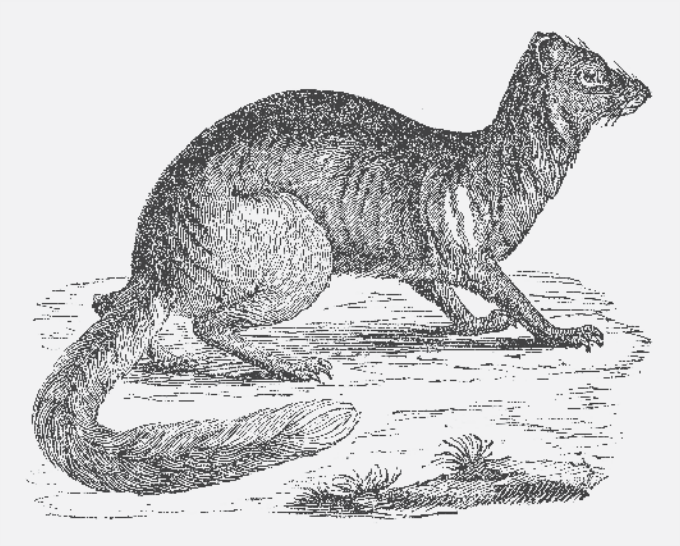
The strategy to solve problems encountered in managing natural resources coming from NWFPs should combine two complementary approaches so that it not only ensures sustainable exploitation of these resources in their natural environment (in situ), but also encourages their cultivation in agricultural zones *(ex situ)*.

The participatory domestication of NWFP species with its sustainability potential should ensure regular, effective production outside forests. By adopting an approach that goes counter to the "gathering mentality", this method seeks to reduce the extraction of resources from natural forests (Leakey, 2004; Schreckenberg *et al.*, 2006). It fosters growth and improvement in the quality of species and facilitates the harvesting of products. Given that NWFPs are not only an alternative source of income for households but are in particular a kind of "women's cocoa" or "landless young farmers' cocoa", it may be concluded that domestication contributes to the establishment of a better social balance.

However, there are a number of challenges to be met:

- NWFP gatherers are not always aware of the danger of overexploitation of species and go on harvesting them in their natural state without any concern for their sustainable management. Increased awareness-raising is needed, based on reliable data concerning stocks of the resource, its extraction rate and its regeneration capacity.
- Local inhabitants do not always know the techniques (domestication, but especially vegetative multiplication) that allow them not only to plant NWFP species in their fields, but also to improve productivity and the quality of products. They thus continue to use seed without any attempt at improvement or selection, with results that are sometimes discouraging. In order to remedy this situation, dissemination of the results of research on domestication should be stepped up and producers should be informed about the existence of nurseries with improved plants in the various regions of Central Africa.

Part VII
Developing entrepreneurship and increasing the added value of NWFPs



The trade in NWFPs is often confined to unprocessed or partially processed products, which gives them little added value and reduces the size of their market. A fund to support technological innovations in NWFP value chains and boost processors' capacities in several spheres (marketing, agricultural and food technology, quality, packaging, domestication and agroforestry) is needed in order to ensure permanent access to markets for these products, the sustainable operation of value chains and the sustainable management of species.

Chapter 16
Technological innovations in NWFP processing in Africa: constraints and future outlook

Ousseynou Ndoye and Honoré Tabuna

1. Introduction

Like other regions of sub-Saharan Africa, Central Africa is very rich in NWFPs, as previous chapters have shown. Apart from their dietary, medicinal and economic importance, these resources also reduce social tensions by increasing household income and giving people the means to obtain such staples as soap, salt, kerosene and meat, not forgetting the costs of children's schooling (Tieguhong and Ndoye, 2006). Rural people sell small quantities of one or several NWFPs and the income this brings in is significant because of the high number of products placed on the market.

Henkemans, cited by van Dijk (1999), estimated that in Cameroon someone selling andok (*Irvingia* spp.) can earn a daily income of CFAF 750 (US$1.5). The market value of njangsang (*Ricinodendron heudelotii*) sold by producers in the New Bell market in Douala was estimated at US$248 700 in 1998 and US$464 235 in 1999 (Ngono and Ndoye, 2004). The annual value of the national safou (*Dacryodes edulis*) market is estimated at more than US$7 million, and exports to African communities in Europe and the United States at more than US$2.2 million (Awono *et al.*, 2002a). In 2000, the market value of andok (*Irvingia* spp.) sold by rural people in ten markets in Cameroon's rainforest region reached more than US$825 714.

In the Democratic Republic of the Congo's Équateur Province, charcoal, palm wine and *Gnetum* spp. are the NWFPs that offer the greatest profit margins to traders and small enterprises, with a monthly average of US$216, US$166 and US$131 respectively (Ndoye *et al.*, 2007). These incomes are higher than the average salary of a secondary school teacher (US$50 to US$70) (Ndoye *et al.*, 2007). Small-scale entrepreneurs in Bandundu Province, who export *Gnetum* spp. to Kinshasa, have an average monthly income of US$270, which is comparable to a doctor's salary (US$190 to US$250) (Ndoye *et al.*, 2007).

The regional and international trade in NWFPs is critical for Central Africa (Tabuna, 2007a; 2007b). For example, in 1997 the value of Cameroonian exports of andok (Irvingia spp.) to the Central African Republic, Equatorial Guinea, Gabon and Nigeria was estimated at US$260 000 (Ngono and Ndoye, 2004). The cross-border andok trade between Cameroon and Gabon through the Abang Minko border market grew by 320 percent between 1999 and 2000, and its rise is continuing, encouraged by the building of a bridge over the Ntem river and the current excellent condition of the Yaoundé-Libreville road.

Despite their socio-economic importance, NWFPs are not yet sufficiently enhanced and optimized, mostly because of the limited know-how of the small enterprises involved in the value chains and the lack of access to market information and to modern technologies that would make it possible to meet consumers' needs, not forgetting an inappropriate legal, regulatory and institutional framework and poor access to investment capital. As Tabuna (2007b) shows, the result is a very small presence of NWFP-based processed products in the various marketing channels. However, this lack is being corrected with the appearance in recent years of new processed products such as dried safou, safou oil, njangsang oil and body cream based on andok kernels (Tabuna and Kayitavu, 2008). These products, which offer greater added value than raw products, have been developed thanks to a number of technological innovations developed by stakeholders in the value chains. There are now many examples of such initiatives. One such is the invention of a machine to extract njangsang seeds, developed under the Farmer Enterprise Development Project implemented by ICRAF (see Chapter 19) and its partners (CIFOR, CARPE, the Support Service for Local Development Initiatives [SAILD] and IRAD). By reducing the laborious effort needed for manual extraction, this instrument should help to increase the volumes placed on the market by small farmers in such producing countries as Cameroon and the Central African Republic. In the case of safou, traditional sun drying is being replaced by drying with modern driers (electric, gas, wood or hybrid).

This chapter provides an overview of the role of technological innovations in NWFP processing in Central Africa. It addresses in particular the constraints encountered in applying these innovations and the future prospects they offer. Lastly, it explores possible strategies for effective implementation.

2. Technological innovation and added value

One of the meanings of "process" given by Webster's Encyclopedic Unabridged Dictionary is: "To convert (an agricultural commodity) into marketable form by some special process." In the agricultural and food sector, processing is carried out to modify the appearance, composition and characteristics of foods with the aim of improving their conservation, appearance and transport, or to make them fit for human consumption. Various methods – cooking, freezing and drying – are employed, all of which are used in rural as well as urban areas in developing countries such as Cameroon, where electricity is widely available. In Central Africa people use traditional know-how and methods to process adjap or moabi (Baillonnelle toxisperma), for example, as studied by Schneemann (1994).

2.1 Innovations in sub-Saharan Africa

For the Organisation for Economic Co-operation and Development (OECD), the word "innovation" covers the scientific, technological, organizational, financial and commercial steps intended to result in new products or technological new procedures. This concept has been widely discussed in several disciplines (economics, sociology, anthropology, etc.). The works of Schumpeter (1935) were a major contribution, particularly because they placed the enterprise and the entrepreneur at the very heart of the process of innovation and economic development. The author distinguished five types of innovation: product innovation (manufacture of a new product), innovation of process or technology, commercial innovation (opening of a new outlet), organizational innovation and, lastly, the conquest of a new raw material. Many writings have been devoted to this concept and to Schumpeter's ideas. The fact is that all these types of

innovation are essential for development of the local product value chain in Africa, especially the NWFP chain (Marzin, 1993; Montaigne, 1993; Treillon, 1993).

There have also been many studies of the various aspects of technological innovation. In the French-speaking world, several French researchers have taken up the question under the Altersyal Programme (Muchnik, 1993; Devautour, 1990; Treillon, 1992; Muchnik, 1993). Their studies were concerned both with traditional agricultural products and also with NWFPs such as soumbala or African mustard (a spice made from the fermented seeds of the African locust bean or *Parkia biglobosa*), for which technological innovations in Senegal have been studied by Ferré and Muchnik (1993). The authors show that two operations (husking and cleaning) in the traditional process to obtain the kernels have been mechanized. Similarly, Boffa *et al.* (1996) have described technological innovations in processing karité kernels to obtain various products, such as cooking oil, soap and body milk. Examination of all these works shows that technological innovation has had an impact on small African enterprises. For example, African locust bean or néré (*Parkia biglobosa*) production has been improved thanks to the introduction of husking machines.

2.2 History of NWFP processing in Central Africa

The tradition of food processing is not new in Central Africa. In his book *Afrique centrale précoloniale*, Obenga (1974) mentions the presence of palm oil in the Batéké kingdom. The Téké used palm oil to make cosmetic products based on tacula, a powdered NWFP. This would indicate that the palm oil came from processing units based either in the Batéké kingdom itself or in neighbouring areas, such as the Kongo or Loango kingdoms. Traditional wood and iron tools from ancient and pre-colonial periods have been updated. There is also a technical vocabulary associated with the processing of traditional foods. Further proof of the antiquity of the tradition is the fact that safou has been processed into a dried product for many years in the Kongo kingdom. Two traditional techniques were used: sun-drying and smoke-drying over hearths in rural areas. In both practices, the fruit is placed on griddles and exposed to the source of heat. In the case of sun-drying, the griddle is exposed outside to the sun's rays, while in the case of smoke-drying, it is exposed over the hearth.

3. The potential of processed NWFPs in sub-Saharan Africa

3.1 Rich traditional know-how

Sub-Saharan Africa is made up of multiethnic states that are rich in know-how concerning the processing of NWFPs. For example, the mechanization of African locust bean (*Parkia biglobosa*) processing was based on a traditional manual method. This approach to improving ancestral methods concerns a number of food products or local products, such as chikwangue in the Congo (Trèche and Muchnik, 1993).

3.2 A wide variety of processing units

Tabuna and Kayitavu (2008) distinguish three types of NWFP processing units on the basis of the equipment used: semi-artisanal processing units, artisanal processing units and semi-industrial processing units.

Semi-artisanal processing units use cooking equipment and traditional techniques to process food NWFPs. They have the advantage of being places where traditional knowledge about processing food crop products and food NWFPs is preserved. They are also places where traditional tools are preserved, such as mortars or grinding stones, but also knives, cooking pots, colanders, bowls and plastic basins. The artisans use griddles or the sun to dry their products and fires and wood to heat the food. These devices could find a place in a museum of traditional food processing in Central Africa.

Artisanal processing units use the simple cooking equipment used by semi-artisanal units, but combine traditional and modern techniques. They use both wood and gas as a source of energy, and have replaced sun-drying with a process using wooden driers, often made by the owners of the processing units themselves.

Semi-industrial processing units use industrial equipment and techniques such as stainless steel trays and grinders (equipment required in the agriculture and food industry). They use electric driers to dry food NWFPs, as well as modern laboratory equipment.

4. Technological innovations in the safou (*Dacryodes edulis*) value chain

The bush pear or safou is highly sought after in Central Africa and Nigeria and is the object of a flourishing trade between rural zones and towns, where most consumers are found. There is also a major trade between Cameroon and other Central African countries such as the Congo, Equatorial Guinea and Gabon (Tabuna, 2007b). Like many NWFPs, its market is confined to the trade in fresh fruit, which hampers the development of long-distance trade, since the fruit is highly perishable and starts to go soft from the fourth day at room temperature. Various researchers have sought solutions to this problem by conserving the fresh fruit, but without any real success so far. At the same time, other researchers have worked to manufacture new products such as safou oil, safou paste and dried safou (Avouampo, 2000). Dried safou is now made by small drying units. This conservation technique had been used in Africa for a long time with the sun as the source of heat, but the units now use modern driers (see Table 1).

Table 1
Technological innovation in safou drying

Processing units	Location	Process used	Equipment used for drying	Origin of equipment
Semi-artisanal processing units	Rural zone	Traditional, exclusively manual	Sun	Nature
Artisanal processing units	Urban and periurban zone	Hybrid	Semi-industrial drier	Manufactured from local materials
Semi-industrial processing units	Urban and periurban zone	Modern	- Electric drier - Hybrid drier (electricity and wood) - Modern wood drier	Manufactured locally from local materials

Source: Tabuna and Kayitavu, 2008

As Table 1 shows, the sun as used in the traditional safou drying process is steadily being replaced by modern driers, designed and made locally using local materials. Use of this technological innovation provides better control of the whole drying process, so that it is more even. Dried

safou produced by the Taless Dry Food semi-industrial unit and by other drying units (see Photos 1, 2 and 3) benefits from a similar improvement.

5. Importance and role of NWFP processing

Processing NWFPs extends their life, gives them added value, facilitates their direct consumption and makes their consumption safer. In Africa, women are particularly involved in these activities and are in charge of most semi-artisanal units. Processing can create new products and allows the development of new markets nationally, subregionally and internationally.

Female retailers in Cameroon selling sliced okok (*Gnetum* spp.) obtain a gross profit per bundle of between CFAF 150 and 500. In the Central African Republic, retailers of cut *Gnetum* spp. can make between US$110 and US$132 per month (the minimum salary is about US$88) (Ndoye, 2011). These two examples show that any effort to increase the added value of NWFPs will enable people to improve their income, which responds perfectly to the millennium development goals.

The production of new safou-based products has been made possible thanks to agricultural and food technology and to traditional know-how. This is the case for safou paste, dried safou, essential safou oil or cream produced from essential safou oil. Production of these items still has weak points that could be rectified through the use of agri-food technology, industrial food engineering and marketing skills. The laboratory enhancement of such products as safou oil, safou paste and dried safou needs further study. The products obtained will then need to undergo taste tests with real safou consumers, both in Cameroon and in other producing and consuming countries. Such tests should also be extended to Europeans, North Americans and other non-African immigrants in Cameroon who do not appreciate fresh safou. The results could feed into reflection on the opportunities for safou-based processed products and on their European, North American and Asian markets. The aim of the tests would be to obtain products of good technological quality with sensory appeal.

In Central Africa, marketing is still one of the major weaknesses of the SMEs involved in NWFP value chains, especially with regard to packaging and communication on sales sites. It would be useful to carry out tests on the acceptability of products with the actual purchasers of safou paste, snacks, chips and oil, and to mount a campaign to promote these products nationally, subregionally and internationally.

6. Obstacles to innovation

These are connected with the use of rudimentary technology, the lack of really appropriate technology, the low quantities produced, the lack of capital, the lack of storage facilities and the absence of sufficiently large markets.

6.1 Use of rudimentary technology

For example, it is very hard to extract the kernels from certain NWFPs such as bush mango (*Irvingia gabonensis*) and njangsang (*Ricinodendron heudelotii*). Gatherers in rural areas have only knives and machetes. Moreover, NWFPs are dried mainly by the sun. However, things are changing: in Cameroon, the Netherlands Development Organization (SNV), working with

FAO, has introduced a splitting machine for bush mango, which improves the productivity of rural women's labour and reduces accidents from the use of machetes. This machine has been replicated and distributed to people in Gabon's Estuaire and Woleu-Ntem Provinces.

6.2 Lack of appropriate technology

Treillon pointed out this lack of appropriate technology in 1992. The initiatives of various international bodies such as the Research and Technological Exchange Group (GRET) and support for appropriate technical innovations should be encouraged, while always taking care to analyse users' expectations. Initiatives such as that of ICRAF and its partners to design a machine to extract njangsang or the design of a machine to extract andok kernels should be encouraged. Development bodies should work with local technicians to involve them in the development of appropriate technologies.

6.3 Lack of storage facilities

This prevents a regular supply to markets and discourages the processing of NWFPs.

6.4 Lack of capital

This is a weakness of all microenterprises and micro, small and medium-sized enterprises. It is impossible for small processing units to invest in NWFP processing technologies.

6.5 Low quantities produced

Despite the huge potential of NWFPs in Central Africa, the main source of supply is still the natural environment, marked by irregular production and long maturing cycles. With deforestation, there come very real risks of the increasing scarcity or even disappearance of the exploited species. Other production niches for NWFPs are therefore needed in order to meet a growing demand in the future, linked, for example, to subregional integration and the development of road infrastructure connecting major towns. The development of domestication to produce improved plants of the exploited species is becoming vital (see Chapter 15). The plants obtained must then be incorporated into existing agroforestry systems, as Bikoi *et al.* (2007) have proposed. Sonwar *et al.* (2001) believe that these improved plants should be incorporated into cocoa plantations. A mode of coexistence of cocoa and certain NWFPs such as kola (*Cola acuminata*), njangsang (*Ricinodendron heudelotii*), bush mango (*Irvingia gabonensis*) and safou (*Dacryodes edulis*) could thus be encouraged.

7. Future outlook and potential for technological innovations

The promotion of NWFPs in the world in general and sub-Saharan Africa in particular arises from the recommendations of the summits on sustainable development in Rio de Janeiro in 1992 and Johannesburg in 2002. In Central Africa, the optimization and promotion of NWFPs is a concern of the leaders of the COMIFAC member states. NWFPs occupy an important place in the COMIFAC Convergence Plan, contributing to nine of the ten strategic axes of the plan and more specifically to strategic axis 5 (Sustainable use of forest resources) and strategic axis 6 (Alternative income generation and poverty alleviation activities). Implementation of actions

under these two axes requires the promotion of domestication, the development of markets and the development of small processing units. And the latter can be developed only if there is access to real technological innovations in order to manufacture quality products that meet customers' expectations and national, subregional and international standards. This will give them access to markets that can receive processed NWFPs, so that they can make a real contribution to improving the income of rural inhabitants and alleviating poverty. The development of small and medium-sized forest enterprises is the subject of the following chapter. The success of quality products based on karité and Amarula liqueur made in South Africa are examples of the positive outcomes of technological innovations. The wide range of traditional know-how and procedures used throughout sub-Saharan Africa represents a potential and a basis for technological innovations that are yet to be devised and developed.

8. Development strategies

Apart from a few success stories, NWFP processing in Central Africa is still being carried out by very small units, generally run by women and operating in the informal sector. Although they are small and not competitive, these units do have the merit of constituting important bases for technological development and optimization of the hundreds of NWFPs that are available in the region's savannah and forest zones.

8.1 Objectives

The development of technological innovations in the NWFP value chain in Central Africa has the following aims: development of small processing units; placing of quality products on the market; creation of access for processed NWFPs to national, subregional and international mass markets; creation of jobs; reduction of poverty among small-scale NWFP producers; and greater optimization of traditional know-how and processes.

8.2 Many opportunities

The development of technological innovations in NWFP value chains may today be supported by:

- the political will expressed at the national, subregional (see the COMIFAC Convergence Plan) and international (see the Rio de Janeiro and Johannesburg Summits) levels;
- the existence in all Central African countries of a wide, varied range of processing units using NWFPs;
- the existence of traditional know-how, processes and equipment for processing NWFPs;
- the existence of a considerable range of NWFPs;
- the existence of bodies involved in research on the domestication of NWFPs and their incorporation into agroforestry systems;
- the existence of technical experts with experience in designing new equipment suited to small processing units;
- the existence of solvent national, subregional and international markets, capable of accepting processed products;
- the existence of expertise in the development of NWFP value chains;
- the existence of many varied stakeholders involved in NWFP value chains.

8.3 Actions to be undertaken

Given the failures encountered to date in the processing of local foods in sub-Saharan Africa, actions to be carried out in the area of technological innovations for NWFPs must be devised and initiated by the stakeholders themselves, focusing on consumer preferences. The authors propose two closely linked types of action: preliminary actions to prepare the ground and concrete development actions.

8.3.1 Preliminary actions

1. Identify units involved in processing NWFPs and organize them into a professional association.
2. Identify technical experts specializing in manufacturing appropriate equipment for local products, including NWFPs, and organize them into a professional association.
3. Identify research centres or research firms on technological innovations in NWFP value chains.
4. Identify research centres on traditional know-how and procedures for processing NWFPs.
5. Identify available expertise in the development and marketing of NWFPs, including processed items.
6. Identify available expertise on domestication and agroforestry.
7. Carry out a technical, organizational and commercial diagnosis of all stakeholders directly or indirectly involved in the value chains.
8. Analyse the needs and expectations of all the direct or indirect stakeholders involved in the value chains.
9. Assess the financial requirements connected with developing technological innovations.
10. Create and promote a fund for technological innovations.
11. Create and promote a technical body to manage the fund for technological innovations in NWFP value chains.

8.3.2 Development actions

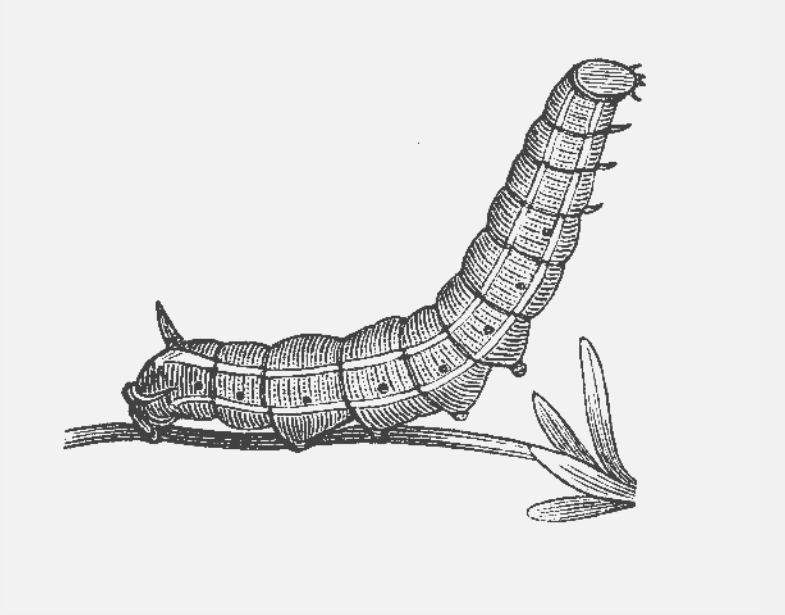
Technological innovations are tools for the development of enterprises, and the current expectations of stakeholders, including NWFP processors, are considerable. It is therefore important to make sure that they are effective and practical. It will be up to the stakeholders themselves to specify what they want. The actions to be carried out would include: market research and study; capacity-building for stakeholders in areas where they are weak; removal of obstacles to good daily functioning and the training of stakeholders; improvement in the trading environment; and improvement in storage and packaging techniques.

9. Conclusion

NWFPs play a defining role in the daily life of disadvantaged rural and urban people. Their potential and importance could increase still further if their trade were not basically confined to unprocessed products. It should be stressed that a considerable effort is already under way for NWFPs such as safou (*Dacryodes edulis*), for which drying (dried safou) and semi-industrial processing (safou oil) could help develop the market and contribute to the prosperity of the stakeholders in this very promising value chain.

In Central Africa, there are still various obstacles to the use of technological innovations. These include the use of rudimentary or inappropriate technologies that are not sufficiently based on the country's socio-economic and environmental realities, the small quantities of NWFPs produced coupled with growing demand, the lack of capital to purchase equipment and the lack of storage facilities.

Elimination of these constraints would enable NWFPs to expand their markets at national, regional and international levels. If the benefits of technological innovations are to be long-lasting, a sustained effort is needed to boost the stakeholders' capacities in marketing, agricultural and food technology, quality and packaging techniques, as also in domestication and agroforestry techniques. All these efforts will encourage the creation of greater added value and more jobs in the rural world. They will enable rural people and the African private sector to benefit more fully from the NWFP value chains in which they are involved.



It is generally accepted that NWFPs are very important for the well-being of millions of people living in Central Africa and are traded on national as well as subregional and international markets. They are also an important source of income for rural people and not inconsiderable revenue for the exporting states. However, they are often marketed solely in their natural state, unprocessed or minimally so, which gives them little added value and reduces the size of their market. Boosting the development of small and medium-sized forest enterprises (SMFEs) focusing on NWFPs is thus becoming a development imperative in Central Africa, where the Market Analysis and Development (MA&D) approach has been adopted by FAO to support sustainable NWFP management and increase the local population's income through entrepreneurship.

Chapter 17
Boosting the development of small NWFP forest enterprises in Central Africa

Aloys Nnama, Ousseynou Ndoye, Juliane Masuch and Armand Asseng Zé

1. Introduction: a general overview

This chapter is based on the authors' field experience and the testimonies of a beneficiary and an FAO expert (hence an absence of bibliographical references). NWFPs with a high commercial value are subject to increasingly intensive, systematic or even predatory gathering for commercial ends. This raises the question of the sustainable management and domestication of these resources that are now gathered in an unorganized manner. In the face of a growing demand, value chains are being organized and structured under the prompting of enterprise promoters. However, this structuring remains insufficient and these enterprises have not been placed on a sufficiently professional, formal footing. This need for a more professional approach and a better understanding of market requirements affects the whole sector, from small associations of women gatherers up to large-scale purchasers.

Despite the development of markets and value chains over recent decades, forest legislation in Central African countries still follows a classic model, with a forest and natural resource management that focuses on the extraction of timber. Forest codes refer to NWFPs as secondary products (see Chapter 4). In general, the free access of local communities is restricted to the traditional right of use, authorizing inhabitants to consume the products they gather in forests, but solely for the sake of subsistence and not for sale.

The most important NWFPs are governed by the forest administration according to a system of quotas that are allocated with no real knowledge of resources that have not been properly surveyed. Moreover, the very selective allocation of quotas and the complicated application processes lead to the exclusion of communities and most vendors, who do not understand them or are unable to comply with the required administrative formalities.

There are many challenges to be met with a view to developing innovative, viable enterprises able to contribute to alleviating poverty and boosting food security. These include the creation of a legal entrepreneurial environment that is both enabling and motivating.

2. Challenges to be met

These concern land and forest governance as it relates to the *commercial exploitation of NWFPs.* Most rural inhabitants do not own the land and forests they exploit. In such a situation, the

sustainable exploitation of NWFPs by enterprises would seem to be a risky undertaking from the outset, inasmuch as the land and forests belong to the state, which could grant or withdraw authorization as it sees fit.

2.1 Establishment or revision of land rights and of legislation on the commercial exploitation of NWFPs

The main NWFP species are becoming scarcer, which is having a negative effect on the food security of poor rural people, whose livelihoods depend on free access to forests for gathering purposes.

Land tenure problems, the lack of appropriate legislation and rural poverty are responsible for the degradation of forest resources. The clarification and regulation of land tenure rights, combined with encouragement of the participation, empowerment and non-discrimination of forest people, will help to provide sustainable solutions. Stable land tenure rules, equitable legislation and a realistic reading of subsistence rights should facilitate the legal marketing of NWFPs by rural people.

Cameroon, the Central African Republic, the Republic of the Congo, the Democratic Republic of the Congo and Gabon are incorporating the COMIFAC subregional guidelines concerning the sustainable management of NWFPs of plant origin into their national legal frameworks. This will allow an improvement in the legal and institutional framework governing the sector.

2.2 Promotion of the potential of communities dependent on forests and boosting of the capacities of government sectoral agencies

Rural communities and families can exercise significant control over forest resources and the use of NWFPs for subsistence and commercial purposes. Once a legal framework has been established, together with appropriate institutional support such as training sessions provided by government agencies and NGOs, rural communities will have a greater ability to participate effectively in forest management and the development of NWFP enterprises.

2.3 Information and knowledge sharing and growth of the potential to produce forest goods and services

NWFP management is complicated and requires technical and managerial capacities on the part of the various partners in the sector. Many activities are currently underway throughout Central Africa in the context of participatory management of natural resources. As was seen in Chapter 12, there are many sources of information and technical knowledge on managing and marketing the main NWFPs. Current initiatives seek to boost stakeholders' capacities to increase their economic benefits through better use of NWFPs from natural and planted forests.

Experience and information need to be shared with all stakeholders involved in the NWFP sector, making sure that they are accessible and comprehensible to rural people. Integrated, intersectoral approaches should be adopted with a view to combating food insecurity and malnutrition. An approach based on the right to adequate food (RAF) will contribute to intersectoral and interdepartmental cooperation and bring together the main parties concerned with food security with those concerned with governance and human rights.

2.4 Lack of equity, poor capitalization and absence of guarantees: the economic challenge

SMEs operating in the NWFP sector have to cope with recurrent difficulties regarding equity, capitalization and guarantees. The long-term solvency of an enterprise is tied to the level of its own capital, which is also a criterion used by finance institutions in assessing the leaders' degree of commitment.

It has to be recognized that small and medium-sized forest enterprises (SMFEs) working in NWFP value chains in Central Africa have a low level of capitalization, which cannot meaningfully cover their needs in terms of working capital. This means that a considerable external financial input is needed.

The governments of the region's countries must facilitate access to credit and microfinance institutions for SMFEs. Researchers and development specialists need to provide these institutions with information so that they can gain a better appreciation of the sector and its potential for alleviating poverty, boosting food security and creating jobs for women and young people.

2.5 Isolation of sites for setting up SMFEs, lack of infrastructure, cost of transport: the challenges for development

Isolation exercises a real brake on any economic and therefore sociocultural expansion. In rural areas of Central Africa, it hampers the promotion of NWFPs and the sustainable development of SMFEs.

Africa lags behind other continents in all these areas, a situation that can be attributed to the isolation of its towns and countryside. If agricultural activity, domestication and sustainable NWFP exploitation are to develop, a first step is to provide production zones with infrastructure that will allow producers to sell their products on high-potential markets.

The establishment of communication and telecommunication infrastructure is a determining factor in ensuring the sustainability of NWFP exploitation. If rural people in COMIFAC countries are to produce more and SMFEs are to develop, they must first be provided with the means of transporting their products.

A generalized opening-up process for rural zones in the COMIFAC countries would inject a dynamic spirit into the socio-economic life of all NWFP value chains and reduce transport-linked charges, which are still exorbitant for SMFEs.

3. Promotion of NWFPs through the MA&D approach

The Market Analysis and Development (MA&D) approach proposed by FAO can resolve some of the challenges described above by boosting the capacities of stakeholders involved in NWFP value chains, facilitating information sharing and increasing social cohesion among members of the same SMFE.

This approach was designed and created specifically to help households and local communities to develop a sustainable system of existence that will enable them to increase their economic resources and improve the management of local forests. MA&D enables local people to identify potential products and then market them without endangering the natural resources from which they are taken.

3.1 Principles of the MA&D approach

The goal of the MA&D approach is to help the local population create profitable enterprises while conserving forest resources. Its strong point is that it systematically takes into account not only technical, commercial and financial issues, but also the social and environmental aspects of a product. Appraisal of the sustainability of local ecosystems is thus an integral part of the identification and planning of potential enterprises. The approach also provides guidelines for choosing *flagship NWFPs* for marketing.

The MA&D approach consists of four phases, each divided into several steps. These enable field workers to support interested members of local communities and help them develop a project for an enterprise. Each step allows key information to be collected and analysed, so that carefully calculated decisions can be taken before proceeding to the next step.

First phase: analysis of the existing situation or participatory diagnosis. The idea here is to identify potential enterprises and existing resources and products, then to identify products that are already a source of income for the local population and eliminate products that are not viable. This phase also defines the financial objectives of the local stakeholders who want to create enterprises.

Second phase: selection of products, markets and means of placing products on the market. This phase comprises the selection of promising products, the identification of marketing outlets and the taking into account of the resources needed to place the products on the market.

Third phase: planning of enterprises within the framework of sustainable development. This phase entails preparation of the enterprise's strategy and development plan. The future enterprise heads formulate a development plan that encompasses all the strategies and services needed for sustainability.

Fourth phase: start-up support for the enterprise. The entrepreneurs receive training, technical assistance, coaching and, if necessary, the financing they may need in order to implement their development plan.

3.2 Beneficiaries of the MA&D approach

Beneficiaries include the *heads of enterprises* that harvest NWFPs to make a profit from them and not for their own consumption, the gatherers and, in the case of domestication, producers of raw materials, processors and traders. With the MA&D approach, they can plan and develop forest enterprises that are in line with collective interests and are financially viable, sustainable and environmentally respectful.

Use of the MA&D approach also allows *field agents, animators* and *planners* to take account of social and other factors connected with resource management in their work with the local

population. MA&D expands the range of skills, so that an in-depth market study can be carried out, thus reducing the risks of failure.

For government bodies and development organizations, the MA&D approach reduces the risks of losing time and money if insufficiently prepared enterprises are launched. It is an effective and cost-effective process that helps in the creation of viable enterprises.

3.3 Objectives of the MA&D approach

The MA&D approach supports the creation of small natural resource processing enterprises. Given its "ecological viability" orientation, it is particularly well suited for enterprises using resources that need to be protected or conserved.

The MA&D approach stresses four development objectives:

3.3.1 Sustainability

Sustainability of resources. The MA&D approach erects safeguards to prevent the development of markets and products that would result in the overexploitation of resources.

Commercial sustainability. The MA&D approach helps to assess the evolution of markets and adapt products so that they remain competitive and attractive to consumers.

Social/institutional sustainability. The MA&D approach can help identify potential conflicts of interest and encourage the equitable sharing of benefits.

Technological sustainability. The MA&D approach obtains long-term advantages for the community members who learn to use and maintain new equipment and master the processes of the production, manufacture and sale of products.

3.3.2 Participation

The community members who create their enterprises are the main decision-makers, even if initially they may need the support of a facilitator. One of the long-term goals of the MA&D approach is to see that local people are capable of developing their own enterprises and making them work without outside intervention.

3.3.3 Institutional development

The MA&D approach promotes the development of skills and the strengthening of local institutions so that they can help rural inhabitants to control their own resources and develop and manage their small enterprises.

3.3.4 Strategic partnerships

The MA&D approach calls widely on strategic partnerships with enterprises, companies or community organizations. Such partnerships can foster the development of commercial ties between small local enterprises and buyers, encourage the development of enterprises through training and capacity-building, and identify potential sources of finance. They lead to the

sharing of information, and this is essential for small farmers with limited access to information and credit.

3.4 Implementation of the MA&D approach in Central Africa

The MA&D approach was developed by FAO and has been used in Asia, Latin America and Africa for 20 years. It has been applied in Central Africa by various FAO NWFP projects, especially in Cameroon, the Central African Republic, the Republic of the Congo, the Democratic Republic of the Congo and Gabon. The following testimonies relate how these initiatives have worked in practice.

4. Testimony of a beneficiary of the MA&D approach

Mr Yaya ALHADJI is leader of the Common Initiatives Group for the Production and Promotion of Local Products from Lara to Kaélé (GIC PRO3 LOCAUX). He has been both a facilitator and a beneficiary of the MA&D approach applied by FAO in northern Cameroon as part of the FAO/SNV/CIFOR/ICRAF project financed by the European Union.

FAO: ***Tell us about GIC PRO3 LOCAUX.***
Mr Alhadji: We created the CIG in 2007 on the advice of a Cameroonian researcher working in Senegal, who led me to discover the potential of neem (*Azadirachta indica*) and karité (*Vitellaria paradoxa*). We now have 17 members in our group, 10 women and 7 men, and we have three objectives: (1) to promote neem and karité in order to combat poverty and unemployment among young people; (2) to promote the spirit of enterprise at the group level; and (3) to promote the sustainable exploitation of NWFPs as distinct from non-domesticated wild products.

FAO: ***What are the practical activities of the CIG?***
Mr Alhadji: In our CIG: (1) we buy neem, karité and other NWFPs from other groups; (2) we cultivate and produce moringa (*Moringa oleifera*) in our plantation; and (3) we process, store and deliver products derived from these natural species and tested in laboratories (tea, soap, spirulina, oil etc.) to pharmacies, supermarkets and perfumers in Garoua, Maroua, Yaoundé and Douala. We are not yet known to the wider public, but it won't be that way for long.

FAO: ***Based on the training you received in the MA&D approach, the GIC PRO3 LOCAUX has supported groups in the commercial use of NWFPs in the far north of Cameroon. How did you work?***
Mr Alhadji: The GIC PRO3 LOCAUX was chosen with other organizations and trained by FAO as a facilitating organization for the MA&D process. We began with awareness-raising activities through churches and mosques, culminating in the organization of meetings with interested people. Between 100 and 200 people took part in these meetings, the majority women. Discussions during the meetings enabled us to identify the NWFP varieties available in our zone of action, their uses and possible restrictions. Following this, we carried out feasibility studies that enabled us to identify the comparative advantages per product and per group, and to prioritize certain NWFPs over others. Three flagship NWFPs were identified in the GIC PRO3 LOCAUX intervention zone: neem oil (*Azadirachta indica*), balanites seeds and balanites leaves (*Balanites* spp.)

FAO: ***What are the common characteristics of the groups supported by the GIC PRO3 LOCAUX?***
Mr Alhadji: We have supported 13 common interest groups, mostly made up of women. Some of these groups have shown a real enthusiasm for working as a team, while others have had to face internal difficulties. Sometimes cultural barriers connected with the presence of both men and women in the same group have weakened team-work and the functioning of the group.

FAO: ***What was your work during the third phase of the MA&D approach, which has the objective of preparing enterprise development plans?***
Mr Alhadji: During this phase, we asked each group to determine its capacity to produce the selected NWFP and to define its financial objective. Based on this exercise, the groups understood the need to reduce their financial goals, and we took advantage of this to explain to them that it was not possible to meet all their needs in the short term, but that they had to move forward step by step.

FAO: ***How long did the phases of the MA&D approach last?***
Mr Alhadji: Implementation of the MA&D approach ran from 2009 to 2011, about three years, because of administrative hold-ups. After the obstacles were eliminated, support activities had to be carried out immediately and quickly. It would have been better if the people had benefited from uninterrupted support.

FAO: ***In your opinion, what are the results of applying the MA&D approach in the far north of Cameroon?***
Mr Alhadji: The groups and their members have improved their living conditions considerably, thanks to the MA&D approach, by (1) applying simple accounting techniques before and after sales; (2) "forced" savings; (3) an increase in production and in income from NWFPs; and (4) solidarity and shared experience in an association, thanks to NWFPs. Through the GIC PRO3 LOCAUX, we now know how to keep accounts and draw up forward plans. The MA&D approach has also given us greater visibility and credibility in our intervention area and even beyond. However, there are still difficulties in gaining access to credit to invest in forest products because the agricultural calendar consulted by banks does not yet include NWFPs.

FAO: ***In your opinion, are there other activities still to be carried out?***
Mr Alhadji: For me, the most urgent thing is to facilitate the creation of NWFP nurseries to boost their cultivation and the replacement of aging species. This reforestation could be undertaken by the state. I would also suggest that the government should send experts out into the field. I hope that FAO, through its projects, will make purchasing NWFPs in Chad easier, seeing that we are in a border zone with that country.

FAO: ***Your final word?***
Mr Alhadji: I thank FAO for this training. I hope the activity will continue, so that other groups can have the benefit. We plan to become a large NWFP enterprise, thanks to this support.

Comments collected by: Juliane Masuch, Armand Asseng Zé and Aloys Nnama
FAO NWFP Project, Regional Coordination

5. Testimony of Ms Sophie Grouwels, Forestry Officer for the Development of Community Forest Enterprises, Forest Policy and Resources Division, FAO, Rome

Sophie GROUWELS provided technical and operational support to a project supporting small and medium-sized forest enterprises (SMFEs) for NWFPs in Central Africa, specifically in the Northwest, North and Far North Regions of Cameroon, and in the Kinshasa, Bas-Congo and Équateur Provinces of the Democratic Republic of the Congo, from January 2007 to June 2011, financed by the European Union and implemented by FAO in partnership with the Center for International Forestry Research (CIFOR), the International Center for Research in Agroforestry (ICRAF) and the Netherlands Development Organization (SNV). Sophie Grouwels talks about the difficulties still hampering the development of NWFP enterprises and what can be done to overcome them.

FAO: ***What has your team's concrete work been for Project 408 mentioned above?***
Ms Grouwels: The regional coordination that I was supporting guided the project. In the field, interventions were carried out by national coordinators, assisted by local technical advisors. The main dialogue partners and other partners mobilized in the field were governments, project partners, farmers' groups, professional organizations and local communities. For my part, being based at FAO headquarters in Rome, I provided operational support to the project team in setting up and managing working teams, coordinating activities and seeing to administrative aspects. I provided technical assistance concerning the management of NWFP enterprises, which was an opportunity for me to make available to the project my years of experience with FAO on this subject in different parts of the world.

FAO: ***What do you think of the current situation of NWFP enterprises in Central Africa?***
Ms Grouwels: There is a huge potential to profit from the wealth of NWFPs in Central Africa. It is a sector very well suited to small rural enterprises, which are closer to these natural resources. However, there is a serious need for better organization of the sector and the SMFEs, given the fact that different varieties of NWFP have different value chains.

FAO: ***What are the main difficulties that NWFP enterprises encounter?***
Ms Grouwels: NWFP enterprises come up against various types of difficulty. These include a lack of organization, entrepreneurial skills and knowledge about markets and demands to meet; the limited number of service providers; difficulties in finding sources of finance from finance institutions (because of a lack of knowledge and trust between the financial sector and the forestry sector); the absence of an enabling political environment, entailing many extra costs in the shape of informal taxes; the absence of possibilities to share information with similar entrepreneurs in order to learn good practices from one another; and the lack of knowledge about appropriate techniques for sustainable harvesting and domestication.

FAO: ***Would you describe for us the typical way an enterprise gets going?***
Ms Grouwels: The transition from a domestic activity to an enterprise usually takes place progressively, as the necessary additional capital is not always available.

FAO: ***How is the search for outlets carried out?***
Ms Grouwels: Here I should say that there is not enough information about market requirements.

Markets are constantly evolving and information needs to be searched for and updated so that an enterprise can be steered toward reliable outlets.

FAO: ***And for finding raw materials?***
Ms Grouwels: This is a fundamental question when enterprises depend on natural resources. It is vital to consider the long-term viability of these resources as an important part of an enterprise development plan. The plan must also take into account the investment in training in sustainable exploitation, planting/replanting (nurseries) and domestication, as well as management plans for the NWFPs exploited and extraction permits.

FAO: ***What about the legal framework?***
Ms Grouwels: Most of these enterprises develop in the informal sector because there has not been a political environment favourable to regulations encouraging small-scale entrepreneurial activities. This means that the operating costs for a small enterprise following all the rules put in place are heavier than for an informal enterprise, even if informal taxes are taken into account. So there are very few incentives for a small entrepreneur to leave the informal sphere. In order to break this vicious circle, it is recommended that policy-makers should gain a good understanding of the contribution (both formal and informal) of small forest enterprises to the national economy, so that they can take proactive measures to stimulate growth and employment.

FAO: ***And difficulties concerning the organization of value chains?***
Ms Grouwels: The various stakeholders in each value chain are not properly linked together. In most cases, intermediaries such as transporters or distributors are responsible for moving products along the value chain. It is therefore important for small entrepreneurs to understand where their products will be going and who the various players in their value chain are, so that direct links can be forged to their advantage, thereby promoting the marketing of their products, improving quality for a fair price and opening up possibilities of financing.

FAO: ***How do you assess the involvement of government services in promoting initiatives to create NWFP enterprises in Central Africa?***
Ms Grouwels: As I've just said, there is a long way to go before support for NWFPs in Central Africa is taken seriously into account in public policies. The fact that Central Africa is a key subregion for timber means that NWFPs are too often considered "secondary" or simply "unimportant". However, with the research and support needed for development, it could be made clearer that several of the subregion's NWFPs can make their contribution to national economies.

FAO: ***In your opinion, how can entrepreneurship be developed in the NWFP sector?***
Ms Grouwels: The various SMFEs need to get together in producers' organizations with the aim of structuring their markets and improving the quality of their products to give them added value. The important thing is to obtain more economies of scale, which will not only improve market outlets or help solve technological/technical problems with processing, but also make it easier to respond to customers' needs for service providers. Sometimes, existing farmers' organizations could also meet the needs of some NWFPs.

FAO: ***Going back to the project, what have its results been? Do you feel its objectives have been achieved?***
Ms Grouwels: Thank you. This gives me a chance to stress that the project had the benefit of a great team made up of various technical experts who made significant contributions to the

results achieved. There were teething problems because of operational shortcomings and a lot of time was lost in consolidating the SMFEs taken on board. However, the project achieved interesting results and encouraged the practice of processing and the development of a spirit of enterprise among local partners. These major results are now contributing to the recognition of NWFPs in the Central Africa region in general, beyond Cameroon and the Democratic Republic of the Congo.

FAO: ***In implementing the project, the MA&D approach was applied for the first time in Central Africa. Can you tell us about your experience with this approach?***
Ms Grouwels: Gladly! This was perhaps the hardest part of the project, but it did enable it to obtain many meaningful results in the field. Implementing the MA&D approach purely as a tool for training communities in entrepreneurship seems too limited. If the approach had been adopted from the start as a planning tool, we could have had results better targeted on NWFPs, which would have been of great help to communities in terms of marketing and income-generation. By concentrating on their needs, specific research and action could have focused on sustainable exploitation, domestication, value chain studies, the market information system and the formulation of related policies.

FAO: ***What remains to be done?***
Ms Grouwels: Plenty! The project needed a follow-up phase of at least three years. We must continue to support pilot enterprises and the reform of NWFP use policies, and also provide more support to local producers' organizations so that they can become agents of change, capable of providing many more services to their members and bringing pressure to bear on sectoral policies.

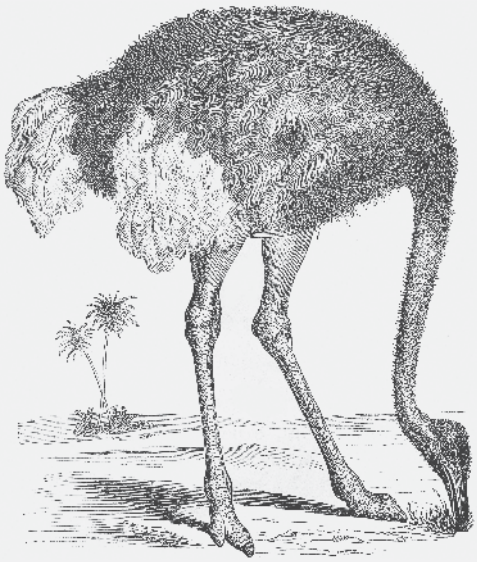
Comments collected by: Juliane Masuch, Armand Asseng Zé and Aloys Nnama
FAO NWFP Project, Regional Coordination

6. Conclusion

In order to boost the development of small NWFP forest enterprises in Central Africa, the Market Analysis and Development (MA&D) method was adopted as FAO's main intervention approach. It provides a holistic perspective on the long-term economic use of NWFP resources.

The professionalization of SMFEs also entails the creation of platforms bringing together the stakeholders involved in value chains so as to foster the sharing of information, capacity-building for all the stakeholders, the creation of greater added value, improvement in the quality of products and better access to markets and microfinance institutions.

The process of creating an enterprise requires the mobilization of financial, material, technical and managerial resources to ensure its sustainability. While creating an enterprise is a major step, keeping it running so that it achieves its objectives is an ongoing challenge. The foundation on which an enterprise must build its growth, ensure its competitiveness and achieve its long-term objectives depends upon a permanent balance between the three basic pillars – commercial, organizational and financial.



Support for developing small and medium-sized forest enterprises (SMFEs) for NWFPs in Central Africa is a real challenge, calling for use of the Market Analysis and Development (MA&D) approach, capacity-building to make SMFEs more professional, creation of stakeholder platforms, boosting of entrepreneurial capacities, creation of greater added value, improvement in product quality and improvement in access to microfinance bodies. If these measures are properly applied, they will have positive effects in terms of improving market access, quality and diversity and in facilitating the certification of food products from NWFP species.

Chapter 18
Developing the quality, diversity and certification of food products to improve market access

Paul Vantomme and Marie Torbay

1. Introduction

This chapter focuses on edible NWFPs that are subject to restrictive but necessary standards for the safety of consumers, both local and foreign. If markets for them are to be developed, it is vital to guarantee consistency in their quality, whether processed or not.

2. Toward respect for food standards?

2.1 Quality conditions

Quality may be defined as the group of characteristics of an item that confer upon it the capacity to satisfy both expressed and implicit needs.[30] In the strict sense, it is the capacity of a product (a good or a service) to satisfy the whole chain of customers, from suppliers right through to consumers. It allows a customer or user to like a product or service (Tabuna, 2007b). The harmlessness of a food is a basic constituent of its quality. It signifies the absence, or the presence at acceptable levels and without danger, of contaminants, natural toxins or any other substance that can make a product harmful to health acutely, immediately or chronically. Other criteria of quality are nutritional value and such sense properties as appearance, colour, texture, taste and functional properties (FAO, 1999b).

2.2 Quality and health safety of NWFPs

There are many natural toxins in NWFPs, for the most part poorly known. Processing techniques (handling, preparation, storage, conservation or cooking) are sometimes insufficient to ensure that a product is properly preserved and harmless. Ingesting inedible or toxic products can cause poisoning. Symptoms vary in severity, but may result in the demise of particularly weak people. Chronic toxicity may cause fatigue, digestive problems and exacerbation of the symptoms of malnutrition (F. Tonnoir, personal communication, 2012). It is therefore important for consumers that products should be guaranteed harmless. This is a fundamental condition for their being marketed internationally, especially in Europe where foodstuffs must comply with strict standards.

[30] https://www.ofcertification.fr/qualite

Box 1
The Codex Alimentarius and EFSA

The Codex Alimentarius Commission, created in 1963 by FAO and WHO, develops food standards, guidelines and coordinated international use codes aimed at protecting consumers' health and ensuring fair practices in the food trade. It also encourages the coordination of all work on food standards by governmental and non-governmental organizations.

The European Food Safety Authority (EFSA) is the cornerstone of the European Union with regard to assessing risks concerning food safety. Working closely with national authorities and consulting openly with stakeholders from various sectors, EFSA provides independent scientific opinions as well as clear information on existing and emerging risks. The international guidelines of the Codex Alimentarius Commission have also been formulated for the production, processing, labelling and trade of biological products (including some NWFPs).

For further information: http://www.efsa.europa.eu and http://www.fao.org/fao-who-codexalimentarius/codex-home/en/

2.3 Meeting health standards

Under the auspices of the Inter-African Phytosanitary Council (IAPSC), Central African countries have shown their political will to promote and respect human and plant health standards. The council was created in 1956 on FAO's recommendation and is the African Union's[31] specialized body for health issues. In association with the Central African Economic and Monetary Community (CEMAC),[32] it has contributed to setting up programmes to improve health standards as part of the Regional Programme for Food Safety in Central Africa.[33] However, while exported cash crops (coffee, cocoa, dessert bananas) are controlled, food NWFPs such as safou fruit (*Dacryodes edulis*) and *Gnetus* spp. leaves are not subject to any quality control, other than some visual checking, before being placed on the market.

Complying with the standards of European Union importing countries and with the Codex Alimentarius is still very complicated for many NWFPs. As long as the conditions of production, processing, conservation and marketing are not better coordinated, compliance with regulations and legislation will be extremely difficult.

[31] The African Union is the continent's main organization in the field of promoting accelerated socio-economic integration, with the aim of "achieving unity and solidarity between African countries and Africans", according to the site www.au.int

[32] CEMAC comprises six countries: Cameroon, the Central African Republic, Chad, the Congo, Equatorial Guinea and Gabon. Its mission, according to the site www.cemac.int, is to promote the harmonious development of the member states within the framework of the institution of a real common market.

[33] The objectives of the Regional Programme for Food Safety in Central Africa, which is being applied by the six CEMAC countries, are to feed a population in a context of rapid demographic growth and urbanization, to promote the sustainable increase in agricultural production and promote competitiveness in trade, and to reduce poverty in rural areas and contribute to combating HIV/AIDS and major incapacitating endemic diseases.

Box 2
Involvement of Central African countries in Codex committees and national and international standards

Involvement of Central African countries in Codex committees
The countries of Central Africa are currently involved in the work of the Codex for some foodstuffs that are the objects of major trade. The development of the world trade in food commodities offers consumers increasing access to a wider variety of foods. NWFPs constitute a marginal portion of the foodstuffs imported, exported and traded. Progress is not even: in Gabon, Codex work began in 2009 and the formation of a committee is more or less complete, whereas in the Central African Republic, apart from a national committee, no concrete activity is currently being carried out.

International standards that can be applied to NWFPs
EFSA assesses risks regarding food safety. International guidelines from the Codex Alimentarius Commission (i.e. FAO and WHO) have also been drawn up for the production, processing, labelling and marketing of biological products (including certain NWFPs). For the private sector, the International Federation of Organic Agriculture Movements (IFOAM) has created international standards for the production and processing of organic foods, including fibres and certain NWFPs. The Codex and IFOAM guidelines are periodically reviewed with regard to inspection and certification criteria.

National standards of importing countries
With regard to recommendations for organic agriculture, their objective is to help governments and private monitoring bodies to fix standards meeting the specific needs of the country. Most national standards (European Union countries, Japan, Argentina, India, Tunisia, the United States) are specified in legally binding regulations. There are also local standards that are not binding but that need to be considered if exporting NWFPs. In some countries (Germany, for example), private monitoring bodies may fix their own standards. Such standards are often stricter than the regulations currently in force, especially when they are responding to consumers' specific demands. At the national level, governments or national monitoring authorities authorize monitoring bodies operating in their countries, if appropriate legislation exists. In addition to their own specifications, both public and private bodies accede to the International Organization for Standardization in order to receive formal accreditation (ISO 65).

Sources:

- IFOAM site: http://www.ifoam.bio
- Codex Alimentarius site: www.codexalimentarius.org
- Increased participation in Codex activities: FAO/WHO, 2006, training documents, available online: ftp://ftp.fao.org/docrep/fao/009/y5884f/y5884f00.pdf
- Codex Alimentarius Commission, Procedural Manual, 15th edition. Joint FAO/WHO Food Standards Programme, 2005. ftp://ftp.fao.org/codex/Publications/ProcManuals/Manual_15e.pdf found on: http://www.fao.org/fao-who/codexalimentarius/procedures-strategies/procedural-manual/en/
- *Perspectives and guidelines on food legislation, with a new model food law,* Legislative study, FAO, 2005. Available online: http://www.fao.org/3/a-a0274e.pdf
- *Understanding Codex Alimentarius*, FAO/WHO, 2016
- EFSA site: http://www.efsa/europa.eu
- M. Bied Charreton, 2003. *Valorisation des produits forestiers non ligneux des zones arides et semi-arides: problématique de leur production, transformation, utilisation, conditions de marché, commercialisation.*

2.3.1 *Two international bodies dealing with food standards*

Many countries apply the standards recommended by the Codex Alimentarius and EFSA (see Box 1 above). In order to be fully legally exported and traded internationally, NWFPs must comply with these standards. Many plant NWFPs are still not covered by regulations in their country of origin, but rapid growth in their production has been accompanied by a proliferation of legislation in the various countries to protect producers from unfair competition and consumers from bacteriological risks. The desire to gain access to large export markets seems to be an incentive for the adoption of a new legislative framework. Some NWFPs, such as honey or karité butter have been the subject of a number of codes, standards and references used as bases for national or transnational standards (F. Tonnoir, personal communication, 2012).

2.3.2 *The case of bushmeat*

The whole health issue with bushmeat (for local consumption or export) is too complex to be covered by the legislative framework. At present there are no specific health standards for these food items that are very fragile from a bacteriological point of view. The origin of the meat is too varied and uncertain to meet the requirements of European standards concerning meat exports (F. Tonnoir, personal communication, 2012). There is a significant market for this type of highly valued food, especially among members of the African diaspora,[34] but it is as yet informal.

3. Possible outlets for a diversification of byproducts

NWFPs are most often exported internationally in their raw or unprocessed state. The added value of a product comes in large part from processing and from diversification in its derived products. Today this added value mostly benefits the industrialized countries that process certain barks whose components are used in the pharmaceutical industry. For Central African countries, it would be more advantageous to carry out the processing and diversification of products on their own territory. The topic of processing NWFPs is discussed extensively in Chapter 16, so this section will treat only diversification as offering commercial outlets.

3.1 Immigrants in Central Africa

The subregion hosts significant communities from other parts of the continent, especially West Africa. It also has immigrants from North Africa, Europe, Lebanon, India and, increasingly, China. These communities represent a miniature market in the host countries on which tests can be made of products intended for export to their home countries, while they allow identification of the potential of others than can lead to food and agricultural innovation. Immigration is thus a blessing for marketing and for enterprises seeking export niches and opportunities.

Properly exploited, this social phenomenon is a source of useful ideas for the diversification of enterprises, which can take advantage of the presence of foreigners to identify traditional foods

[34] According to the definition of the African Union Commission, "The African Diaspora consists of peoples of African origin living outside the continent, irrespective of their citizenship and nationality and who are willing to contribute to the development of the continent and building of the African Union."

that might interest them. However, the lack of information on migration within the region makes it hard to analyse and establish marketing strategies (Tabuna, 2007b).

3.2 The diaspora

Like other regions in the continent, Central Africa sends a sizeable diaspora to other regions of Africa and to the world (see Chapter 8). This group of people is also of great interest in terms of marketing. It can play an important role in introducing the traditional foods and flavours of Central Africa to its host countries. Similarly, the diaspora can encourage the expansion of the consumption of traditional foods to consumers not originally from the subregion (Tabuna, 2007b).

4. Certification of NWFPs in Central Africa: for more sustainable management?

4.1 What is certification?

Certification is a marketing tool in origin, enabling producers to demonstrate to their consumer public the good quality of their management system, processing method or product. It is a procedure by which a third party provides an assurance or a written commercial label, attesting that a product conforms to specific predefined standards. This procedure is carried out on the basis of an audit conducted according to authorized methods. There are various types of certification: certification of origin, used to enhance the reputation of a given area; organic certification, which sets the priority on respect for the techniques of biological agriculture; or certification of quality. In the case of NWFPs, the certification that seems most suitable is that of forest management.

4.2 Advantages of certification

Certification can contribute to the sustainable management of NWFPs i.e. management that is economically viable, socially equitable and ecologically acceptable. It allows greater optimization of forest products and offers them access to formal markets. It also helps to provide value chains with a more formal structure in accordance with the laws and regulations in force, to the benefit of all the social strata involved in their management. Lastly, certification conveys the assurance that the NWFP is being exploited in an environmentally respectful manner.

There have so far been no initiatives in Central Africa regarding the certification of NWFPs. The procedure can turn out to be complicated, since production and trade are still generally informal. It requires a prior evaluation of the costs of setting up a system and the selection of NWFPs that have enough commercial value to cover the costs of management and allow a profit.

However, since NWFPs are an integral part of the forest ecosystem, an alternative could be envisaged in the form of certification of the sustainable management of the forest where the NWFP is gathered, accompanied by traceability of the latter. Certification of forest management entails a process of inspection of the forest or woodland in order to make sure it is being managed according to a set of standards. These authorized standards could take account of economic, social and environmental aspects of forest management, which would thus allow

the certification to respond as well as possible to the concerns of all the parties involved. This approach has an important potential for the process of NWFP certification in Central Africa.

The standards for forest management certification would have the following objectives:

- that states, as the owners of the forests, should see their laws and regulations respected and applied on the ground, with monitoring being carried out by a third party; they would also earn credit internationally for their conservation and sustainable management efforts;
- that forest workers, local communities and indigenous people should see their rights better respected;
- that environmental NGOs should be assured that forest management is becoming increasingly sustainable through respect for environmental standards;
- that NWFP harvesters should sell their products on sensitive markets with better added value and acquire credibility for their sustainable management efforts.

With regard to certification of the traceability of a product, this will allow a guarantee of the monitoring of its management from the forest to the final product, but will not be concerned with the origin of the product or with the way its on-site production is carried out. It will not ensure that the production system is economically viable or that it respects environmental and social standards. Certification of traceability would apply to all types of NWFP (Mbolo *et al.*, 2006).

4.3 Criteria for the eligibility of NWFPs for certification

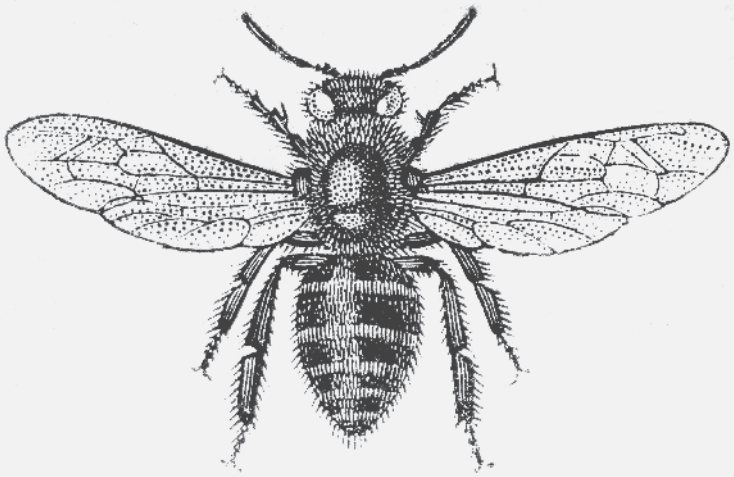
One study (Mbolo *et al.*, 2006) has allowed the definition of criteria for the eligibility of NWFPs for certification. NWFPs thus have a potential for certification when:

- they have access to an international market with a significant demand and are the object of a widescale trade with added value;
- their harvesting is organized in a well-structured value chain;
- they have a regular production with a well-known timeframe;
- they have a high conservation value.

Some NWFPs can already meet these requirements, for example *Gnetum* spp. vegetable leaves. One of the potential benefits, if not the most important one, associated with certification of Gnetum spp. leaves is the existence of international markets with a demand and with consumers. *Gnetum* spp. is sold on European and American markets (Tabuna, 2000b; Mbolo, 2002) and also Asian markets, as was seen in Chapter 14. Some barks are also traded on international markets, where they are used for their medicinal virtues. In particular, the extract of *Prunus africana* bark is known throughout the world for the treatment of prostate cancer, that of *Prunus yohimbe* bark for its aphrodisiac effects, and that of *Enantia chlorantha* bark for the treatment of hepatitis. These barks are highly valued by the pharmaceutical industry and thus have an important potential for certification.

5. Conclusion

The aim of this chapter was to consider the possibilities of improving the access of NWFPs to markets, thanks in particular to the MA&D approach. The food quality and safety aspect was discussed, with the work of two international food standardization bodies, the Codex Alimentarius and EFSA. Various outlets were then identified for a diversification of NWFP-based food products, with special attention to the potential offered by the presence of immigrants in Central Africa and the existence of an extensive diaspora, especially in Europe and the United States, with consumption habits and tastes that can provide useful information for the marketing of NWFP-based products.



The existence of international markets with a demand and consumers for NWFPs means that mechanisms to certify products sold on European, American and Asian markets need to be established. Barks and other NWFPs sold on international markets and valued by the pharmaceutical industry thus represent a major potential for certification, as Chapter 18 has just shown. An international economic environment favourable to the sustainable exploitation of NWFPs, as the chapter also showed, will therefore involve the adoption of innovative production, harvesting and post-harvest strategies that will allow an expansion in the field cultivation of NWFP species, the development of mechanisms and other stakeholder platforms within value chains, the establishment of a market information system for communities and the identification of political and institutional constraints, not forgetting the evaluation of opportunities to incorporate small-scale producers into the NWFP value chains.

Chapter 19
Increasing the benefits generated by NWFPs by developing farmers' entrepreneurial skills: the example of njangsang (central Cameroon)

Ann Degrande, Divine Foundjem-Tita, Charlie Mbosso and Nimino Godwill

1. Introduction

Despite the wealth of its natural resources, the Congo Basin is still one of the poorest areas in the world. Poverty alleviation and environmental conservation there will entail the development of innovative strategies. Natural resources are under threat, for example, from agricultural and forest exploitation and policies of increasing protected areas, which prevent local people's access to NWFPs, resulting in a worsening in their income and living conditions (Yanggen, 2010).

There is an urgent need to find solutions reconciling a sustainable improvement in local people's income with protection of the environment. One solution consists of developing and encouraging the participation of small-scale producers in the value chains of NWFPs from traditional agroforestry systems[35] such as home gardens and cocoa plantations. This will enable them to move steadily from gathering to cultivation of the most popular species with products destined for small and medium-sized enterprises (SMEs) and markets. A number of studies have indicated a high demand for NWFPs in Congo Basin countries, especially such products as kola (*Cola* spp.), njangsang (*Ricinodendron heudelotii*), bush mango or andok (*Irvingia* spp.) and eru or okok (*Gnetum* spp.) (Ndoye and Ruiz-Pérez, 1999; Awono *et al.*, 2002b). Unfortunately, small-scale producers find it hard to derive any benefit here, for lack of reliable market information, marketing networks, associations and appropriate processing and preservation methods. The "development of farmers' entrepreneurial skills" approach is intended to bring about better organization of stakeholders in the value chain and promotion of a more effective marketing strategy.

2. The "development of farmers' entrepreneurial skills" approach

The innovative approach known as the "development of farmers' entrepreneurial skills" was first implemented in Cameroon in 2003 by the International Center for Research in Agroforestry (ICRAF) and its partners and then extended to the Democratic Republic of the Congo in 2009. It supports small-scale producers in developing their knowledge and marketing strategies. It uses the results of research on the domestication of local trees with a view to the field cultivation of

[35] These NWFPs are agroforestry products harvested from trees grown outside forests (home gardens, village orchards), as opposed to those gathered in natural forests. However, once on the market, they are indistinguishable.

NWFP-bearing species and comprises four lines of action: (i) development and improvement of production, harvesting and post-harvest techniques; (ii) improvement of the organization and strengthening of the links among all the stakeholders in value chains; (iii) establishment of a market information system for local communities; and (iv) identification of political and institutional constraints and assessment of national and regional opportunities to incorporate small-scale producers into these value chains.

This chapter presents the lessons learned after seven years' production of njangsang in Cameroon's central region (Akonolinga district).

3. NJANGSANG (*RICINODENDRON HEUDELOTII*)

Ricinodendron heudelotii belongs to the Euphorbiaceae family. It is a large tree with pale grey bark and can grow to heights of 40 metres, with diameters of 1.20 metres. Its germination is fairly slow and its germination rate is not high (40 percent). The growth of young plants is very rapid in full light, and the first fruit may be borne four years after planting. In Cameroon, *Ricinodendron heudelotii* trees are found in forests and agroforests. Flowering begins in March and the fruit start to fall in August. The fruit, commonly known as njangsang, contain one to three oily seeds, which are used to thicken and flavour sauces. In terms of nutritional value, Table 1 shows that if groundnut is replaced by njangsang in fish sauce (per 100 grams), there is a gain of 0.6 grams of protein, 117 milligrams of calcium and 51.6 milligrams of iron. If cucurbit or egusi seed is replaced by njangsang, there is a gain of 44.9 milligrams of iron, but a loss of 27 milligrams of calcium.

Table 1
Content of protein, calcium, iron and zinc in fish sauce prepared with and without njangsang (per 100 grams)

Dish (sauce)	Protein	Ca (mg)	Fe (mg)	Zn (mg)
Tomato, njangsang & fresh fish (1)	28.9	351	60.9	3.3
Tomato, groundnut & fresh fish (2)	28.3	234	9.3	3.5
Tomato, cucurbit seed & fresh fish (3)	-	378	16.0	3.9
(1) - (2)	0.6	117	51.6	-0.2
(1) - (3)	-	-27	44.9	-0.6

Source: Bell Rikong-Adie *et al.* (1996) cited by Manirakiza (2007)

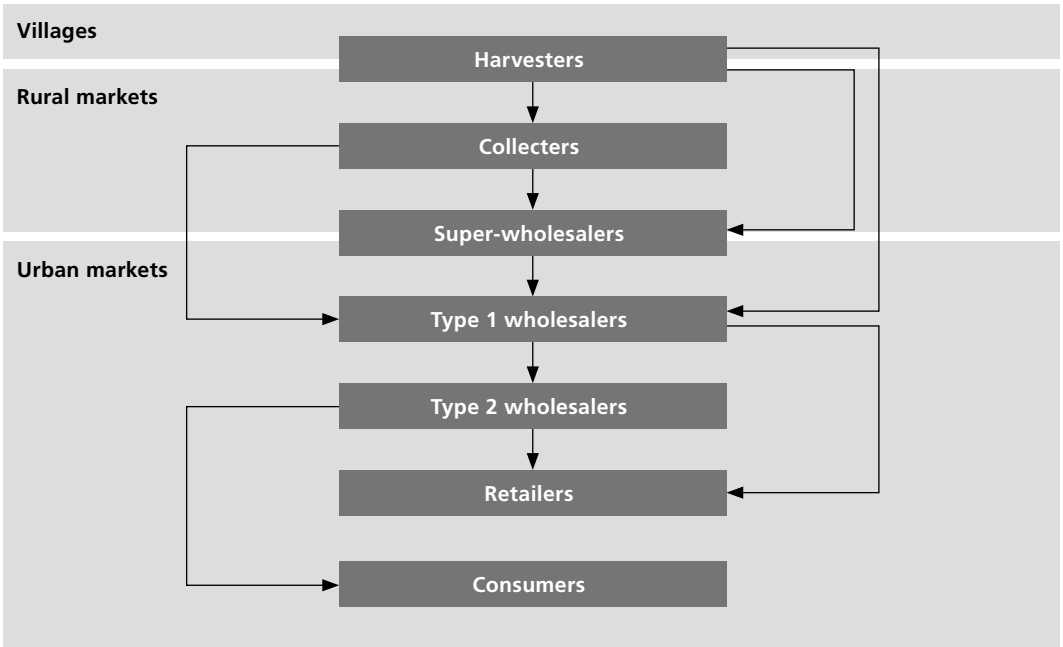
In Cameroon, *Ricinodendron heudelotii* markets are concentrated around the main urban centres. Wholesalers buy from local markets and in villages and re-sell in large urban centres or to the export market (Laird, 1997). Mezogue *et al.* (2006) report that njangsang seeds are sold throughout the year in the large markets on the coast (New Bell in Douala) and in the centre (Mokolo and Mfoundi in Yaoundé). According to the same source, prices vary depending on market, season, year and demand. Njangsang is sold in heaps, in glasses or in 397-gram powdered milk containers. Dried *Ricinodendron heudelotii* kernels can keep for two years, which means they can be stored and sold throughout the year (Vivien and Faure, 1996; Laird, 1997). Manirakiza (2007) reports that 100 percent of households in Yaoundé, whatever their origin, consume njangsang and 70 percent declare they do so at least three times a week. The frequency of consumption does not vary with the season, nor is it influenced by the price. The reason is that there is no real substitute for njangsang in terms of taste and smell. The annual consumption of njangsang in Yaoundé is estimated at 735.8 tonnes, with an annual expenditure

per consumer of roughly CFAF 850 (Manirakiza, 2007). Taking the average price of njangsang as CFAF 1 500 per kilogram, the annual individual consumption is 565 grams. The same author also indicates that urban demand should increase with the rate of urbanization. Njangsang is also much appreciated in Nigeria, and Cameroon exported 1 307 tonnes by land in 2002 (Manirakiza, 2007).

A 2009 study of 60 njangsang producers in the Ekpwassong and Nkoloboudou areas (Akonolinga district in Cameroon's central region) and 38 traders in rural markets (Akonolinga, Ayos and Sa'a) and urban markets (Mokolo and Mfoundi in Yaoundé and the Central and New Bell markets in Douala) showed that the njangsang value chain comprises six categories of actors, primarily women: harvesters, collectors, super-wholesalers, type 1 and 2 wholesalers, and retailers (Nakuna, 2009). Producers (harvesters) take care of the harvesting and collectors are responsible for transferring the product from the production zones to rural markets. The super-wholesalers and types 1 and 2 wholesalers transport it to the New Bell market in Douala and the Mfoundi market in Yaoundé (see Figure 1). There is no contractual relationship between these actors and the only agreements are verbal, sustained by trust and advance payment to collectors by super-wholesalers.

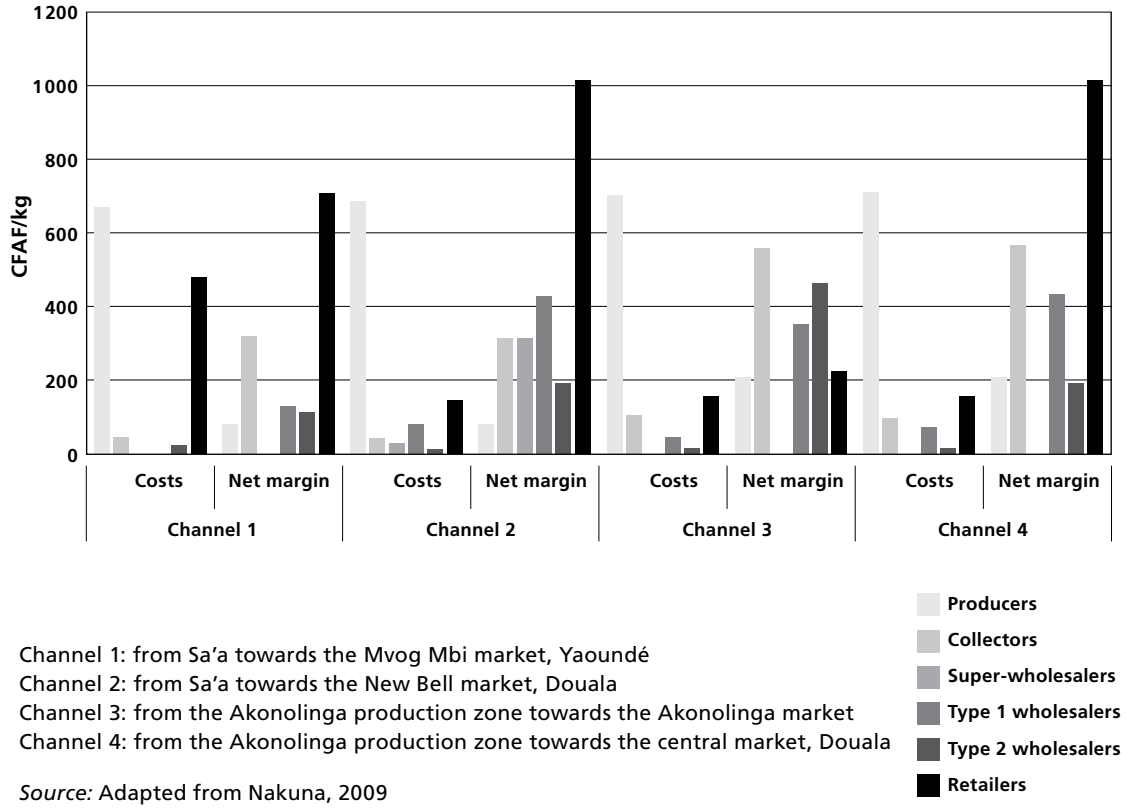
The njangsang produced in the Sa'a and Akonolinga areas supplies the Douala and Yaoundé markets, with the largest flows being towards Douala (66.7 percent; Nakuna, 2009). The producers and sellers bear the costs linked to the various stages of harvesting njangsang, and also the costs of travel, transport, withholding tax, handling, packaging, rental of premises, security and telephone charges. The highest charges are paid by the producers, while retailers enjoy the highest margins and the lowest charges are paid by Type 2 wholesalers (see Figure 2; Nakuna, 2009).

Figure 1
Njangsang marketing channels



Source: Nakuna, 2009

Figure 2
Costs and net margins in the njangsang trade per category of stakeholder and per channel



Channel 1: from Sa'a towards the Mvog Mbi market, Yaoundé
Channel 2: from Sa'a towards the New Bell market, Douala
Channel 3: from the Akonolinga production zone towards the Akonolinga market
Channel 4: from the Akonolinga production zone towards the central market, Douala

Source: Adapted from Nakuna, 2009

3.1 Production, harvesting and post-harvest techniques

Despite its growing importance on local markets, the njangsang trade is penalized by inappropriate production, harvesting and post-harvest methods.

3.1.1 Domestication

The multiplication method most widely used by producers to date has been by seed or by transplanting wild stock. Njangsang germination is slow and the germination rate is not high because of its hard seed-case. Manual scarification of seeds shortens dormancy and gives a germination rate of nearly 70 percent (Tchoundjeu and Atangana, 2006).

Multiplication by seed has the drawback that no distinction is made between male and female trees before the production phase, which hampers any intensification of njangsang production. It is essential to develop vegetative multiplication methods, which would make it possible to reproduce only female trees with the desired characteristics. ICRAF research in Cameroon on *Ricinodendron heudelotii* propagation by cuttings has shown that the use of cuttings of leaved stems of about 4 centimetres with a leaf area of 50 square centimetres in a sand-sawdust substrate gives a rooting rate of 70 percent and a survival rate of 80 percent after rehabilitation. Njangsang also responds well to side-tongue or cleft grafting, with a 70 percent success rate (SCUC, 2006). These vegetative multiplication methods are now being taught to groups of producers in village nurseries.

Producers' group members have begun to keep and even plant njangsang trees in their fields., inasmuch as increasing the field cultivation of *Ricinodendron heudelotii* is one of the first steps towards increasing production without degrading the resource. In the Akonolinga area, Van Parys (202) has reported that 14 percent of households involved in grouped sales have already planted njangsang trees, against 4 percent in the case of farmers who are not involved. The percentage of fields in which wild *Ricinodendron heudelotii* stock is protected was significantly higher in the villages where ICRAF has intervened (9.5 percent) than in villages without any intervention (2.9 percent; p = 0.010). These results suggest that there is a growing awareness of the need to plant trees so as to ensure a supply that can meet the increasing market demand for njangsang.

3.1.2 Njangsang crushing

Njangsang harvesting is carried out in six stages: gathering the fruit, depulping, washing the nuts, cooking the nuts, crushing, and finally drying the kernels obtained (Tiki-Manga *et al.*, 2003; Nakuna, 2009). Extraction of the kernels from the seed-cases requires a preliminary partial splitting of the nut during cooking. This is thus a critical moment and one that causes a bottleneck in preparation of the product. It takes about one hour to crush 1 kilogram of nuts by hand, and wounds to the hands are frequent. With a view to solving the problem, a prototype njangsang crushing machine is at present being evaluated (Tchoundjeu *et al.*, 2008b). This socio-economic evaluation made four years after its introduction at Ekpwassong (Akonolinga department in the central region; Tabougue, 2011) shows that mechanical crushing is faster than manual crushing. The machine can crush 30 kilograms of nuts per hour, but more time is then required to separate the broken kernels in order to obtain a good quality product. The high breakage rate, estimated at 23 percent, is the main drawback for most users. To reduce the problem, alternative methods of treating the nuts prior to crushing are currently being tested, and preliminary results are indicating a reduction to less than 10 percent. Taking into account the purchase price of CFAF 1 500 000 for the machine, the cost of mechanized crushing is still higher (CFAF 132 kg^{-1}) than that of manual crushing (CFAF 129 kg^{-1}), with an annual production of 6 000 kilograms and a machine crushing cost of CFAF 44 kg^{-1} of nuts (Tabougue, 2011). If the annual quantity is increased to 24 000 kilograms, the machine costs fall to CFAF 21 kg^{-1}, which permits the cost of mechanized crushing to be reduced to CFAF 108 kg^{-1} (against CFAF 126 kg^{-1} for manual crushing). This encourages producers to produce more. If the machine is viewed as a purchased tool that must pay its way, it is important to increase the amount to be machine crushed, since it is only possible for the group to obtain any benefit with an annual production of 8 000 kilograms of nuts. Further efforts are therefore needed to improve the performance of the crusher, while reducing its manufacturing cost.

3.2 Finding good modes of organization

3.2.1 Grouped sales

Grouped or joint sales facilitate connections among stakeholders in the value chain, especially producers and traders. This approach requires the boosting of producers' groups' organizational and entrepreneurial capacities.

First phase: boosting the groups' capacities. Training in group dynamics has led to the formation of producers' groups that are able to develop initiatives to promote grouped sales. The issues addressed during training include: the number of meetings organized by each group annually, their functions, members' participation, leadership, conditions for members' joining

or leaving, members' roles, communication within and outside the group, creativity within the group, mobilization of resources by the group and solidarity within the group.

Second phase: identification of commercial strategies. The strategy preferred by all the members of the groups is still direct sale to village traders because of the high costs of transport to urban markets. Producers are interested in grouped sales to village wholesalers, which has the advantage of putting them in direct contact with the purchaser. However, this strategy requires the boosting of producers' entrepreneurial skills, such as their capacities to negotiate, manage finances and manage available stocks.

The *grouped sales process* comprises four phases: inventory of available quantities, decision as to the time of selling, negotiation of the selling price and fixing of the sales day.

Producers manage their njangsang stocks individually, as warehouses are not available for storage. It is therefore very important to make an inventory of the quantities available. The group's head of marketing is responsible for monitoring the members' njangsang production from the flowering phase through to the drying of the kernels. In some groups, the members coordinate their work by fixing a precise period for the extraction of kernels. Everyone thus has their product available at the same time, which avoids individual sales before the grouped sales are organized. When all goes well, the group organizes a meeting to assess the total amount available.

The decision to organize the sale comes from the producers and depends on the amount available (at least 135 kilograms) or the number of producers involved in the sale (at least ten). Sometimes, though rarely, when three or four members are experiencing some urgent need, they can request organization of the deal. However, when the group reaches a certain degree of maturity, the decision to hold a grouped sale is made depending on the market price, and the group prefers to wait for the time when the price of njangsang is high.

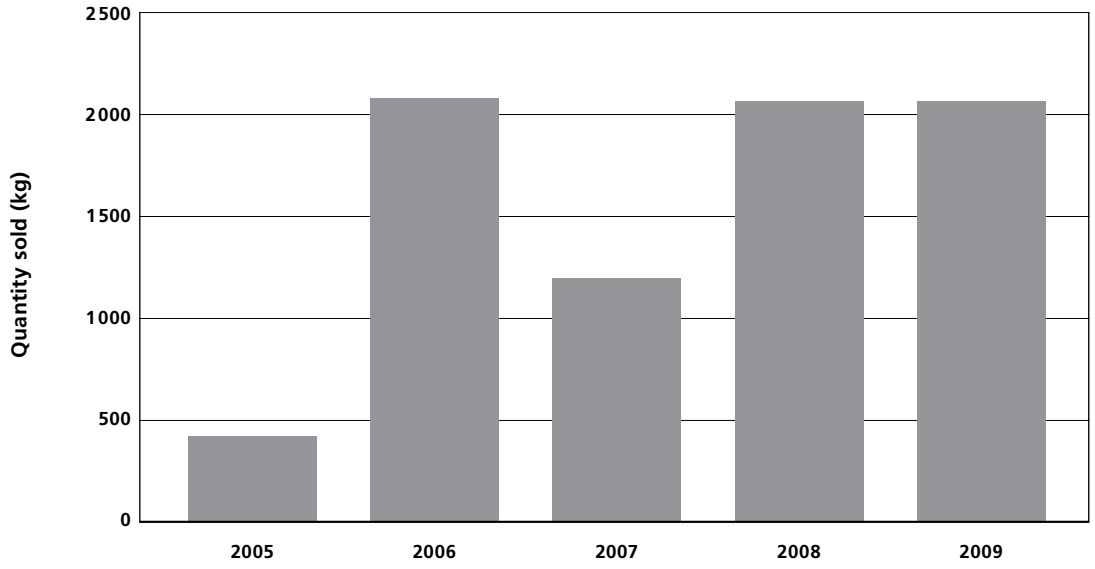
When the group decides to organize a sale, it contacts a third party (either the NGO providing training, or ICRAF) responsible for facilitating grouped sales. Depending on the amount available, the group is placed in contact with one or several traders, so that they can agree on the price. Negotiations between the producers' group and the traders focus on the quantity of njangsang to be sold, the sale price and the date of the sale. This negotiation is mostly carried out by telephone.

Fixing the day of the sale depends on the availability of funds among traders and the timetable of the third party. The sale generally takes place no later than one week after the price has been agreed upon. The third party may withdraw once there is sufficient trust between the producers and the traders.

Grouped sales enable the producers to receive a substantial sum of money all at once, which they say is a great advantage. Individuals then use the income from grouped sales to pay for children's education, finance other activities and improve the family's health. Within some well-organized groups, a percentage is deducted from each producer's transaction after the grouped sale to finance certain future actions, such as communicating with traders or the operation of the njangsang crusher. However, the greatest challenge for the success of grouped sales is to help producers to hold onto their product and wait for the best moment to sell. A producer may be forced to sell before the anticipated time in order to meet some financial emergency (for example, sickness). Possible solutions include the setting up of a guarantee fund that would allow

producers to borrow money with a portion of their production as a guarantee (Foleu, 2010). The loans are deducted directly from sales revenue, with or without interest. The guarantee fund may initially be set up with external funds, but should in the long term be composed of group members' savings. As Figure 3 shows, the quantities sold in Ekpwassong fell considerably in 2007 following the withdrawal of the guarantee fund made available to the group by the project, then rose again in 2008 and 2009.

Figure 3
Evolution of quantities of njangsang sold as a group in Ekpwassong



3.2.2 Improving market information

Njangsang producers in the Akonolinga area use various methods to obtain information about the state of the market and to communicate with traders. Since the production zone is not serviced by a telephone network, information comes either from travellers (traders, motorcyclists, other visitors) who go to areas where mobile telephones work, or from family and friends living in the major consumption areas. Traders interested in njangsang travel to the production areas in search of the product.

A new market information system involving certain groups of njangsang producers and traders was launched in 2010. It covers quantities produced and demanded, places of sale, payment methods and state of the roads (transport), and it is regularly disseminated to traders and producers by relay organizations (local NGOs or grassroots community organizations) either by telephone or via the Internet. This market information system was set up in the Akonolinga zone and is intended to improve knowledge about supply and demand, and also links between producers and traders. It is at present undergoing evaluation (performance, efficiency and sustainability).

3.2.3 Governance based on grouped sales to reduce transaction costs

Governance in a value chain refers to coordination among its various stakeholders. In the context of the njangsang trade, the governance structure (or form of coordination) acts on two levels:

- *horizontal coordination*, in other words, the grouping of njangsang producers and the association of traders;
- *vertical coordination*, which signifies collaboration between producers' groups and individual traders or groups of traders.

The governance structure of stakeholders in the njangsang value chain was studied by Foundjem (2009). Before establishing grouped sales, producers and traders in the Akonolinga zone, as was the case everywhere in Cameroon, organized most of their transactions according to a governance system known as "spot markets" (Peterson *et al.*, 2001). In this type of coordination, traders go from door to door to collect small bundles of produce gathered by the producers. Negotiations are carried on individually between producers and traders and are characterized by a limited sharing of information, which is often strategic but generally biased. Producers get little information about the quantities and quality of products demanded by the end markets. Transaction costs therefore remain high for both producers and traders (Pingali *et al.*, 2005).

In order to reduce these costs, njangsang producers in several pilot villages in Akonolinga district decided on a different governance structure, entailing grouped sales. Unlike the spot market system, where there is no coordination or collaboration between producers and traders, the partnership set up in the framework of grouped sales has allowed the solution of a number of problems. Njangsang producers and traders first reached an agreement on respect for quality standards required by traders. Traders in Douala, for example, require reddish-brown njangsang, while those in Yaoundé prefer a yellowish-brown colour. The two parties agreed on prices (also taking quantities and quality into consideration), on a certain flexibility if the price on the end markets changes from that initially agreed upon, on penalties if quantities and quality are not respected, on the site for transactions, on the sharing of handling costs between producers and traders, on the units of measurement to be used (cup, glass or kilogram), on the delivery date and on the form and terms of payment. In response to traders' quality requirements, the njangsang producers' groups have started to sort the kernels to remove broken pieces and they now avoid drying the kernels over smoke. These efforts have reduced quality monitoring costs. Agreement between the two parties on the use of the kilogram as the unit of measurement has also made it easier to carry out checks during transactions. The result is a growth in trust between the two parties.

Although information costs have gone up (since producers communicate by telephone with traders and resource people in urban markets to obtain market information), dialogue between producers and traders has improved and deals have become more transparent. Traders, for their part, have reduced their search costs because they now purchase large quantities assembled by producers' groups, instead of having to go from door to door.

Inasmuch as negotiations on price are an essential element in the grouped sales process, producers are no longer simply "price takers" obliged to accept whatever price the traders offer, as is the case in the spot market system or in individual deals with traders. Grouped sales thus allow the mutual interests of producers and traders to be better taken into account (Foundjem, 2009).

Box 1
Impact of the "development of farmers' entrepreneurial skills" approach

A study was carried out in 2010/2011 in the Akonolinga area to assess the impact of the "development of farmers' entrepreneurial skills" project on njangsang producers' financial capital (Cosyns *et al.*, 2011). The results show a clear increase in income derived from njangsang, mainly due to a rise in the amounts sold. This increase concerns all the households involved in the activity between 2005 (pre-intervention) and 2010 (post-intervention). In 2010, the income from njangsang sales ranged from US$2 to US$860 per household, while 50 percent of households earned between US$30 and US$108. Although the increase between 2005 and 2010 did not show any significant difference between producers associated with the project and those not associated, the relative contribution of njangsang to the total incomes of the households supported by the project was greater (from 12.4 to 21.1 percent) than among producers in the control group (from 15 to 20 percent). A self-evaluation on the five-level Likert scale (-2 = large reduction; -1 = reduction; 0 = no change; +1 = increase; +2 = large increase) gave a score of 1.16 for households involved in project activities, as against a significantly lower score ($p < 0.001$) of 0.46 for control-group households.

3.3 Political and institutional environment

The state plays an important role in creating an institutional environment that is conducive to commercial exchanges (Bienabe *et al.*, 2004). Law 92/006 of 1 August 1992 on associations and common interest groups has facilitated collective action by producers. However, there are other institutional aspects that hamper the expansion of the njangsang trade, as the following examples show.

The roads that link production villages to markets are mostly unsealed and therefore barely practicable in the rainy season, a situation that increases producers' and traders' operating and transaction costs.

Traders often complain about harassment from the police and Ministry of Forestry and Wildlife officers, who demand permits to extract, transport and sell NWFPs, as required by Law 94-1 of 20 January 1994. The procedures to obtain these documents (the same as for timber) are complicated and laborious. They should be simplified and adapted to agroforestry products already being cultivated in fields, such as njangsang.

The grouped sales mechanism means that producers must have access to microfinance services so that they can finance the storage of njangsang while waiting for the sales day. Traders also need financial support in order to have the necessary capital to purchase the large quantities assembled by producers' groups. Cameroon's banking and microfinance institutions are not well enough informed about the economic importance of the NWFP sector and are not always adequately prepared to offer such services.

However, these constraints can strengthen grouped sales strategies. Moukend Mandjoum (2009) has demonstrated that grouped sales have obtained better results in zones with difficult access

to markets than in more accessible zones. This can be explained by the difficulty that producers from distant villages have in selling their products individually, whether in their villages or in towns, because of high communication and transport costs.

4. Conclusion

Implementation of the "development of farmers' entrepreneurial skills" approach in the context of the njangsang trade as presented here shows the importance of working on every link in the value chain. The refinement of vegetative propagation methods and the promotion of field cultivation of *Ricinodendron heudelotii* will ensure the supply of a quality product capable of meeting a growing demand without destroying natural resources. Similarly, use of the crushing machine, which facilitates the extraction of kernels, should make it possible to increase the quantities of njangsang produced per producer, on condition that the machine is used to full capacity and its performance is improved.

Collective action by producers is steadily growing. Producers now prefer to sell their products as a group so as to reduce transaction costs and attract more traders to their production zone. Grouped sales not only allow producers to increase their unit price, but also appear to benefit traders, who can reduce their search costs and avoid door-to-door collection of the product. Traders are thus attracted by grouped sales and are also beginning to organize themselves so that they can raise more capital to purchase available stocks from producers' groups. The impact of this approach on traders needs to be assessed.

The success of this approach depends on groups' capacity to assemble a large quantity of the product. Unfortunately, experience has shown that with no pre-financing system, group members find themselves forced to sell a portion of their production separately before the date set for grouped sales. This practice hampers the success of this type of governance, inasmuch as the stocks available for grouped sales are not large enough to attract traders and provide the benefit of genuine economies of scale. Furthermore, estimates of available stocks that are made by the group and communicated to traders are not reliable, with amounts shrinking as time passes and producers sell their product separately. This does not allow a partnership of trust to develop between producers and traders. Pre-financing systems, either through advance payment or through a guarantee fund, are therefore indispensable, but have not yet been sufficiently developed. If producers are to place the product in common, adequate management is needed – and this is not always achieved by local communities. Capacity-building in terms both of mobilizing members and boosting group dynamics and of the management of stocks and finances, is imperative.

Today, the njangsang trade is governed by Forestry Law 94-1 of 20 January 1994 and requires an extraction permit. Although the law was passed with the intention of preserving resources, in the case of njangsang it is no longer suited to current conditions: *Ricinodendron heudelotii* is steadily becoming part of the agricultural landscape and the harvesting method does not threaten the sustainability of the species. Efforts to reform the law are under way. It would be good to use such experience as that described in this chapter to inform the debate. The reform would allow clarification of the status of cultivated NWFPs and those where harvesting does not threaten the sustainability of the species.

Conclusion
Food and nutritional security, improvement in livelihoods and sustainable management of NWFPs

Ousseynou Ndoye

This work has shown the social, cultural, economic and environmental importance of forests and NWFPs for the people of the Central African Forests Commission (COMIFAC) countries: Burundi, Cameroon, the Central African Republic, Chad, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, the Republic of the Congo, Rwanda, and Sao Tome and Principe. It has also stressed the need to share and coordinate efforts and experience among FAO, research institutions such as CIFOR, ICRAF and Bioversity International, development bodies such as SNV and GIZ, regional institutions such as ECCAS, and universities, in order to give greater visibility to the NWFP sector through a publication for a wider public.

1. Contribution of NWFPs to food and nutritional security

As the authors of Chapters 5 and 6 of this work showed, NWFPs contribute to food and nutritional security (i) through their direct consumption within the home and their input of proteins, fats, minerals and vitamins, and (ii) through their commercialization, which generates income to purchase such items as food and medicine.

This contribution could be improved by applying the principles of the right to adequate food:

- by facilitating access to forest resources for local and indigenous people (respecting customary land rights and collective and individual rights of ownership, possession, access and the use of the land and natural resources of indigenous people) and by providing appeal mechanisms suited to the particular situations of local and indigenous people;
- by transforming the traditional right of use into a right of limited commercial use, permitting people to sell their NWFPs in the extraction zones in order to purchase other staple commodities;
- by reducing highway harassment, which creates income for the forces of order and reduces producers' and traders' incomes;
- by encouraging intersectoral collaboration of stakeholders involved in ensuring food security.

2. Economic, social and cultural importance of NWFPs

As was described in Chapter 7, NWFPs generate considerable income for rural and urban inhabitants. In Cameroon, for example, and also in the Democratic Republic of the Congo, the annual value of nine NWFPs is more than US$38 million. In the Republic of the Congo and the Central African Republic, NWFP sellers can earn higher incomes than the guaranteed minimum interprofessional wage (Mialoundama, 2008; FAO and COMIFAC, 2013). The income from the sale of NWFPs is used mainly for food, health care for the family, clothing and children's education. In this way, they contribute to achieving the Millennium Development Goals in the same way as other productive sectors in Central African countries. The NWFP sector also provides many jobs for women and young people. Lastly, as Chapter 8 showed, forest products are of value not only for households but also for the regional and international economy. In cultural terms, the work examined the example of kola, which is consumed during traditional marriages to strengthen the bonds between families, and that of palm wine, which is used in resolving conflicts and strengthening social cohesion in the rural environment.

3. Need for sustainable management of NWFPs to ensure their long-term contribution to food and nutritional security

Despite the recognized importance of NWFPs in Central Africa, they are not always managed sustainably. If their contribution to improving people's standard of living is to be permanent, the following actions need to be carried out:

1. Promotion of the sustainable management of NWFPs through: their domestication and incorporation into agricultural areas; improvement in harvesting techniques; performance of forest inventories to gain a clear idea of the availability of NWFPs and have better control of the allocation of quotas; and formulation of management plans.
2. Acceleration of the process of incorporating the COMIFAC NWFP guidelines into the national legislation of the various countries so as to improve the legal and institutional framework governing the sector and support states in implementing them. The COMIFAC countries have adopted the guidelines and this political will has been affirmed; however, it must be intensified so as to give effect to the right to adequate food. Access to NWFPs and their use should be promoted through a restructuring of the sector, domestication, processing and packaging of products in order to improve people's food and nutritional security while preserving resources.
3. Creation by each COMIFAC country of a service responsible for collecting data on the forest sector and especially on NWFPs, in order to demonstrate this sector's contribution to the national economy.
4. Facilitation of the access of SMFEs to credit and microfinance institutions. If this is to have the anticipated effects, researchers and development experts must support the process by providing microfinance institutions with information enabling them to appreciate the sector better, with its potential for alleviating poverty, boosting food and nutritional security and creating jobs for women and young people.
5. Promotion of the processing of NWFPs to create greater added value and increase the incomes of the stakeholders involved in the various value chains.

References

References

A

Abernethy, K., Obiang, A.M.N. 2009. *Bushmeat in Gabon*.

Abugiche, S.A. 2008. Impact of Hunting and Bushmeat Trade on Biodiversity Loss in Cameroon: A Case Study of the Banyang-Mbo Wildlife Sanctuary. Faculty of Environmental Sciences and Process Engineering. Cottbus, Germany. Brandenburg University of Technology Doctor of Philosophy (Ph.D). Dans: Environmental and Resource Management: 207. Disponible en ligne: http://d-nb.info/996537201/34

Adesina, A.A., Sonwa, D.J., Tchatat, M., Weise, S.F., Nkongmenec, B.A., Ndoy, O., Gockowski, J. 1997. *Rôle des agroforêts cacao dans la foresterie paysanne et communautaire au Sud Cameroun*, Réseau de Foresterie pour le Développement Rural.

Afrikhepri. 2016. http://afrikhepri.org/lhistoire-des-bantous

Ahenkan, A., Boon, E. 2011. Improving Nutrition and Health through Non-Timber Forest Products in Ghana. Dans: *Journal of Health, Population and Nutrition*, (29)2: 141-148.

Akinnifesi, F.K., Leakey, R.R.B., Ajayi, O.C., Sileshi, G., Tchoundjeu, Z., Matakala, P., Kwesiga, F.R. 2008. *Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization*. World Agroforestry Centre. CAB International Publishing, Wallingford, Royaume-Uni.

Alcorn, J.B. 1993. Indigenous Peoples and Conservation. *Conservation Biology*, 7(2): 424-426.

Alexandre, P., Binet, J. 1958. *Le groupe dit Pahouin (Fang, Boulou, Beti)*. L'Harmattan, Paris.

Alvard, M. 1995. Shotguns and Sustainable Hunting in the Neotropics. *Oryx*, 29(1): 58-65.

Ambrose-Oji, B. 2003. The contribution of NTFPs to the livelihoods of the 'forest poor': evidence from the tropical forest zone of south-west Cameroon. *International Forestry Review*, 5(2): 106-117.

Angelsen, A., Wunder, S. 2003. *Exploring the forest-poverty link: key concepts, issues and research implications*. CIFOR Occasional Paper No. 40, Centre de recherche forestière international, Bogor, Indonésie.

Angelsen, A., Babigumira, R. 2010. *Quantifying the role of forests in poverty alleviation: Preliminary results from the PEN dataset*. XXIII IUFRO World Congress « Forests for the Future: Sustaining Society and the Environment », IUFRO. Seoul, Korea, 23-28 August 2010.

Armitage, D.R. 2003. Traditional agroecological knowledge, adaptive management and the socio-politics of conservation in Central Sulawesi, Indonesia. *Environmental Conservation*, 30(1): 79-90.

Arnold, J.E.M., Ruiz-Pérez, M. 2001. Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics*, 39: 437-447.

Asaah, E.K. 2012. *Beyong vegetative propagation of indigenous fruit trees: case of Dacruodes edulis (G. Don) H.J. Lam and Allanblackia floribunda Oliv*. Thèse de doctorat. Faculty of Bioscience Engineering, Université de Gand, Belgique.

Asaha, S., Mahop, T.M., Ndam, N., Blackmore, P. 2000. State of knowledge study on *Gnetum africanum* Welw. and Gnetum buchholzianum Eng. Produits forestiers non ligneux CARPE. Dans: Clark, L.L. (Ed.), *Atelier sur les résultats de la recherche pour le programme régional de l'Afrique centrale*. CARPE, Yaoundé: 20-23.

ASB. 2000. *Alternatives to Slash-and-Burn Phase II Report: Forest Margins Benchmark of Cameroon, Alternatives to Slash-and-Burn Programme*. IITA Humid Forest Ecoregional Centre, Yaoundé.

Assembe Mvondo, S., Lema Ngono, D. 2007. Droits des populations locales et conservation des ressources forestières: Analyse du cas du sanctuaire à gorilles de Mengame-Cameroun. *Journal du droit de l'environnement et du développement*, (3/3): 272-281. Disponible en ligne: http://www.lead-journal.org/content/07270.pdf

Asseng Zé, A. 2008. *Gestion durable des produits forestiers non ligneux dans la concession forestière de Pallisco*. FAO, Rome. Disponible en ligne: ftp://ftp.fao.org/docrep/fao/011/k3611f/k3611f00.pdf

Asseng Zé, A. 2011. *Gnetum spp.* Dans: *Non-wood News*, (23): 25.

Assoumou Ndoutoume, D. 1986. *Du Mvett*. L'Harmattan, Paris.

Atangana, A.R. 2010. *Phenotypic diversity in fruit and seed traits, and neutral genetic diversity in Allanblackia floribunda*. Thèse de doctorat. Université de Laval, Canada.

Atangana, A.R., Tchoundjeu, Z., Fondoun, J.M., Asaah, E., Ndoumbe, M., Leakey, R.R.B. 2001. Domestication of *Irvingia gabonensis*: 1. Phenotypic variation in fruits and kernels in two populations from Cameroon. *Agroforestry Systems*, 53: 55-64.

Aubame, J-M. 2004. *Les Beti du Gabon et d'ailleurs: Croyances, us et coutumes* (tome II). L'Harmattan, Paris.

Avouampo, E. 2000. Contribution à l'étude de la valorisation alimentaire du safou: procédés de séchage des pulpes et d'extraction d'huile par pressage mécanique. Dans: Kengue, J., Kapseu, C., Kayem, G.J., 3e séminaire sur la valorisation du safoutier et autres oléagineux non conventionnels: 519-532. 3-5 octobre 2000. Yaoundé, Cameroun.

Awono, A., Ndoye, O., Shreckenberg, K, Tabuna, H., Isseri, F., Temple, L. 2002a. Production and marketing of safou (*Dacryodes edulis*) in Cameroon and internationally: Market development issues. *Forests, Trees and Livelihoods*, 12(1): 125-147.

Awono, A., Lema Ngono, D., Ndoye, O., Tieguhong, J.C., Eyebe, A., Tonye Mahop, M. 2002b. *Étude sur la commercialisation de quatre produits forestiers non ligneux dans la zone forestière du Cameroun*. FAO, Yaoundé.

Awono, A., Manirakiza, D., Ingram, V. 2009. *Étude de base de la filière Ndo'o (Irvingia spp.), régions du Centre, Sud et Littoral, Cameroun*. Rapport d'étude projet GCP/RAF/408/EC, «Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale», Yaoundé. Disponible en ligne: http://www.fao.org/forestry/enterprises/45716/en/

Awono, A., Manirakiza, D., Owona, H., Ingram, V. 2009. *Étude de base de la filière miel dans les provinces de Bas-Congo et de Kinshasa (RDC)*. Projet GCP/RAF/408/EC, « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières

des produits forestiers non ligneux en Afrique centrale ». Yaoundé: FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC: 79.

Ayeni, J.S.O., Tah, E.A., Mdaihli, M. 2001a. A Survey of Wildlife Utilization in Boki and Anyang Tribes, edited by M. Cameroonian (MINEF)-GERMAN (GTZ). Project for the Protection of Forests Around Akwaya (PROFA). Mamfe: PROFA.

Ayeni, J.S.O., Mgaihli, M., Ebot, R.A. 2001b. *Community-Based Approach to Biodiversity Conservation of the Takamanda Forest Reserve, Southwest Province, Cameroo*n. Projet PROFA. (GTZ)-MINEF, Mamfe, Cameroun.

B

Bahuchet, S. 1997. Un style de vie en voie de mutation: Considérations sur les peuples des forêts denses humides. *Civilisations*, 44:16-31.

Balandier, G. 1982. *Sociologie actuelle de l'Afrique noire. Dynamique sociale en Afrique centrale*. Presses universitaires de France (2e édition), Paris.

Baldus, R.D. 2009. A Practical Summary of Experiences after Three Decades of Community-based Wildlife Conservation in Africa: What are the Lessons learnt? Publication conjointe FAO et CIC, Budapest. Disponible en ligne: http://www.wildlife-baldus.com/download/cbnrm.pdf

Balinga, M.P., Monzambe Mapunzu, P., Moussa, J., Ngasse, G. 2004. *Contribution des insectes de la forêt à la sécurité alimentaire*. Document de travail, FAO.

Belcher, B., Kusters, K. 2004. Non-timber forest product commercialisation: development and conservation lessons. Dans: Kusters, K., Belcher, B. (Eds.), *Forest Products, Livelihoods and Conservation: Case Studies of Non-timber Forest Product Systems*. Vol. 1 – Asia: 1-22. CIFOR, Bogor, Indonésie. Disponible en ligne: http://www.cifor.org/ntfpcd/pdf/ntfp-asia-r.pdf

Belcher, B., Michon, G., Angelsen, A., Ruiz-Pérez, M., Asbjornsen, H. 2005. The socioeconomic conditions determining the development, persistence, and decline of forest garden systems. *Economic Botany*, 59(3): 245-253.

Belcher, B., Schreckenberg, K. 2007. Commercialisation of Non-timber Forest Products: A Reality Check. *Development Policy Review*, 25(3): 355-377.

Bell, J. 2004. Contribution à la valorisation du *Gnetum africanum* et du *Gnetum buchholzianum* au Cameroun. DEA, Departement of Plant Biology, Université de Yaoundé I, Yaoundé.

Bell, A., Rikong-Adié, H., Hagbé, B., Ndanga, T. 1996. Teneurs en protéines et minéraux des plats cuisinés camerounais. Dans: Froment, A., De Garine, I., Binam Bikoi, Ch., Loung, J.F. (Eds.), *Bien manger et bien vivre. Anthropologie alimentaire et développement en Afrique intertropicale: du biologique au social*. L'Harmattan et ORSTOM, Paris, France.

Bennett, E., Robinson, J. 2000. Hunting of Wildlife in Tropical Forests: Implications for Biodiversity and Forest Peoples. *Biodiversity Series - Impact Studies Paper No. 76*. EU, WCS. New York, USA.

Besong, M., Samalang, P., Abia, C. 2001. Commercialisation as incentive and threat for *Gnetum spp.* (eru) in Cameroon. Incentive for sustainable use and conservation of agrobiodiversity. Lusaka, Zambie.

Bienable, E., Coronel, C., Le Coq, J.F., Liagre, L. 2004. *Linking smallholder farmers to markets: Lessons learned from literature review and analytical review of selected projects*. World Bank, Final Report. CIRAD, IRAM. Disponible en ligne: http://www.iram-fr.org/documents/LFTM%20main%20report%20-%20final%20report.pdf

Bikié, H., Ndoye, O., Sunderlin, W.D. 2000. «L'impact de la crise économique sur les systèmes agricoles et le changement du couvert forestier dans la zone forestière humide du Cameroun». CIFOR Occasional Paper No. 27.

Bikoué, M.A.C., Essomba, H., Tabuna, H., Degrande, A., Tchoundjeu, Z., Walter, S. 2007. *Gestion des ressources naturelles fournissant les produits forestiers non ligneux alimentaires en Afrique centrale*. Produits forestiers non ligneux, document de travail No.5. Projet GCP/RAF/398/GER, FAO. Disponible en ligne: ftp://ftp.fao.org/docrep/fao/010/ah946f/ah946f00.pdf

Billand, A. 2012. Biodiversity in Central African forests: An overview of knowledge, main challenges and conservation measures. Dans: De Wasseige, C., De Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, P., Desclée, B., Nasi, R., Billand, A., Defourny, P., Eba'a, A.R. (Eds.), *The Forests of the Congo Basin: State of the Forest 2010*. Office des publications de l'Union européenne, Luxembourg.

Boffa, J.M., Yaméogo, G., Nikiéma, P., Knudson, D.M. 1996. Shea nut (*Vitellaria paradoxa*) production and collection in agroforestry parklands of Burkina Faso. Dans: Leakey, R.R.B., Temu, A.B., Melnyk, M., Vantomme, P. *Domestication and commercialization of non-timber forest products in agroforestry systems*: 110-121. FAO, Rome. Disponible en ligne: http://www.fao.org/3/a-w3735e.pdf

Bonannée, M., Asseng Zé, A., Walter, S. 2007. *Le cadre législatif et règlementaire régissant l'utilisation des produits forestiers non ligneux (PFNL) en Afrique centrale*. Programme des produits forestiers non ligneux, Projet GCP/RAF/398/GER Renforcement de la sécurite alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux. Norvège-FAO, Yaoundé, Cameroun.

Boot, R.G.A, Gullison, R.E. 1995. Approaches to developing sustainable extraction systems for tropical forest products. *Ecological Applications*, 5: 896-903.

Bowen-Jones, E. 2003. A Review of the Commercial Bushmeat Trade with Emphasis on Central/West Africa and the Great Apes. *African Primates*, 3(1-2): 1-42.

Brockway, L. 2002. *Science and colonial expansion, the role of the British Royal Botanic Gardens*. Yale University Press, Newhaven, Royaume-Uni.

Browder, O. 1992a. Social and Economic Constraints on the Development of Market-Oriented Extractive Reserves in Amazon Rainforests. *Advances in Economic Botany*, 9: 33-42. Bronx, New York, The New York Botanical Garden.

Browder, O. 1992b. The Limits of Extractivism: Tropical Forest Strategies beyond Extractive Reserves. *BioScience*, 42(3): 174-182.

Brummett, R. 2005. Ornamental fishes: A sustainable livelihoods option for rainforest communities. FAO Aquaculture bulletin d'information, 33:29-35.

C

Camilleri, J.L. 1996. *La petite entreprise africaine. Mort ou résurrection*. L'Harmattan, Paris, France.

CARPE. 2001. La déforestation en Afrique centrale. Bassin du Congo. *Bulletins d'informations*, 6:1-4.

Carrière, S. 1999. *Les orphelins de la forêt: Influence de l'agriculture itinérante sur brûlis de Ntumu et des pratiques agricoles associées sur les dynamiques forestière du Sud Cameroun*. Thèse de Doctorat, Université de Montpellier, Montpellier. Disponible en ligne: http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers/010020958.pdf

Cernea, M.M. 2005. 'Restriction of Access' is Displacement: A Broader Concept and Policy. *Forced Migration Review*, 23: 48-49.

Cerutti, P.O., Ingram, V., Sonwa, D. 2009. Les forêts du Cameroun en 2008. Dans: De Wasseige, C., Devers, D., Marcken, P., Eba'a Atyi, R., Nasi, R., Mayaux, Ph. (Eds.), *The Forests of the Congo Basin, State of the Forest 2008*. Congo Basin Forest Partnership, Yaoundé, Cameroun.

Cerutti, P.O., Lescuyer, G., Assembe-Mvondo, S., Tacconi, L. 2010. The challenges of redistributing forest-related monetary benefits to local governments: a decade of logging area fees in Cameroon. *International Forestry Review*, 12(2): 130-138.

Chadha, M.L., Engle, L.M., Oluoch, M.O. 2000. *Vegetable germplasm conservation and management*. AVRDC-African Regional Program, Tanzania.

Chape, S., Harrison, J., Spalding, M., Lysenko, I. 2005. Measuring the Extent and Effectiveness of Protected Areas as an Indicator of Meeting Global Biodiversity Targets. *Philosophical Transactions of the Royal Society*, 360(1454): 443-455.

Chrétien, J.P. 1985. Les Bantous, de la philologie allemande à l'authenticité africaine. Dans: *Vingtième Siècle, revue d'histoire*, 8(8): 43-66.

Clark, L., Tchamou, N. 1998. *La recherche sur les produits forestiers non ligneux en Afrique centrale: la situation du secteur*. Compte rendu préparé pour le Programme régional pour l'environnement en Afrique centrale (CARPE).

Clark, L.E., Sunderland, T.C. (Eds.). 2004. *The Key Non-Timber Forest Products of Central Africa: State of the Knowledge*. SD Publication Series Technical Paper No. 122. USAID, Washington, D.C. Disponible en ligne: http://pdf.usaid.gov/pdf_docs/Pnada851.pdf

Clause, S. 2010. *Problématique de la collecte des feuilles de Gnetum Africanum en zone d'exploitation forestière*. Mémoire de fin d'étude, Gembloux AgroBiotech, Gembloux.

Clemente Muñoz, M.A., Navarro-Cerrillo, R.M., Kasimis, N., Hernández Bermejo, J.E., Padrón Cedrés, E., Martín-Consuegra Fernández, E., Hernández Clemente, R., García-Ferrer Porras, A. 2006. *Evaluation of the Harvest of Prunus Africana Bark on Bioko (Equatorial Guinea): Guidelines for a Management Plan*. Universidad de Córdoba, Córdoba, Espagne. Disponible en ligne: https://cites.org/sites/default/files/ndf_material/Evaluation-Prunus-africana.pdf

Coad, L., Burgess, N., Fish, L., Ravillious, C., Corrigan, C., Pavese, H., Granziera, A., Besançon, C. 2009. Progress towards the Convention of Biological Diversity Terrestrial 2010 and Marine 2012 Targets for Protected Area Coverage. *Parks*, 17: 35-42.

Colfer, C.J.P. 1997. *Beyond Slash and Burn: Building on Indigenous Management of Borneo's Tropical Rainforests (Advances in Economic Botany)*. New York Botanical Garden.

Colfer, C.J.P., Woelfel, J., Wadley, R.L., Harwell, E. 2001. Assessing people's perceptions of forests: Research in West Kalimantan, Indonesia. Dans: Colfer, C.J.P., Byron, Y. (Eds.), *People managing forests: the links between human well-being and sustainability*. RFF-CIFOR, Washington, D.C.

COMIFAC, FAO, GTZ. 2008. *Directives sous-régionales relatives à la gestion durable des produits forestiers non ligneux d'origine végétale en Afrique centrale*. Projet GCP/RAF/398/GER, «Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux ». COMIFAC, FAO, GTZ, Yaoundé. Disponible en ligne: http://www.fao.org/3/a-ak414f.pdf

COMIFAC, FAO. 2010. *Voyage d'étude et d'échanges sur le développement entrepreneurial du secteur PFNL au niveau sous-régional, national et local dans les pays de l'Afrique centrale*. Rapport final. Yaoudé, Cameroun. Disponible en ligne: http://www.fao.org/docrep/013/am142f/am142f00.pdf

COMIFAC, FAO, GTZ. 2008. *Directives sous-régionales relatives à la gestion durable des produits forestiers non ligneux d'origine végétale en Afrique centrale*. Projet GCP/RAF/398/GER, «Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux ». COMIFAC, FAO, GTZ, Yaoundé. Disponible en ligne: http://www.fao.org/3/a-ak414f.pdf.

Conklin, H.C. 1957. Hununoo agriculture. FAO Forestry Development Paper No. 12. FAO, Rome, Italy.

Cosyns, H., Degrande, A., De Wulf, R., Van Damme, P., Tchoundjeu, Z. 2011. Can commercialization of NTFPs alleviate poverty? A case study of *Ricinodendron heudelotii* (Baill.) Pierre ex Pax. kernel marketing in Cameroon. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, 112(1): 45-56.

Cowlishaw, G., Meldelson, S., Rowcliffe, J.M. 2004. The Bushmeat Commodity Chain: patterns of trade and sustainability in a mature urban market in West Africa. *Wildlife Policy Briefing No 7.* ODI, London. Disponible en ligne: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3298.pdf

Cunningham, A.B. 1997. An Africa-wide overview of medicinal plant harvesting, conservation and health care. Dans: *Medicinal plants for conservation and health care*. FAO. Rome.

Cunningham, A.B. 2001. *Applied Ethnobotany: People, Wild Plant Use and Conservation*. Earthscan, Londres. Disponible en ligne: http://priede.bf.lu.lv/grozs/AuguFiziologijas/Augu_resursu_biologija/gramatas/Applied%20Ethnobotany.pdf

D

Danielsen, F., Balete, D.S., Poulsen, M.K., Enghoff, M., Nozawa, C.M., Jensen, A.E. 2000. A simple system for monitoring biodiversity in protected areas of a developing country. *Biodiversity and Conservation*, 9(12): 1671-1705. Disponible en ligne: http://www.monitoringmatters.org/publications/Danielsen%20et%20al%202000%20A%20simple%20system.pdf

Dawson, I., Were, J. 1997. Collecting germplasm from trees – some guidelines. *Agroforestry Today*, 9(2): 6-9.

De Beer, J., McDermott, M. 1989. *The Economic Value of Non-timber Forest Products in Southeast Asia*. Comité des Pays-Bas pour l'UICN, Amsterdam. Disponible en ligne: https://portals.iucn.org/library/sites/library/files/documents/1996-020.pdf

Debroux, L., Hart, T., Kaimowitz, D., Karsenty, A., Topa, G. (Eds.). 2007. *Forests in Post-Conflict Democratic Republic of Congo: Analysis of a Priority Agenda*. Rapport conjoint de la Banque mondiale, CIFOR CIRAD, AWF, CNONGD, CI, GTF, LINAPYCO, SNV, REPEC, WCS, WHRC, ICRAF et WWF. Center for International Forestry Research, Jakarta, Indonesia. Disponible en ligne: http://www.cifor.org/publications/pdf_files/Books/BCIFOR0701.pdf

Degrande, A., Schreckenberg, K., Mbosso, C., Anegbeh, P., Okafor, V., Kanmegne, J. 2006. Farmers' fruit tree-growing strategies in the humid forest zone of Cameroon and Nigeria. *Agroforestry Systems*, 67: 159-175.

Delacote, P. 2008. *The Safety-Net Use of Non Timber Forest Products*. Nancy: LEF-ENGREF-INRA. Disponible en ligne: http://ssrn.com/paper=1310108

Delacote, P. 2009. *Commons as insurance: safety nets or poverty traps?* Economics Department, EUI, Florence, Italie. Disponible en ligne: http://gambusia.zo.ncsu.edu/readings/Delacote%20 2009.pdf

Delvingt, W., Dethier, M., Auzel, P., Jeanmart, P. 1997. *La chasse villageoise Badjoué, gestion coutumière durable ou pillage de la ressource gibier?* Gembloux: Presses agronomiques de Gembloux.

De Merode, E., Homewood, K., Cowlishaw, G. 2004. The value of bushmeat and other wild foods to rural households living in extreme poverty in Democratic Republic of Congo. *Biological Conservation*, 118: 573-581. Disponible en ligne: http://gambusia.zo.ncsu.edu/readings/Merode%20et%20al%202004.pdf

De Wasseige, C., De Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, Ph., Desclée, B., Nasi, R., Billand, A., Defourny, P., Eba'a, A.R. 2012. *The Forests of the Congo Basin. State of Forest 2010*. Office des publications de l'Union européenne, Luxembourg. Disponible en ligne: http://www.observatoire-comifac.net/edf2010.php?l=en

De Wasseige, C., Devers, D., De Marcken, P., Eba'a Atyi, R., Nasi, R., Mayaux, PH. (Eds). 2009. *Les forêts du bassin du Congo – État des forêts 2008*. Office des publications de l'Union européenne. Luxembourg. Disponible en ligne: http://www.observatoire-comifac.net/edf2008.php

De Wasseige, C., Devers, D., Marcken, P., Eba'a, R.A., Nasi, R., Mayaux, P. (Eds.). 2009. *The Forests of the Congo Basin: State of the Forest 2008*. Office des publications de l'Union européenne. Luxembourg.

De Wasseige, C., De Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, Ph., Desclée, B., Nasi, R., Billand, A., Defourny, P., Eba'a, A.R. 2012. *The Forests of the Congo Basin. State of Forest 2010*. Luxembourg, Office des publications de l'Union européenne. Disponible en ligne: http://www.observatoire-comifac.net/edf2010.php?l=en

Diaw, M.C. 1997. *Si, Nda bot and Ayong: Shifting Cultivation, Land Use and Property Rights in Southern Cameroon*. ODI, Londres. Disponible en ligne: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1156.pdf

Diaw, M.C., Oyono, P.R. 1998. Dynamiques et représentations des espaces forestiers au Sud Cameroun: pour une relecture sociale des paysages. *Arbres, Forêts et Communautés Rurales*, 15/16: 36-43. Disponible en ligne: http://pmb.sicac.org/opac_css/doc_num.php?explnum_id=1033

Dounias, E. 1995. Du jardin au recrû forestier: agroforêts, cueillette et chasse chez les Mvae du Sud Cameroun (littoral forestier). Dans: *Recherche et développement dans les zones tropicales humides d'Afrique centrale et de l'Ouest*. Yaoundé, Cameroun.

Dounias, E. 1996. *Écotone forêt-savane et système agraire des Tikar du Haut Mbam (Cameroun central)*. Article présenté au Symposium international Dynamique à long terme des écosystèmes forestiers intertropicaux, 20-22 mars 1996, Paris. Disponible en ligne: http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers12-10/010023913.pdf

Dounias, E. 1996. Recrûs forestiers post-agricoles: perceptions et usages chez les Mvae du Sud-Cameroun. *Journal d'agriculture tropicale et de botanique appliquée*, 38(1): 153-178.

Dounias, E., Hladik, M. 1996. Les agroforêts Mvae et Yassa au Cameroun littoral: fonctions socioculturelles, structure et composition floristique. Dans: Hladik, A., Hladik, C.M., Pagezy, H., Linares, O.F., Koppert, G.J.A., Froment, A. (Eds.), *L'alimentation en forêt tropicale: interactions bioculturelles et perspectives de développement*: 1103-1126. UNESCO, Paris. Disponible en ligne: http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers09-03/010009736.pdf

Dounias, E., Rodrigues, W., Petit, C. 2000. Review of Ethnobotanical Literature for Central and West Africa. *African Ethnobotany Network*, 2: 5-117.

Dugast, L. 1949. *Inventaire ethnique du Sud Cameroun*. Mémoires de l'IFAN, Série populations, 1.

Dove, M. 1993. A Revisionist View of Tropical Deforestation and Development. *Environmental Conservation*, 20(01): 17-24.

Dove, M. 1995. Political versus Techno-Economic Factors in the Development of Non-timber Forest Products: Lessons from a Comparison of Natural and Cultivated Rubbers in Southeast Asia (and South America). *Society and Natural Resources*, 8(3): 193-208.

Draulans, D., Van Krunkelsven, E. 2002. The impacts of war on forest areas in the Democratic Republic of Congo. Oryx, 36(1): 35-40. Disponible en ligne: http://www.colorado.edu/geography/class_homepages/geog_2002_s06/laptop_s06/current%20projects/Cox_Low%20Robinson%20Book%20chapter/Cox_Low%20Book%20chapter/impact%20war%20on%20forests%20DRC.pdf

Dubiez, E., Vermeulen, C., Proces, P., Balimbaki, A. 2010. *Recensement, histoire, occupation spatiale et secteur associatif du village de Kinkosi, Province du Bas-Congo, République démocratique du Congo*. Projet Makala. CIRAD, Université Gembloux Agro Bio Tech, Kinshasa.

E

Ebamane, S. 2008. *Synthèse des rapports d'études réalisées dans le cadre du Projet GCP/RAF/398/GER*. Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux. Yaoundé, Cameroun: FAO.

Essama-Nssah, B., Gockowski, J.J. 2000. *Cameroon Forest Sector Development in a Difficult Economy*. Evaluation Country Case Study Series. Département de l'évaluation des opérations de la Banque mondiale, Washington, D.C.

ETFRN. 2000. *Developing Needs-Based Inventory Methods for Non-Timber Forest Products. Application and Development of Current Research to Identify Practical Solutions for Developing Countries*. FAO, Rome, Italie.

Ewane, M., Awono, A., Ingram, V. 2009. *Baseline study on Irvingia spp. in the SouthWest and East Regions of Cameroon*. Projet GCP/RAF/408/EC, « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale ». Yaoundé, Cameroun: FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC.

Eyog Matig, O., Ndoye, O., Kengue, J., Awono, A. (Eds.). 2006. *Les fruitiers forestiers comestibles du Cameroun*. Institut international des ressources phytogénétiques (IPGRI), Rome. Disponible en ligne: http://www.doc-developpement-durable.org/file/Arbres-Fruitiers/Les_fruitiers_forestiers_comestibles_Cameroun.pdf.

Eyong, C.T. 2007. Indigenous Knowledge and Sustainable Development in Africa: Case Study on Central Africa. Dans: Boon, E.K., Hens, L. (Eds.), *Indigenous Knowledge Systems and Sustainable Development: Relevance for Africa*. Kamla-Raj Enterprises. Disponible en ligne: http://www.zef.de/module/register/media/deed_Chapter12_Eyong-C-Takoyoh.pdf

F

Fa, J.E., Peres, C.A., Meeuwig, J. 2002. Bushmeat Exploitation in Tropical Forests: an International Comparison. *Conservation Biology*, 16(1): 232-237.

Fa, J.E., Currie, D., Meeuwig, J. 2003. Bushmeat and food security in the Congo Basin: Linkages between wildlife and people's future. *Environmental Conservation*, 30(1): 71-78

Fa, J.E., Ryan, S.F., Bell, D.J. 2005. Hunting vulnerability, ecological characteristics and harvest rates of bushmeat species in afrotropical forests. *Biological Conservation*, 121(2):167-176.

Fa, J.E., Seymour, S., Dupain, J., Amin, R., Albrechtsen, L., Macdonald, D. 2006. Getting to grips with the magnitude of exploitation: Bushmeat in the Cross-Sanaga rivers region, Nigeria and Cameroon. *Biological Conservation*, 129(4): 497-510.

Fa, J.E., Olivero, J., Real, R., Farfán, M.A., Márquez, A.L., Vargas, J.M., Ziegler, S., Wegmann, M., Brown, D., Margetts, B., Nasi, R. 2015. Disentangling the relative effects of bushmeat availability on human nutrition in central Africa. *Scientific Reports*, 5: 8168. DOI:10.1038/srep08168. Disponible en ligne: http://www.nature.com/articles/srep08168

Fairhead, J., Leach, M. 1994. Représentations culturelles africaines et gestion de l'environnement. *Politique africaine*, 53. Disponible en ligne: http://www.politique-africaine.com/numeros/pdf/053011.pdf

FairWild Foundation. *2010. FairWild Standard: Version 2.0*. Weinfelden, Suisse. Disponible en ligne: https://www.wwf.or.jp/activities/upfiles/FairWild-Standard-V2.pdf

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.

FAO. 1995a. *Non wood forest products and nutrition*.

FAO. 1995b. *Report of the International Expert Consultation on Non-Wood Forest Products.*

Yogyakarta, Indonesia. 17-27 janvier 1995. Disponible en ligne: http://www.fao.org/docrep/018/v7540e/v7540e.pdf

FAO. 1999a. *Données statistiques des produits forestiers non ligneux du Cameroun*. Programme de partenariat CE-FAO (1998-2001), projet GCP/INT/679/EC. FAO/Direction générale de la Commission européenne pour le développement.

FAO. 1999b. *L'importance de la qualité et de l'innocuité des aliments pour les pays en développement*. Disponible en ligne: http://www.fao.org/docrep/meeting/x1845f.htm

FAO. 2007. *Commerce sous-régional et international des produits forestiers non ligneux alimentaires et des produits agricoles traditionnels en Afrique centrale: État des lieux et stratégie de développement*. Rome. Disponible en ligne: ftp://ftp.fao.org/docrep/fao/012/ak412f/ak412f00.pdf

FAO. 2009a. *Indigenous people food systems: the many dimensions of culture, diversity and environment for nutrition and health*. Rome.

FAO. 2009b. *Cadre législatif et réglementaire régissant l'exploitation et la commercialisation des produits forestiers non ligneux (PFNL) au Cameroun*. Édition: FAO. Yaoundé: FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC.

FAO. 2011a. *Situation des forêts du monde 2011*. Rome. Disponible en ligne: www.fao.org/docrep/013/i2000f/i2000f00.htm

FAO. 2011b. *The State of Forests in the Amazon Basin, Congo Basin and Southeast Asia. A report prepared for the Summit of the Three Rainforest Basins*. Brazzaville, République du Congo, 31 mai-3 juin 2011. Rome. Disponible en ligne: http://www.fao.org/docrep/014/i2247e/i2247e00.pdf

FAO. 2011c. *Stratégie nationale et plan d'actions pour le développement du secteur des produits forestiers non ligneux en République gabonaise*. Disponible en ligne: http://www.fao.org/docrep/field/009/ap865f/ap865f00.pdf

FAO. 2012. *Stratégie nationale et plan d'actions pour le développement du secteur des produits forestiers non ligneux en République gabonaise*. GCP/RAF/441/GER. Disponible en ligne: http://www.fao.org/docrep/field/009/ap865f/ap865f00.pdf

FAO. 2013. *Edible Insects: Future prospects for Food and Feed security*. Disponible en ligne: http://www.fao.org/docrep/018/i3253e/i3253e.pdf

FAO, FLD, IPGRI. 2004. *Forest genetic resources conservation and management: Overview, concepts and some systematic approaches* (Vol. 1). International Plant Genetic Resources Institute, Rome, Italy.

FAO, COMIFAC. 2013. *Atelier final de restitution et de validation des résultats du projet.* Projet GCP/RAF/441/GER «Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion durable des produits forestiers non ligneux». FAO, COMIFAC, Ministère fédéral allemand de l'Alimantation, de l'Agriculture et de la Protection des Consommateurs. Brazzaville, République du Congo. Disponible en ligne: http://www.fao.org/docrep/field/009/ap864f/ap864f00.pdf

Fargeot, C., Dieval, S. 2000. La consommation de gibier à Bangui, quelques données économiques et biologiques. *Canopée*, 18: 5-7.

Farnsworth, N. 1988. Screening Plants for New Medicines. Dans: Wilson, E.O. (Eds.), *Biodiversity*, 83-97. National Academies Press, Washington, D.C.

Ferré, T., Muchnik, J. 1993. Le nététou au Sénégal, systèmes techniques et innovations. Dans: Muchnik, J., *Alimentation, techniques et innovations dans les régions tropicales*: 263-293. L'Harmattan, Paris, France.

Foaham, B., Dagobert, S., Ingram, V., Awono, A. 2009. *Inventaire de Prunus africana dans les provinces du sud-ouest et du nord-ouest du Cameroun, Novembre 2007-Novembre 2008*. Projet GCP/RAF/408/EC, « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale ». Yaoundé: CIFOR.

Focho, D.A., Newu, M.C., Anjah, M.G., Nwana, F.A., Ambo, F.B. 2009. Ethnobotanical survey of trees in Fundong, Northwest Region, Cameroon. *Journal of Ethnobiology and Ethnomedicine*, 5(17).

Folke, C. 2004. Traditional Knowledge in Social-Ecological Systems. *Écologie et Société*, 9(3).

FONDAF. 2010. Foyer Notre-Dame de la Forêt. Disponible en ligne: http://fondaf-bipindi.solidarites.info/fondaf.php

Fondoun, J.M., Tiki-Manga, T. 2000. Farmers indigenous practices for conserving *Garcinia kola* and *Gnetum africanum* in southern Cameroon. *Agroforestry Systems*, 48(3): 289-302. Disponible en ligne: https://www.researchgate.net/publication/227192492_Farmers_indigenous_practices_for_conserving_Garcinia_kola_and_Gnetum_africanum_in_southern_Cameroon

Forest Carbon Asia. 2011. Disponible en ligne: http://www.forestcarbonasia.org/other-publications/the-state-of-the-forests-in-the-amazon-basin-congo-basin-and-south-east-asia/

FORENET. 2010. *Subregional workshop on harmonisation of national reviews on 'Non-timber forest products (NTFPs) in Central Africa'*. Communication à l'atelier sous-régional sur «l'harmonisation des revues nationales sur les produits forestiers non ligneux (PFNL) en Afrique centrale», mai 2010, Douala, Cameroun.

Foundjem Tita, D. 2009. *A transaction cost analysis of factors affecting market arrangements in the agroforestry tree product value chain in Cameroon*. Thèse. Programme "Erasmus Mundus International Master of Science in Rural Development". Université de Gand, Belgique. Disponible en ligne: http://www.worldagroforestry.org/downloads/Publications/PDFS/B16462.pdf

Fourche, T., Morlighem, H. 2002. *Une bible noire: Cosmogonie bantu*. Les Deux Océans, Paris.

FRA. 2000. *Global Forest Resources Assessment 2000: Main report*. FAO Forestry Paper, 140.

Franc, L. 1905. *De l'origine des Pahouins: essai de résolution de ce problème ethnique*. Paris.

Franzel, S., Hannah, J., Jaussen, W. 1996. *Choosing the Right Trees. Setting Priorities for Multipurpose Tree Improvement*. ISNAR-Research report 8.

Freese, C. 1997. The "use it or lose it" Debate: Issues of a Conservation Paradox. Dans: Freese, C. (Ed.), *Harvesting Wild Species: Implications for Biodiversity Conservation*, 1-48. Johns Hopkins Press, Baltimore, États-Unis.

G

Garrity, D., Bandy, D. 1995. A Global Focus on Alternatives to Slash and Burn. Dans: LiYu, X., YuangZhang, Y., JinHui, Q. (Eds.), *Alternatives to Slash-and-Burn Agriculture*: 52-58. Symposium International 6-16 mars 1995. Kunming, PR. Chine.

Gelabert, L.P., Asouti, E., Marti, E.A. 2011. The ethnoarchaeology of firewood management in the Fang villages of Equatorial Guinea, central Africa: Implications for the interpretation of wood fuel remains from archaeological sites. *Journal of Anthropological Archaeology*, 30(3): 375-384.

Gockowski, J., Tonye, J., Diaw, C., Hauser, S., Kotto-Same, J., Njomgang, R., Moukam, A., Nwaga, A., Tiki-Manga, T., Tondoh, J., Tchoundjeu, Z., Weise, S.W., Zapfack, L. 2005. The Forest Margins of Cameroon. Dans: Palm, C.A., Vosti, A.S., Sanchez, A.P., Polly, J.E. (Eds.), *Slash-and-burn Agriculture: The Search for Alternatives:* 305-331. Columbia University Press, New York.

Godoy, R., Bawa, K.S. 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.

Gradwohl, J., Greenberg, R. 1988. *Saving the Tropical Forests*. Earthscan Publications, Londres.

Guariguata, M.R., Cronkleton, P., Shanley, P., Taylor, P.L. 2008. The Compatibility of Timber and Non-timber Forest Product Extraction and Management. *Forest Ecology and Management*, 256: 1477-1481.

Guariguata, M.R., García-Fernández, C., Nasi, R., Sheil, D., Herrero-Jáuregui, C., Cronkleton, P., Ingram, V. 2011. Timber and non-timber forest product extraction and management in the tropics: towards compatibility? Dans: Shackleton, S., Mitchell, D., Shackleton, C., Campbell, B., Shanley, P. (Eds.), *Non-timber Forest Products in the Global Context*. Springer, Berlin.

Guedje, N.M. 2002. *La gestion des populations d'arbres comme outil pour une exploitation durable des produits forestiers non ligneux: l'exemple de Garcinia lucida (Sud Cameroun)*. Thèse de doctorat: Université libre de Bruxelles.

Guedje, N.M., van Dijk, H., Nkongmeneck, B.A. 1998. *Écologie et exploitation de quelques produits forestiers non ligneux (PFNL) de la forêt humide du sud – Cameroun*. Article présenté au Séminaire FORAFRI, Libreville.

Guedje, N.M., Zuidema, P.A., During, H., Foahom, B., Lejoly, J. 2007. Tree bark as a non-timber forest product: The effect of bark collection on population structure and dynamics of *Garcinia lucida* Vesque. *Forest Ecology and Management*, 240(1-3): 1-12.

Guyer, I.J. 1984. Family and farm in southern Cameroon. *African research studies*, 15. Boston University/African Studies Center, Boston.

Gwomb Bi Hell, E. 2011. La forêt du bassin du Congo: un écosystème socialement incontournable et économiquement indispensable au niveau international. *Non-Wood News*, 22: 18,19. Disponible en ligne: http://www.fao.org/3/contents/42fdd93c-845b-5df6-bc2e-ef9a1c741439/i2220e02.pdf

Gyde Lund, H. 2002. When is a forest not a forest? *Journal of Forestry*, 100(8): 21-28.

H

Haggar, M.A. 2009. «État des statistiques concernant les produits forestiers non ligneux au Tchad». Programme de partenariat CE-FAO, 1998-2001.

Hall, P., Bawa, K.S. 1993. Methods to assess the impact of extraction of non-timber forest products on plant populations. *Economic Botany*, 47(3): 234-247.

Hamilton, A.C. (Ed.). 2008. *Medicinal Plants in Conservation and Development: Case Studies and Lessons Learnt*. Plantlife International, Salisbury, Royaume-Uni.

Hartmann, H.T., Kester, D.E., Davis, F.T. 1990. *Plant propagation: principles and practices*. 5th edition. Prentice Hall International, Englewood Cliffs, New Jersey.

Hecht, S.B., Anderson, A.B., May, P. 1988. The Subsidy from Nature: Shifting Cultivation, Successional Palm Forests, and Rural Development. *Human Organization*, 47(1): 25-35.

Helms, A.J. 2002. What Do These Terms Mean? Forest, Forestry, Forester. *Journal of Forestry*: 15-19.

Herzog, F.M. 1992. *Étude biochimique et nutritionnelle des plantes alimentaires sauvages dans le sud du V-Baoulé, Côte d'Ivoire*. Thèse de doctorat, École polytechnique fédérale, Zurich, Suisse.

Herzog, F.M., Gautier-Béguin, D., Müller, K. 1995. Uncultivated plants for human nutrition in Côte d'Ivoire. Disponible en ligne: http://www.fao.org/docrep/w3735e/w3735e10.htm

Hoyt, R. 2004. Wildmeat Harvest and Trade in Liberia: Managing biodiversity, economic and social impacts. *ODI Wildlife: Policy Briefing*, No. 6. Disponible en ligne: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3300.pdf

Hobhouse, H. 1999. *Seeds of Change: Six Plants that Transformed Mankind*. Londres, Papermac Press.

Homma, A. 1992. The Dynamics of Extraction in Amazonia: A Historical Perspective. *Advances in Economic Botany*, 9: 23-31.

Hutton, J.M., Adams, W.M., Murombedzi, J.C. 2005. Back to the Barriers? Changing Narratives in Biodiversity Conservation. *Forum for Development Studies*, (32)2: 341-370.

I

Infield, M. 1988. Hunting, trapping and fishing in villages within and on the periphery of the Korup National Park. Publication No. 3206/A96. WWF International, Gland.

Ingram, V.J. 2009. *The hidden costs and values of NTFP exploitation in the Congo Basin.* Communication au 13e Congrès forestier mondial, 18-23 octobre 2009, Buenos Aires, Argentine.

Ingram, V.J. 2011. *Forest-poverty-commodity links in the Congo Basin: a value chain perspective. Nature™ Inc? Questioning the Market Panacea in Environmental Policy and Conservation.* ISS, La Haye, Pays-Bas. Disponible en ligne: http://www.iss.nl/fileadmin/ASSETS/iss/Documents/Conference_presentations/Nature_Inc_Verina_Ingram.pdf

Ingram, V.J. 2014. *Win-wins in forest product value chains? How governance impacts the sustainability of livelihoods based on non-timber forest products from Cameroon.* Amsterdam

Institute for Social Science Research, Governance and Inclusive Development Group. Amsterdam, University of Amsterdam. PhD: 361. Disponible en ligne: https://openaccess.leidenuniv.nl/bitstream/handle/1887/24875/ASC-075287668-3469-01.pdf?sequence=2

Ingram, V., Awono, A., Schure, J., Ndam, N. 2009. *Guidance for a National Prunus africana Management Plan, Cameroon*. Projet GCP/RAF/408/EC « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale ». FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC-GTZ, Yaoundé, Cameroun. Disponible en ligne: http://www.fao.org/forestry/20776-0928f6e1bca7338bedfca1afabcfe2b89.pdf

Ingram, V., Schure, J. 2010. *Review of Non Timber Forest Products (NTFPs) in Central Africa: Cameroon*. CIFOR, Yaoundé. Disponible en ligne: http://dare.uva.nl/document/2/95165

Ingram, V.J., Ndumbe, L.N., Ewane, M.E. 2012a. *Small Scale, High value: Gnetum africanum and buchholzianum Value Chains in Cameroon*. Small-scale Forestry DOI: 10.1007/s11842-012-9200-8.

Ingram, V., Ndoye, O., Iponga, D.M., Tieguhong, J.C., Nasi, R. 2012b. Non-timber forest products: Contribution to national economy and strategies for sustainable management. Dans: De Wasseige, C., De Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, P., Desclée, B., Nasi, R., Billand, A., Defourny, P. Eba'a R. (Eds.), *The Forests of the Congo Basin. State of the Forest 2010*. Luxembourg: Office des publications de l'Union européenne.

Ingram, V., Ndoye, O., Iponga, D.M., Tieguhong, J.C., Nasi, R. 2012b. Produits forestiers non ligneux: contribution aux économies nationales et stratégies pour le développement durable. Dans: De Wasseige, C., De Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, P., Desclée, B., Nasi, R., Billand, A., Defourny, P. Eba'a R. (Eds.), *Les Forêts du bassin du Congo – État des forêts 2010*. Luxembourg: Office des publications de l'Union européenne.

J

Jamnadass, R., Dawson, I., Franzel, S., Leakey, R., Mithoper, D., Akinnifesi, F., Tchoundjeu, Z. 2011. Improving livelihoods and nutrition in sub-Saharan Africa through the promotion of indigenous and exotic fruit production in smallholders' agroforestry systems: a review. *International Forestry Review*, 13(3): 338-354. Disponible en ligne: http://www.cifor.org/publications/pdf_files/articles/ACIFOR1108.pdf

Jaza Folefack, A.J., Eboutou, L.Y., Degrande, A., Fouda Moulende, T., Kamajou, F., Bauer, S. 2015. *Benefits from tree species' diversification in cocoa agroforests in the Centre region of Cameroon*. RJOAS, 11(47): 3-13.

Jetz, W., Rahbek, C., Colwell, R.K. 2004. The coincidence of rarity and richness and the potential signature of history in centres of endemism. *Ecology Letters*, 7:1180-1191. Disponible en ligne: http://jetzlab.yale.edu/sites/default/files/Jetz%20et%20al%20EcoLett%2004.pdf

Jiofack, T., Fokunang, C., Kemeuze, V., Fongnzossie, E., Tsabang, N., Nkuinkeu, R., Mapongmetsem, P.M., Nkongmeneck, B.A. 2008. Ethnobotany and phytopharmacopoea of the South-West ethnoecological region of Cameroon. *Journal of Medicinal Plants Research*, 2(8): 197-206.

Jiofack, T., Ayissi, I., Fokunang, C., Guedje, N., Kemeuze, V. 2009. Ethnobotany and phytomedicine of the upper Nyong valley forest in Cameroon. *African Journal of Pharmacy and Pharmacology*, 3(4): 144-150.

Joiris, D.V., Bahuchet, S. 1993. Afrique équatoriale. Dans: *Situation des populations indigènes des forêts denses humides:* 387-448. Commission européenne, Bruxelles.

K

Kahindo Muhongya, J.M. 2012. Potentiel en produits forestiers autres que le bois d'œuvre dans les formations forestières de la région de Kisangani. Cas des rotins *Eremospatha haullevilleana* De Wild. et *Laccosperma secundiflorum* (P. Beauv.) Küntze de la réserve forestière de Yoko (Povince Orientale, RD Congo). Thèse Docteur en sciences. UNIKIS, DRC.

Kanmegne, J., Oyono Belinga, J.M., Degrande, A., Tchoundjeu, Z., Tiki-Manga, T. 2007. Gender analysis in the commercialization of *Gnetum africanum/buchholzianum* in the Lékié division in Cameroon. *Journal of Food, Agriculture & Environment*, 5(1): 243-247.

Kengue, J. 2002. *Safou: Dacryodes edulis*. International Centre for Underutilised Crops, Southampton, Royaume-Uni.

Kengue, J., Kengni, E., Ewedje, E.E., Tabuna, H. 2011. *Conservation et utilisation durables des ressources génétiques des espèces ligneuses alimentaires prioritaires de l'Afrique subsaharienne.* Bioversity International, Rome. Disponible en ligne: http://citarea.cita-aragon.es/citarea/bitstream/10532/1688/2/2011_340FR.pdf

Kiss, A. 2004. Making Biodiversity Conservation a Land-Use Priority. Dans: McShane, T., Wells, M. (Eds.), *Getting Biodiversity Projects to Work* (98-123). Columbia University Press, New York.

Koffi, Y.A. 2005. *Sciage artisanal, transformation et commerce du bois d'oeuvre du Cameroun à destination de l'arc soudano-sahélien*. Mémoire, CNEARC, Montpellier.

Koppert, G., Dounias, E., Froment, A., Pasquet, P. 1996. Consommation alimentaire dans trois populations forestières de la région côtière du Cameroun; Yassa, Mvae et Bakola. Dans: Hladik, C.M., Hladik, A., Pagezy, H., Linares, O.F., Koppert, G., Froment, A. (Eds.). *L'Alimentation en forêt tropicale, interactions bioculturelles et perspectives de développement. Volume 1, Les ressources alimentaires: production et consommation*. 477-496. UNESCO, Paris.

Kusimba, S.B. 1999. Hunter-Gatherer Land Use Patterns in Later Stone Age East Africa. *Journal of Anthropological Archaeology*, 18(2): 165-200.

L

Laburthe-Tolra, P. 1981. *Les seigneurs de la forêt*. Publication de la Sorbonne, Paris.

Ladipo, D.O. 1998. 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 West and Central Africa. Dans: Sunderland, T.C., Clark, L.E., Vantomme, P., *Non-Wood Non-Wood Forest Products in Central Africa; Current research issues and prospects for conservation development*. FAO, Limbé, Cameroun.

La Frankie, J.V. 1994. Population Dynamics of some Tropical Trees that Yield Non-timber Forest Products. *Economic Botany*, 48(3): 301-309.

Lagarde Betti, J. 2007a. *Perspectives d'une fiscalité appropriée promouvant le commerce et la gestion durable des produits forestiers non ligneux en Afrique centrale*. Projet Renforcement

de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux, GCP/RAF/398/GER. Ministère des Forêts et de la Faune, FAO-COMIFAC-GTZ.

Lagarde Betti, J. 2007b. *Stratégie/plan d'action pour une meilleure collecte des données statistiques sur les produits forestiers non ligneux au Cameroun et recommandations pour les pays de la COMIFAC*. Ministère Fédéral d'Allemagne pour l'Alimentation, l'Agriculture et la Protection des Consommateurs, COMIFAC, FAO, Yaoundé. Disponible en ligne: http://www.fao.org/forestry/14285-0f206abff017b5e52f65fec92fab01e03.pdf

Laird, S.A. 1997. The management of forests for timber and non-wood forest products in Central Africa. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Non-Wood Forest Products of Central Africa: Current Research Issues and Prospects for Conservation and Development:* 51-60. FAO, Rome. Disponible en ligne: http://www.fao.org/docrep/x2161e/x2161e00.htm

Laird, S.A., Ingram, V., Awono, A., Ndoye, O., Sunderland, T.C.H., Fotabong, E.L., Nkuinkeu, R. 2010. Integrating Customary Statutory Systems: The Struggle to Develop a Legal and Policy Framework for NTFPs in Cameroon. Dans: Laird, S.A., McLain, R., Wynberg R.P. 2010. *Wild Product Governance: Finding Policies that Work for Non-timber Forest Products:* 53-70, Earthscan, Londres.

Leakey, R.R.B. 2004. *Domestication and marketing of novel crops for ecoagriculture*. Draft. International Ecoagriculture Conference and Practitioners' Fair. ICRAF House, Nairobi.

Leakey, R.R.B., Mesén, J.F., Tchoundjeu, Z., Longman, K.A., Dick, J.McP., Newton, A., Matin, A., Grace, J., Munro, R.C., Muthoka, P.N. 1990. Low technology techniques for the vegetative propagation of tropical trees. *Commonwealth Forestry Review*, 69(3): 247-257. Disponible en ligne: https://assets.publishing.service.gov.uk/media/57a08dd3e5274a31e0001a52/CFR69_Low-Technology.pdf

Leakey, R.R.B., Simons, A.J. 2000. When does vegetative propagation provide a viable alternative to propagation by seed in forestry and agroforestry in the tropics and sub-tropics? Dans: Wolf, H., Albrecht, J. (Eds.), *Problems of Forestry in Tropical and Sub-tropical Countries – Procurment of Forest Seed – The Example of Kenya:* 67-81. Ulmer Verlag, Allemagne.

Leakey., R.R.B., Tchoundjeu, Z. 2001. Diversification of tree crops: domestication of companion crops for poverty reduction and environmental services. *Experimental Agriculture*, 37(3): 279-296.

Leakey, R.R.B., Tchoundjeu, Z., Schreckenberg, K., Shackleton, S.E., Shackleton, C.M. 2005. Agroforestry Tree Products (AFTPs): Targeting Poverty Reduction and Enhanced Livelihoods. *International Journal of Agricultural Sustainability*, 3(1): 1-23. Disponible en ligne: http://www.worldagroforestry.org/treesandmarkets/inaforesta/documents/agrof_cons_biodiv/Agroforestry%20tree%20products.pdf

LeBreton, M., Prosser, A.T., Tamoufe, U., Sateren, W., Mpoudi-Ngole, E., Diffo, J.L.D., Burke, D.S., Wolfe, N.D. 2006. Patterns of bushmeat hunting and perceptions of disease risk among central African communities. *Animal Conservation*, 9: 357-363.

Lefroy, E.C., Hobbs, R.J., O'Connor, M.H., Pate, J.S. (Eds.). 1999. Agriculture as a Mimic of Natural Ecosystems. *Agroforest. Syst.* (45): 275-289.

Leplaideur, A. 1985. *Les systèmes agricoles en zone forestière: les paysans du Centre et du Sud Cameroun.* Thèse de doctorat, Université Montpellier 1.

Lescuyer, G., Karsenty, A., Eba'a Atyi, R. 2009a. *Un nouvel outil de gestion durable des forêts d'Afrique centrale: les paiements pour services environnementaux*. Dans: De Wasseige *et al.* (Eds.). 2009. *Les forêts du bassin du Congo – État des forêts 2008.* Office des publications de l'Union européenne. Luxembourg.

Lescuyer, G., Eba'a, R.A., Cerutti, P. 2009b. *Consommations nationales de bois d'oeuvre en Afrique centrale: un enjeu majeur pour la gestion forestiere durable*. World Forestry Congress XIII 2009 FAO. Buenos Aires, Argentine.

Letouzey, R. 1979. *Vegetation, In Atlas de la Republique Unie du Cameroun*. London, edited by Laclavere, G. pp. 20–24.

Levang, P., Michon, G., De Forestra, H. 1996. De la jachère arborée aux agroforêts, des stratégies paysannes adaptées à des milieux de fertilité médiocre. Dans: *Fertilité du milieu et stratégies paysannes sous les tropiques humides*. CIRAD, Ministère de la coopération, Montpellier.

Levang, P., Michon, G., de Foresta, H. 1997. Agriculture forestière ou agroforesterie? *Bois et Forêts des Tropiques*, 251(1): 29-42.

Levang, P., Dounias, E., Sitorus, S. 2005. Out of the forest, out of poverty? Dans: *Forests, Trees and Livelihoods*, 15: 211-235. Disponible en ligne: http://www.cifor.org/publications/pdf_files/articles/ALevang0501.pdf

Levang, P., Sitorus, S., Dounias, E. 2007. City Life in the Midst of the Forest: A Punan Hunter-Gatherer's Vision of Conservation and Development. *Ecology and Society*, 12(1): 18. Disponible en ligne: http://www.ecologyandsociety.org/vol12/iss1/art18/

LG Bushmeat. 2009. Report of the liaison group meeting on bushmeat. First meeting, Buenos Aires, 15-17 October 2009.Convention on biological diversity. Buenos Aires.

Loubelo, E. 2012. *Impact des produits forestiers non ligneux (PFNL) sur l'économie des ménages et la sécurité alimentaire: cas de la République du Congo*. Thèse de doctorat, Université Rennes 2.

Loumeto, J.J. 2010. *Gestion et valorisation des PFNL au Congo. Revue bibliographique.* Projet FORENET. Brazzaville, Congo. Disponible en ligne: http://www.cifor.org/forenet/publications/pdf_files/PFNL_en_Congo_2010.pdf

M

Maheshwari, P., Vasil, V. 1961. *Gnetum*. Botanical Monograph, 1: 131-154. CSIR, New Delhi, Inde.

Maille, P. 2001. *Bibliography NTFPs Central Africa*. US Forest Service.

Makazi, L.C. 2004. Evaluation of the channels of commercialisation of bushmeat trade around Socambo Lobeke National Park. A consultancy report to WWF Southeast Project.

Makueti, J.T., Tchoundjeu, Z., Kalinganire, A., Nkongmeneck, B.A., Asaah, E., Tsobeng, A., Kouodiekong, L. 2012a. Influence de la provenance du géniteur et du type de pollen sur la fructification sous pollinisation contrôlée chez *Dacryodes edulis* (Burseraceae) au Cameroun. *International Journal of Biological and Chemical Sciences*, 6(3): 1202-1222.

Makueti, J.T., Tchoundjeu, Z., Kalinganire, A., Nkongmeneck, B.A., Kouodiekong, L., Asaah, E., Tsobeng, A. 2012b. Morphological traits of control-pollinated fruits in African

plum (*Dacryodes edulis* (G.Don). Lam.) using multivariate statistical techniques. *International Journal of Agronomy and Agricultural Research (IJAAR)*, 2(8): 1-17.

Mala, W.A. 2009. *Knowledge Systems and Adaptive Collaborative Management of Natural Resources in Southern Cameroon: Decision Analysis of Agrobiodiversity for Forest-Agriculture Innovations*. Thèse, Université de Stellenbosch.

Mala, W.A., Geldenhuys, C.J., Prabhu, R. 2008. A Predictive Model of Local Agricultural Biodiversity Knowledge Management in Southern Cameroon. *Biodiversity*, 9(1&2): 96-101.

Mala, W.A., Geldenhuys, C.J., Prabhu, R. 2010. Local conceptualisation of nature, forest knowledge systems and adaptive management in Southern Cameroon. *Indilinga: African Journal of Indigenous Knowledge Systems*, 9(2): 172-184.

Malleson, R. 1999. Community Management of Non-Wood Forest Resources: A Case Study from the Korup Forest, Cameroon. Dans: Sunderland, T.J., Clark, L.E., Vantomme, P. (Eds.), *Non-Wood Forest Products of Central Africa: Current Research Issues and Prospects for Conservation and Development:* 117-122. FAO, Rome. Disponible en ligne: http://discovery.ucl.ac.uk/1353790/

Manirakiza, D. 2007. *Étude de la consommation d'Irvingia spp. (mangue sauvage) et Ricinodendron heudelotii (njansang) à Yaoundé et Libreville.* Rapport final dans le cadre du projet FAO GCP/RAF/398/GER: «Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux». FAO, COMIFAC, Ministère fédéral d'Allemagne pour l'alimentation, l'agriculture et la protection des consommateurs, Yaoundé, Cameroun. Disponible en ligne: http://www.fao.org/forestry/14248-038a4e9e08209487b8e1e902ee9be01ee.pdf

Manirakiza, D., Awono, A., Owona, H., Ingram, V. 2009. *Étude de base de la filière Fumbwa (Gnetum spp.) en RDC*. Projet GCP/RAF/408/EC, « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale ». Yaoundé: FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC, CIFOR: 79.

Mapedza, E. 2007. Keeping CAMPFIRE going: Political uncertainty and natural resources management in Zimbabwe. *Gatekeeper Series 133*. IIED. Disponible en ligne: http://pubs.iied.org/pdfs/14554IIED.pdf

Marshall, E., Newton, A.C., Schreckenberg, K. 2003. Commercialisation of non-timber forest products: first steps in analyzing the factors influencing success. *International Forestry Review*, 5(2): 128-137.

Marzin, J. 1993. Rappel historique et mise en garde contre quelques idées reçues concernant le concept d'innovation en économie. Dans: Muchnik, J., *Alimentation, techniques et innovations dans les régions tropicales*: 455-472. L'Harmattan, Paris, France.

Masuch, J., Ndoye, O., Chupezi Tieguhong, J.C, Mala, W.A., Asseng Zé, A. 2011. Impact of laws and regulations on the use of non-wood forest products and the wellbeing of forest dependent communities in Central Africa. *Nature & Faune*, 25(2): 77-80.

Mauduit, J.A. 1962. *L'Afrique primitive*. Collection Connaissance de l'Afrique. Société continentale d'éditions modernes illustrées, Paris.

Mayaka, T.B., Stigter, J.D., Heitkönig, I.M.A., Prins, H.H.T. 2004. A population dynamics model for the management of Buffon's kob (Kobus kob kob) in the Bénoué National Park Complex, Cameroon. *Ecological Modelling*, 176(1-2): 135-153.

Mayaux, P., Achard, F., Malingreau, J.P. 1998. Global tropical forest area measurements derived from coarse resolution satellite imagery: A comparison with other approaches. *Environmental Conservation*, 25: 37-52.

Mba, L. 2002. *Essai de droit coutumier pahouin*. Raponda-Walker, Libreville, Gabon.

Mba Abessole, P. 2006. *Aux sources de la culture Fang*. L'Harmattan, Paris.

Mbete, R.A., Banga-Mboko, H., Racey, P., Mfoukou-Ntsakala, A., Nganga, I., Vermeulen, C., Doucet, J.L., Hornick, J.L., Leroy, P. 2011. Household bushmeat consumption in Brazzaville, the Republic of the Congo. *Tropical Conservation Science*, 4(2): 187-202. Disponible en ligne: http://tropicalconservationscience.mongabay.com/content/v4/11-06-27_187-202_Mbete_et_al.pdf

Mbile, P., Pa'ah, P., Popoola, L., Tchoundjeu, Z., Nchoutmboube, J., Ndzomo-Abanda, G. 2005. *Community-Based Stock Assessment and Monitoring System (CBSAMS) for Non-Wood Forest Products in Community Forests in Cameroon: A methodological guide.* IUFRO World Forest Congress, groupe de recherche 5.11.

Mbile, P., Ngaunkam, P., Besingi, M., Mfoumou, C., Degrande, A., Tsobeng, A., Sado, T. Menimo, T. 2009. Farmer Management of Cocoa Agroforests in Cameroon: Impacts of Decision Scenarios on Structure and Biodiversity of Indigenous Tree Species. *Biodiversity*, 10(4): 12-19.

Mbolo, M. 2002. *La collecte et l'analyse des données statistiques sur les produits forestiers non ligneux. Une étude pilote au Cameroun*. Projet GCP/INT/679/EC «Collecte et analyse de données pour l'aménagement durable des forêts dans les pays ACP: joindre les efforts nationaux et internationaux». Projet GCP/RAF/354/EC «Programme d'aménagement durable des forêts dans les pays africains de l'ACP». FAO, Rome. Disponible en ligne: http://www.fao.org/docrep/019/y7384f/y7384f.pdf

Mbolo, M., Asseng Zé, A., Walter, S. 2006. *Les perspectives de la certification des PFNL en Afrique centrale*. FAO, Rome.

Mbomio, D.O. 2010. *Revue bibliographie complète sur les produits forestiers non ligneux (PFNL) en Guinée équatoriale*. Atelier sous-régional sur «l'harmonisation des revues nationales sur les produits forestiers non ligneux (PFNL) en Afrique centrale». FORENET, Bata, Guinée équatoriale. Disponible en ligne: http://www.cifor.org/forenet/publications/pdf_files/PFNL_en_Guinea_Equatoriel_2010.pdf

Medicinal Plants Specialist Group. 2007. *International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP).* MPSG/SSC/IUCN, WWF Allemagne et TRAFFIC. BfN, Bonn, Allemagne. Disponible en ligne: https://www.bfn.de/fileadmin/MDB/documents/service/skript195.pdf

Mercader, J., Runge, F., Vrydaghs, L., Doutrelepont, H, Ewango, C.E.N., Juan-Tresseras, J. 2000. Phytoliths from archaeological sites in the tropical forest of Ituri, Democratic Republic of Congo. *Quaternary Research*, 54(1): 102-112.

Meunier, Q., Federspiel, M., Moumbogou, C., Grégoire, B., Doucet, J.L., Vermeulen, C. 2011. The first community forests of Gabon: towards sustainable local forest management? *Nature & Faune*, 25(2): 40-45.

Mezogue Ntoune, D.F., Julve, C. 2006. *Transformation et valorisation des produits forestiers non ligneux: le Njansang (Ricinodendron heudelotii).* Projet «Développement d'alternatives communautaires à l'exploitation forestière illégale» (DACEFI), fiche technique. WWF-CARPO.

Mialoundama, F., Jonas, N., Léon, N., Elie, N.M., Enoch, L., Attibayeba, René, S. 2008. *Analyse de l'impact socioéconomique des principaux produits forestiers non ligneux sur l'économie des ménages et l'économie nationale en République du Congo*. Rapport final. Faculté des sciences, Département de biologie et physiologie végétale. Université Marien Ngouabi, Brazzaville, Congo.

Michon, G. 2005a. NTFP development and poverty alleviation: is the policy context favourable? Dans: Pfund, J.L., Robinson, P. (Eds.), *Non-timber Forest Products: Between Poverty Alleviation and Market Forces*: 20-25. Intercooperation, Bern.

Michon, G. 2005b. Domesticating forests: how farmers manage forest resources. IRD/CIFOR, Paris/Bogor. Disponible en ligne: http://www.cifor.org/publications/pdf_files/Books/BMichon0501E1.pdf

Michon, G., De Foresta, H., Levang, P., Verdeaux, F. 2007. Domestic Forests: a New Paradigm for Integrating Local Communities' Forestry into Tropical Forest Science. *Ecology and Society*, 12(2): 1.

MINFOF/FAO. 2005. *Évaluation des ressources forestières nationales du Cameroun 2003-2004: Résumé des résultats de l'Inventaire Forestier National.* Ministère des Forêts et de la Faune/Organisation des Nations Unies pour l'alimentation et l'agriculture, Yaoundé/Rome. Disponible en ligne: http://www.fao.org/forestry/16296-083d4029a3c34cb9aac53d1ede76a8885.pdf

Montaigne, E. 1993. L'étude des innovations technologiques: réflexion méthodologique. Dans: Muchnik, J., *Alimentation, techniques et innovations dans les régions tropicales:* 473-495. L'Harmattan, Paris, France.

Moukend Mandjoum, M.A. 2009. *Étude comparative des facteurs influençant l'efficacité des groupes dans les régions du Centre et du Nord-Ouest au Cameroun*. Mémoire de fin d'études. Faculté d'Agronomie et des Sciences Agricoles, l'Université de Dschang, Cameroun.

Mouvement mondial pour les forêts tropicales. 2004. *Forêts communautaires: équité, utilité, pérennité*. Novib-IUCN.

Muam, C.A. 2011. Le paysage tri-national de la Sangha dans le bassin du Congo: Dimensions socio-économiques de la zone transfrontalière de conservation. *Nature & Faune*, 25(2): 55-60. Disponible en ligne: http://www.fao.org/3/a-am723f.pdf

Muchnik, J. 1993. *Alimentation, techniques et innovations dans les régions tropicales:* 473-495. L'Harmattan, Paris, France.

Mutambwe, S. 2010. *Revue nationale sur les produits forestiers non ligneux (PFNL). Cas de la République démocratique du Congo*. Atelier sous-régional sur «l'harmonisation des revues nationales sur les produits forestiers non ligneux (PFNL) en Afrique centrale». FORENET. Disponible en ligne: http://www.cifor.org/forenet/publications/pdf_files/PFNL_en_RDC_2010.pdf

Mve Ondo, B. 1991. *Sagesse et initiation à travers les contes, mythes et légendes fang*. Centre culturel français Saint-Exupéry, Libreville-Paris.

Mveng, E. 1985. *Histoire du Cameroun*. Tome II. CEPER, Yaoundé.

Mviena, P. 1970. *Univers culturel et religieux du peuple Beti*. Imprimerie Saint-Paul, Yaoundé.

N

Nakuna Tsala, A.M. 2009. *Analyse du fonctionnement de la filière njansang (Ricinodendron heudelotii): estimations des coûts et des marges des acteurs (cas de la région du Centre, Cameroun).* Mémoire de fin d'études. Faculté d'agronomie et des sciences agricoles, Université de Dschang, Cameroun.

Nasi, R., Brown, D., Wilkie, D., Bennett, E., Tutin, C., Van Tol, G., Christophersen, T. 2008. *Conservation and use of wildlife-based resources: the bushmeat crisis*. Secretariat of the Convention on Biological Diversity (Montréal), CIFOR (Bogor). Technical Series, 33: 1-50. Disponible en ligne: http://www.cifor.org/publications/pdf_files/media/cbd-ts-33-en.pdf

Nasi, R., Taber, A., Van Vliet, N. 2011. Empty forests, empty stomachs? Bushmeat and livelihoods in the Congo and Amazon Basins. *International Forestry Review*, 13: 355-368. Disponible en ligne: http://www.cifor.org/publications/pdf_files/articles/ANasi1101.pdf

Nations Unies. 2011. *World Population Prospects: The 2010 Revision. CD-ROM Edition.* Nations Unies, Département des affaires économiques et sociales, Division de la population, New York.

Ndam, N., Nkefor, J.P., Blackmore, P. 2001. Domestication of *Gnetum africanum* and *Gnetum buchholzianum* (Gnetaceae), over-exploited wild forest vegetables of the Central Africa Region. *Systematics and Geography of Plants*, 71: 739-745.

Ndam, N., Tonye, M.M. 2004. "Chop, but no broke pot": the case of *Prunus africana* on Mount Cameroon. Dans: Sunderland, T.C.H., Ndoye, O. (Eds.), *Forest Products, Livelihoods and Conservation: Case Studies of Non-timber Forest Product Systems*, Vol. 2 – Africa: 37-52. CIFOR, Bogor, Indonésie.

Ndong, N.T. 1970. *Le Mvett*. Présence africaine, Paris.

Ndoye, O. 1994. *The Potential Role of Markets in Forest Resources Degradation: An Example of Palm Wine in Central Africa*. Communication à l'Atelier sur les marchés des produits forestiers non ligneux issus des arbres, IFPRI-ICRAF-CIFOR, Annapolis, Maryland, USA.

Ndoye, O. 2011. Produits forestiers non ligneux et amélioration des moyens d'existence des populations rurales: opportunités et défis en Afrique centrale. Présentation au Congrès international pour les forêts communales, Yaoundé.

Ndoye, O., Ruiz-Pérez, M., Eyebe, A. 1997. The Markets of Non-timber Forest Products in the Humid Forest Zone of Cameroon. *Rural Development Forestry Network*, Network Paper 22c, ODI, Londres. Disponible en ligne: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1168.pdf

Ndoye, O., Ruiz-Pérez, M. 1999. Commerce transfrontalier et intégration régionale en Afrique centrale: cas des produits forestiers non ligneux. *Bulletin Arbres, Forêts et Communautés Rurales*, 17: 4-12.

Ndoye, O., Tieguhond, J.C. 2004. «Forest resources and rural livelihoods: the conflict between timber and non-timber forest products in the Congo Basin». *Scandinavian Journal of Forest Research*, 19(suppl. 4): 1-9.

Ndoye, O., Awono, A., Preece, L., Toirambe, B. 2007. Marchés des produits forestiers non ligneux dans les provinces de l'Équateur et de Bandundu: présentation d'une enquête de terrain.

Dans: Croizer, C., Trefon, T. (Eds.), *Quel avenir pour les forêts de la République démocratique du Congo?*: 68-70. Coopération technique belge (CTB), Bruxelles.

Ndoye, O., Marcel, U.K. 2010. Mobilization and capacity-building for small and medium-sized enterprises involved in the non-wood forest products value chains in Central Africa. Dans: *Policy Brief*, 5.

Neba, N.E. 2007. Population dynamics, rural livelihoods and forest protection projects in Sub-Saharan Africa: experiences from Santa, Cameroon. *International Journal of Sustainable Development and World Ecology*, 14(3): 250-259.

Nepstad, D.C., Schwartzman, S. (Eds.). 1992. *Non-timber Products from Tropical Forests: Evaluation of a Conservation and Development Strategy*. Advances in Economic Botany, 9. The New York Botanical Garden, New York.

Neumann, R.P., Hirsch, E. 2000. *Commercialisation of Non-timber Forest Products: Review and Analysis of Research*. CIFOR, Bogor, Indonésie.

N'Gasse, G. 2010. *Revue nationale sur les produits forestiers non ligneux: PFNL (Cas de la République centrafricaine: RCA)*. FORENET, Brazzaville. Disponible en ligne: http://www.cifor.org/forenet/publications/pdf_files/PFNL_en_RCA_2010.pdf

Ngobo, M.P. 2002. *Ecology and socio-economic importance of short fallows in humid forest zone of southern Cameroon*. Thèse de doctorat, Université de Wales, Bangor.

Ngo Mpeck, M.L., Asaah, E., Tchoundjeu, Z., Atangana, A.R. 2003. Strategies for the domestication of *Ricinodendron heudelotii*: Evaluation of variability in natural populations from Cameroon. *Food, Agriculture and Environment,* 1(3&4): 257-262.

Ngoun, J. 1999. Pygmies and industrial logging: The case of the Bagyeli of Southern Cameroon. *Indigenous Affairs*, (2): 14-15.

Ngoye, A. 2010. *Revue bibliographique sur les produits forestiers non ligneux (PFNL): Cas du Gabon*. Atelier sous-régional sur «l'harmonisation des revues nationales sur les produits forestiers non ligneux (PFNL) en Afrique centrale». FORENET. Disponible en ligne: http://www.cifor.org/forenet/publications/pdf_files/PFNL_en_Gabon_2010.pdf

Ngono, L.D., Ndoye, O. 2004. Njansang and bush mango: Cameroonian seeds in national and international markets. Dans: López, C., Shanley, P. (Eds.), *Riches of the forests: For health life and spirit in Africa*: 21-24. CIFOR, Indonésie. Disponible en ligne: http://www.cifor.org/publications/pdf_files/Books/Restution-Africa_case/NTFP-Africa-case-part2.pdf

Ngueguim, J.R. 2001. Étude de la chasse villageoise dans l'unité technique opérationnelle Campo-Ma'an: Cas du secteur Bifa. Rapport final.

Ngwasiri, C.N., Djeukam, R., et Vabi, M.B. 2002. *Legislative and institutional instruments for the sustainable management of non-timber forest products (NTFP) in Cameroon: Past, Present and Unresolved Issues*. Projet Partenariats pour le développement de forêts communautaires (PDFC). MINEF, Yaoundé, Cameroun.

Njiforti, H.L. 1996. Preferences and present demand for bushmeat in north Cameroon: some implications for wildlife conservation. *Environmental Conservation*, 23(2): 149-155.

Nkefor, J.P. 2000. *From the forest to the kitchen: Following the market chain of eru, an important non-timber forest product in Cameroon*. Jardin botanique de Limbé.

Nkem, J., Somorin, O., Jum, C., Idinoba, M., Bele, Y, Sonwa, D. 2012. Profiling climate change vulnerability of forest indigenous communities in the Congo Basin. *Mitigation and Adaptation Strategies for Global Change*: 1-21.

Nkeng, P.F., Ingram, V., Awono, A., Tientcheu, M.L.A. 2009. *Assessment of Prunus africana bark exploitation methods and sustainable exploitation in the South west, North-West and Adamaoua regions of Cameroon.* Projet GCP/RAF/408/EC, « Mobilisation et renforcement des capacités des petites et moyennes entreprises impliquées dans les filières des produits forestiers non ligneux en Afrique centrale ». FAO-CIFOR-SNV-World Agroforestry Center-COMIFAC, Yaoundé.

Nkeoua, G., Boundznga, G.C. 1999. *Données sur les produits forestiers non ligneux en République Du Congo*. Forestry Statistics and Data Collection – AFDCA/TN/08 Projet GCP/INT/679/EC Programme de partenariat EC-FAO (1998-2000). FAO, Brazzaville.

Nolte, C., Duguma, B., Wendt, J. 1997. Research and development of fallows in the humid forest zone of Cameroon. *A working paper prepared for the launching of EPHTA Humid Forest Margins Benchmark*. Yaoundé, Hilton, May 26-28.

Noss, A.J. 1998. Challenges to Nature Conservation with Community Development in Central African Forests. *Oryx*, 31(3): 180-187.

Noubissie, E., Chupezi, T.J. et Ndoye, O. 2008. *Analyse des aspects socioéconomiques des produits forestiers non-ligneux (PFNL) en Afrique centrale.* Synthèse des rapports d'études réalisées dans le cadre du projet GCP/RAF/398/GER, « Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux ». FAO. Yaoundé, Cameroun.

Nnama, A. 1998. Crise cacaoyère, exode rural et dégradation de l'environnement dans le Sud Cameroun forestier. Dans: Auclair, L., Gubry, P., Picouet, M., Sandron, EF. (Eds.), *Régulations démographiques et environnement. Résumés et communications:* 319-320. ORSTOM; CEPED; LPE, Paris.

Ntiamoa-Baidu, Y. 1997. Wildlife and food security in Africa. *FAO Conservation Guide 33*. Rome, Italy.

O

Oates, J.F. 1996. Habitat alteration, hunting and the conservation of folivourous primates in African forests. *Australian Journal of Ecology*, 21: 1-9.

Obenga, T. 1974. *Afrique centrale précoloniale. Documents d'histoire vivante*. Présence africaine, Paris.

Ortiz, E.G. 2002. Brazil Nut (Bertholletia excela). Dans: Shanley, P., Pierce, A.R., Laird, S.A., Guillen, A. (Eds.), *Tapping the Green Market: Certification and Management of Non-timber Forest Products*: 61-74. Earthscan, Londres.

Ostrom, E. 2009. A General Framework for Analyzing Sustainability of Socio-Ecological Systems. *Science*, 325: 419-422. Disponible en ligne: http://science.sciencemag.org/content/325/5939/419

Owono, J.F. 2011. *Pauvreté ou paupérisation en Afrique: Une étude exegético-ethique de la pauvreté chez les Beti-Fang du Cameroun*. University of Bamberg Press, Bamberg.

Oyono, P.R. 2002. Usages culturels de la forêt au Sud Cameroun: rudiments d'écologie sociale et matériau pour la gestion du pluralisme. *Africa*, LVII(3): 334-355.

Oyono, P.R., Mala, W.A., Tonyé, J. 2003. Rigidity versus adaptation: Contribution to the debate on agricultural viability and forest sustainability in Southern Cameroon. *Culture and Agriculture*, 25(2): 32-40.

Oyono, B.J.M. 2006. *Production, exploitation et commercialisation du Gnetum spp. dans le département de la Lékié, Cameroun*. Mémoire d'ingénieur, Université de Dschang.

P

Pagezy, H. 1996. Importance des ressources naturelles dans l'alimentation du jeune enfant en forêt tropicale inondée. Dans: *L'alimentation en forêt tropicale, interactions bioculturelles et perspectives de développement. Volume 1, Les ressources alimentaires: Production et Consommation*. Hladik, C.M., Hladik, A., Pagezy, H., Linares, O.F., Koppert, G.J.A., Froment, A. (Eds.). UNESCO, Paris. 569-588.

Palm, A.C., Vosti, A.S., Sanchez, A.P., Ericksen, J.P. (Eds.). 2005. *Slash-and-Burn Agriculture: The Search for Alternatives*. Columbia University Press, New York. Disponible en ligne: http://www.asb.cgiar.org/PDFwebdocs/Slash-and-Burn%20Agriculture-The-Search-for-Alternatives.pdf

Paumgarten, F. 2007. *The Significance Of The Safety-Net Role Of NTFPs In Rural Livelihoods, South Africa.* Environmental Sciences. Grahamstown, South Africa. Rhodes University. Masters in Science.

Paumgarten, F., Shackleton, C. 2009. Wealth Differentiation in Household Use and Trade in Non-timber Forest Products in South Africa. *Ecological Economics*, 68: 2950-2959. Disponible en ligne: https://cgspace.cgiar.org/handle/10568/20214

Persegol, L. Houdet, J,. Germaneau, C. 2012. Le Protocole de Nagoya, entre espoir et doutes – quelle transparence des entreprises? Disponible en ligne: http://www.synergiz.fr/le-protocole-de-nagoya-entre-espoir-et-doutes-quelle-transparence-des-entreprises/

Peters, C.M. 1994. *Sustainable Harvest of Non-timber Plant Resources in Tropical Moist Forest: An Ecological Primer.* Biodiversity Support Program, World Wildlife Fund, Washington, D.C., USA.

Peters, C.M. 1999. Recherche écologique en vue d'une exploitation durable des produits forestiers non ligneux (PFNL): généralités. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Les produits forestiers non ligneux en Afrique centrale: Recherches actuelles et perspectives pour la conservation et le développement:* 21-37. FAO.

Peters, C.M., Gentry, A., Mendelsohn, R.O. 1989. Valuation of an Amazonian Rainforest. *Nature*, 339: 655-656.

Peterson, H.C., Wysocki, A., Harsh, S.B. 2001. Strategic choice along the vertical coordination continuum. *International Food and Agribusiness Management Review*, 4(2): 149-166.

Pingali, P., Khwaja, Y., Meijer, M. 2005. *Commercializing small farmers: reducing transaction costs*. ESA Working paper No 05-08. FAO, Rome. Disponible en ligne: http://www.fao.org/3/a-af144t.pdf

Postnote. 2005. *The bushmeat trade.* Parliamentary Office of Science and Technology. February. No. 236. Royaume-Uni.

Poulsen, J.R., Clark, C.J. 2010. Congo Basin timber certification and biodiversity conservation. *ETFRN News*, 51: 55-60.

Pouris, A., Pouris, A. 2009. The state of science and technology in Africa (2000-2004): A scientometric assessment. *Scientometrics*, 79(2): 297-309.

Phillips, O. 1993. The Potential for Harvesting Fruits in Tropical Rainforests: New Data from Amazonian Peru. *Biodiversity and Conservation*, 2: 18-38.

Plotkin, M., Famolare, L. (Eds.). 1992. *Sustainable Harvest and Marketing of Rainforest Products*. Conservation International. Island Press, Washington, D.C., USA.

Prance, G.T. 1992. Rainforest Harvest: An Overview. Dans: Counsell, S., Rice, T. (Eds.), *The Rainforest Harvest: Sustainable Strategies for Saving the Tropical Forests*: 21-25. Friends of the Earth Trust, Londres.

Profizi, J., Makita-Madzou, J., Milandou, J., Karanda, C., Motom, M., Bitsindou, I. 1993. *Ressources végétales non ligneuses des forêts du Congo*. Brazzaville: Université Marien Ngouabi (Faculté des Sciences).

Protocole de Nagoya. 2010. Disponible en ligne: https://www.cbd.int/abs/doc/protocol/nagoya-protocol-fr.pdf

Putz, F.E., Blate, G.M., Redford, K.H., Fimbel, R., Robinson, J. 2001. Tropical Forest Management and Conservation of Biodiversity: An Overview. *Conservation Biology*, 15(1): 7-20.

R

Redford, K. 1992. The Empty Forest. *BioScience*, 42(6): 412-422. Disponible en ligne: http://enbt.jbrj.gov.br/mestrado_profissional/seminario/7_Redford%201992.pdf

Redford, K., Stearman, A.M. 1993. Forest-dwelling Native Amazonians and the Conservation of Biodiversity: Interests in Common or in Collision? *Conservation Biology*, 7: 248-255

Redmond, I., Aldred, T., Jedamzik, K., Westwood, M. 2006. *Recipes for survival: Controlling the bushmeat trade*. World Society for the Protection of Animals, Londres, Royaume-Uni.

République du Cameroun. 2008. *Programme sectoriel forêt et environnement: synthèse, état des lieux de la recherche*. MINFOF.

Richards, M. 1993. The Potential for Non-timber Forest Products in Sustainable Forest Management in Amazonia. *Commonwealth Forestry Review*, 72: 21-27.

Rist, L., Uma Shaanker, R., Milner-Gulland, E., Ghazoul, J. 2010. The Use of Traditional Ecological Knowledge in Forest Management: An Example from India. *Ecology and Society*, 15(1): 3.

Robiglio, V. 2008. *Beyond slash-and-burn: landscape ecology of shifting cultivation systems in Southern Cameroon.* Thèse de doctorat, Université de Wales, Bangor.

Rodrigues, A.S.L., Andelman, S.J., Bakarr, M.I., Boitani, L., Brooks, T.M., Cowling, R.M., Fishpool, L.D.C., da Fonseca, G.A.B., Gaston, K.J., Hoffmann, M., Long, J.S., Marquet, P.A.,

Pilgrim, J.D., Pressey, R.L., Schipper, J., Sechrest, W., Stuart, S., Underhill, L.G., Waller, R.W., Watts, M.E.J., Yan, X. 2004. Effectiveness of the Global Protected Area Network in Representing Species Diversity. *Nature*, 428(6983): 640-643. Disponible en ligne: http://eprints.whiterose.ac.uk/233/1/gastonkj1.pdf

Rose, L.A. 2002. How can conservation succeed in Africa? The question of capacity. The Biosynergy Institute / Wildlife Protectors Fund. Palos Verdes, CA, USA.

Ros-Tonen, M.A.F., Wiersum, K.F. 2005. The Scope for Improving Rural Livelihoods though Non-timber Forest Products: An Evolving Research Agenda. *Forests, Trees and Livelihoods*, 15(2): 129-148.

Ruiz-Pérez, M. 2005. Poverty Alleviation and Forest Conservation: The Role of Non-timber Forest Products. Dans: Pfund, J.L., Robinson, P. (Eds.), *Non-timber Forest Products between Poverty Alleviation and Market Forces*: 8-13. Intercooperation, Bern.

Russell, J.R., Kadu, C.A.C., Jamnadass, R., Booth, A., Cordeiro, N.J., Woodhead, M., Dawson, I.K. 2009. AFLP and SSR diversity in the African fruit tree Allanblackia: implications for management of a genus newly subject to domestication for the edible oil industry. *Tree Genetics & Genomes*, (5): 517-527.

S

Santoir, C. 1992. *Sous l'empire du cacao: étude diachronique de deux terroirs camerounais.* ORSTOM, Paris.

Sayer, J.A., Wells, M.P. 2004. The pathology of projects. Dans: McShane, T.O., Wells, M.P. (Eds.), *Getting Biodiversity Projects to Work*: 35-48. Columbia University Press, New York.

Sayer, J.A., Maginnis, S. (Eds.). 2005. *Forests in Landscapes: Ecosystem Approaches to Sustainability.* Earthscan, Londres.

Scales, B., Marsden, S.J. 2008. Biodiversity in small-scale tropical agroforests: a review of species richness and abundance shifts and the factors influencing them. *Environmental Conservation*, 35: 160-172.

Schneemann, J. 1994. *Étude sur l'utilisation de l'arbre moabi dans l'est Cameroun*. Rapport final. SNV, Yaoundé.

Schreckenberg, K., Awono, A., Degrande, A., Mbosso, C., Ndoye, O. Tchoundjeu, Z. 2006. Domesticating indigenous fruit trees as a contribution to poverty reduction. *Forests, Trees and Livelihoods*, 16: 35-51. Disponible en ligne: http://www.worldagroforestry.org/downloads/Publications/PDFS/BC08004.pdf

Schumpeter, J. 1935. *Théorie de l'évolution économique*. Dalloz, Paris.

Schure, J., Ingram, V., Marien, J., Nasi, R., Dubiez, E. 2011. *Le bois énergie pour les centres urbains en République démocratique du Congo*. Brief CIFOR, Bogor, Indonésie.

Scoones, I., Melnyk, M., Pretty, J.N. 1992. *The Hidden Harvest: Wild Foods and Agricultural Systems*. IIED, Londres.

SCUC. 2006. *Ndjanssang: Ricinodendron heudelotii. Field Manual for Extension Workers and Farmers*. Université de Southampton, Southampton, Royaume-Uni.

Shackleton, S., Shackleton, C., Shanley, P. 2011. *Non-Timber Forest Products in the Global Context*. Tropical Forestry, Springer.

Shackleton, C., Shackleton, S., Shanley, P. 2011. Building a Holistic Picture: An Integrative Analysis of Current and Future Prospects for Non-Timber Forest Products in a Changing World. Dans: Shackleton, S., Mitchell, D., Shackleton, C., Campbell, B., Shanley, P. (Eds.), *Non-timber Forest Products in the Global Context*. Springer-Verlag, Heidelberg.

Shanley, P., Luz, L., Swingland, I.R. 2002. The Faint Promise of a Distant Market: A Survey of Belém's Trade in Non-timber Forest Products. *Biodiversity and Conservation*, 11(4): 615-636.

Sheil, D., Wunder, S. 2002. The Value of Tropical Forest to Local Communities: Complications, Caveats and Cautions. *Conservation Ecology*, 6(2): 9.

Shepherd, G. 2004. Poverty and forests: sustaining livelihoods in integrated conservation and development. Dans: McShane, T.O., Wells, M.P. (Eds.), *Getting Biodiversity Projects to Work*: 340-371. Columbia University Press, New York.

Shiembo, P.N. 1999. The sustainability of eru (*Gnetum africanum* and *Gnetum buchholzianum*): An over-exploited non-wood forest product from the forest of Central Africa. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Non-wood Forest Products of Central Africa: Current Research Issues and Prospects for Conservation and Development*, 61-66. FAO: Rome.

Shiembo, P., Newton, A., Leaky, R. 1996. Vegetative propogation of *Gnetum africanum* Welw., a leafy vegetable from West Africa. *Journal of Horticultural Science*, 71(1): 149-155.

Shoup, J.A. 2011. *Ethnic groups of Africa and the Middle East: An Encyclopedia*. ABC-CLIO. Oxford, England.

Sidle, J.G., Dupain, J., Beck, J., Nackoney, J., de Wasseige, C., Biang, J.D.M., Leprohon, R., Malele, S. 2012. Forest Zoning Experience in Central Africa. Dans: de Wasseige, C., de Marcken, P., Bayol, N., Hiol Hiol, F., Mayaux, Ph., Desclée, B., Nasi, R., Billand, A., Defourny, P., Eba'a, A.R. *The Forests of the Congo Basin. State of Forest 2010*: 207-231. Office des publications de l'Union européenne, Luxembourg.

Simons, A.J., Leakey, R.R.B. 2004. Tree domestication in tropical agroforestry. *Agroforestry Systems*, 61(1): 167-181.

Sizer, N., Bass, S., Mayers, J., Arnold, M., Auckland, L., Belcher, B., Bird, N., Campbell, B., Carle, J., Cleary, D, Counsell, S., Enters, T., Fernando, K., Gullison, T., Hudson, J., Kellison, B., Klingberg, T., Owen, C.N. 2005. Wood, Fuelwood, and Non-wood Forest Products. Dans: Chopra, K.R. *et al., Ecosystems and Human Well-being: Policy Responses. Findings of the Responses Working Group*. Island Press, Washington, D.C. Disponible en ligne: http://www.millenniumassessment.org/documents/document.313.aspx.pdf

Solefack, M.C.M. 2009. Influence des activités anthropiques sur la végétation du mont Oku (Cameroun). Doctorat, Faculté des Sciences, Département de biologie et physiologie végétales/ Faculté de Pharmacie, Unité dynamique des systèmes anthropisés, Université de Yaoundé I/ Université de Picardie Jules Verne, Yaoundé/Amiens.

Sonwa, D.J., Weise, S.F., Tchatat, M., Nkongmeneck, B.A., Adesina, A.A., Ndoye, O., Gockowski, J. 2001. Rôle des agroforêts cacao dans la foresterie paysanne et communautaire au Sud Cameroun. Réseau de foresterie pour le développement rural. Disponible en ligne: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1448.pdf

Sonwa, D.J., Nkem, J.N., Idinoba, M.E., Bele, M.Y., Jum, C. 2011. Building regional priorities in forests for development and adaptation to climate change in the Congo Basin. *Mitigation and Adaptation Strategies for Global Change*, 17(4): 441-450.

Southgate, D., Ritchie, M.C., Canelos, P.S. 1996. *Can Tropical Forests be Saved by Harvesting Non-timber Forest Products?* CSERGE Working Paper GEC 96-02.

Starkey, M. 2004. *Commerce and subsistence: the hunting, sale and consumption of bushmeat in Gabon*, PhD thesis, Fitzwilliam College, Université de Cambridge, Royaume-Uni.

Stewart, K.M. 2001. *The commercial bark harvest of the African cherry (Prunus africana) on Mount Oku, Cameroon: effects on traditional uses and population dynamics*. Thèse, Florida International University, Floride.

Stewart, K.M. 2003. The African Cherry (*Prunus africana*): From hoe-handles to the international herb market. *Economic Botany*, 57(4): 559-569.

Stewart, K.M. 2007. *The effects of bark harvest on the endangered African cherry, Prunus africana on Mount Oku, Cameroon*. Flag Report. S. F. C. o. t. E. Club.

Stewart, K.M. 2009. Effects of bark harvest and other human activity on populations of the African cherry (*Prunus africana*) on Mount Oku, Cameroon. *Forest Ecology and Management*, 258(7): 1121-1128. Disponible en ligne: http://fulltext.study/preview/pdf/88944.pdf

Struhsaker, T.T. 1998. A Biologist's Perspective on the Role of Sustainable Harvest in Conservation. *Conservation Biology*, 12(4): 930-932. Disponible en ligne: http://www.life.illinois.edu/ib/451/Struhsaker%20(1998).pdf

Sunderland, T.C.H. 2000. Recherches sur les rotins (Palmae) en Afrique: un produit forestier non ligneux important dans les forêts d'Afrique centrale. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Recherches actuelles et perspectives pour la conservation et le développement.*

Sunderland, T.C.H. 2011. Food Security: Why is Biodiversity Important? *International Forestry Review*, 13(3): 265-274.

Sunderland, T.C.H., Clark, L.E. Vantomme, P. 1998. *Non-Wood Forest Products in Central Africa; Current research issues and prospects for conservation and development*. Communication à la réunion internationale d'experts sur les produits forestiers non ligneux en Afrique centrale. Limbé, Cameroun.

Sunderland, T.C.H., Tchouto, P. 1999. *A Participatory Survey and Inventory of Timber and Non-Timber Forest Products of the Mokoko River Forest Reserve, SW Province, Cameroon.* A report for IR1/CARPE: African Rattan Research Programme and Mount Cameroon Project.

Sunderland, T.C.H., Dransfield, J. 2002. Rattan (various spp.). Dans: Shanley, P., Pierce, A., Laird, S., Guillen, A. (Eds.), *Tapping the Green Market: Certification and Management of Non-timber Forest Products:* 225-239. Earthscan, Londres.

Sunderland, T.C.H., Besong, S., Ayeni, J.S.O. 2002. *Distribution, Utilization and Sustainability of Non-timber Forest Products from Takamanda Forest Reserve, Cameroon.* Consultancy Report, Protection of the forests around Akwaya (PROFA).

Sunderland, T.C.H., Harrison, S.T., Ndoye, O. 2004. Commercialisation of Non-timber Forest Products in Africa: History, Contexts and Prospects. Dans: Sunderland, T.C.H., Ndoye, O.

(Eds.), *Forest Products, Livelihoods and Conservation: Case Studies of Non-timber Forest Product Systems*, Vol. 2 – Africa: 1-24. CIFOR, Bogor, Indonésie.

Sunderland, T.C.H., Ehringhaus, C., Campbell, B. 2008. Conservation and development in tropical forest landscapes: a time to face the trade-offs? *Environmental Conservation*, 34(4): 276-279.

Sunderland, T.C.H., Sunderland-Groves, J., Shanley, P., Campbell, B. 2009. Bridging the Gap: How Can Information Access and Exchange between Conservation Biologists and Field Practitioners Be Improved for Better Conservation Outcomes. *Biotropica*, 41: 549-554.

Sunderlin, W.D., Pokam, J. 1999. L'impact de la crise économique sur les populations, les migrations et le couvert forestier du Sud Cameroun. Yaoundé, Cameroun.

Sunderlin, D.W., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L., Wunder, S. 2005. Livelihoods, Forests, and Conservation in Developing Countries: An Overview. *World Development*, 33(9): 1383-1402.

T

Tabi, I. 1974. *La théologie des rites Beti.* A.M.A-CENC, Yaoundé.

Tabougue Nguefac, P. 2011. *Évaluation de la faisabilité, de la rentabilité et de l'acceptabilité de la concasseuse de njansang à Epkwassong (Centre Cameroun).* Mémoire de fin d'études. Faculté d'agronomie et des sciences agricoles, Université de Dschang, Cameroun.

Tabuna, H. 1998. The Markets for Central African Non-wood Forest Products in Europe. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Non-Wood Forest Products of Central Africa: Current Research Issues and Prospects for Conservation and Development:* 251-264. FAO, Rome.

Tabuna, H. 1999a. *Le marché des produits forestiers non ligneux de l'Afrique centrale en France et Belgique. Produits, acteurs, circuits de distribution et débouchés actuels.* Occasional paper 19. CIFOR, Jakarta, Indonésie. Disponible en ligne: http://www.cifor.org/publications/pdf_files/OccPapers/OP-19.pdf

Tabuna, H. 1999b. The markets for Central Africa non-wood forest products in Europe. Dans: Sunderland, T.C.H., Clark, L.E., Vantomme, P. (Eds.), *Non-wood forest products of Central Africa: current research issues and prospects for conservation and development:* 251-264. FAO, Rome.

Tabuna, H. 2000a. *Les produits forestiers non ligneux alimentaires de l'Afrique centrale sur les marchés français et belge. Situation actuelle et perspectives.* Thèse de Doctorat du Museum national d'histoire naturelle de Paris.

Tabuna, H. 2000b. *Évaluation des échanges des produits forestiers non ligneux entre l'Afrique subsaharienne et l'Europe.* FAO.

Tabuna, H. 2007a. *Le commerce des produits forestiers non ligneux alimentaires et des produits agricoles traditionnels en Afrique centrale. État actuel et perspectives de développement.*

Tabuna, H. 2007b. *Commerce sous-régional et international des produits forestiers non ligneux alimentaires et des produits agricoles traditionnels en Afrique centrale.* Projet GCP/RAF/398/

GER. FAO, Rome. Disponible en ligne: http://www.fao.org/forestry/14282-0ba3d399e551d7bf09e-855dad1fc55585.pdf

Tabuna, H., Kayitavu, I. 2008. *Diagnostic technique et perspectives de développement des unités de transformation des produits forestiers non ligneux alimentaires au Cameroun et en Afrique centrale.* Working Paper No.70. World Agroforestry Centre-West and Central Africa-Humid Tropic. Yaoundé, Cameroun.

Tailfer, Y. 1990. *La forêt dense d'Afrique centrale. Identification pratique des principaux arbres.* (2 vol.). ACCT, Paris, France.

Takforyan, A. 2001. *Chasse villageoise et gestion locale de la faune sauvage en Afrique. Une étude de cas dans une forêt de l'Est-Cameroun*. Thèse de doctorat, EHESS. Paris, France.

Tanly, L.F. 2011. *Caractérisation morphologique des fruits et germination des graines de Dacryodes macrophylla (Oliv.) Lam. (Burseraceae) provenant de la localité de Boumnyebel.* Mémoire de Master, Université de Yaoundé I.

Tchatat, M., Ndoye, O. 2006. Étude des produits forestiers non ligneux d'Afrique centrale: réalités et perspectives. *Bois et Forêts des Tropiques*, 288(2): 27-39. Disponible en ligne: http://bft.cirad.fr/cd/BFT_289_27-39.pdf

Tcheumetcha, J.M. 2011. *How to set up a cane rat breeding farm (Hedgehog).* Presprint Plc. Limbe.

Tchoundjeu, Z., Weber, J., Guarino, L. 1998. Germplasm collections of endangered agroforestry tree species: The case of *Prosopis africana* in the semi-arid lowlands of West Africa. *Agroforestry Systems*, 39: 91-100.

Tchoundjeu, Z., Asaah E., Anegbeh, P., Degrande, A., Mbile, P., Facheux, C., Tsobeng, A., Atangana, A., Ngo Mpeck, M., Simons, A. 2006. Putting participatory domestication into practice in West and Central Africa. *Forests, trees and livelihoods*, 16: 53-69. Disponible en ligne: http://www.worldagroforestry.org/downloads/Publications/PDFS/ja06003.pdf

Tchoundjeu, Z., Atangana, A. 2006. *Ndjanssang Ricinodendron heudelotii (Baill.).* Southampton Centre for Underutilised Crops, Université de Southampton, Southampton, Royaume-Uni.

Tchoundjeu, Z., Atangana, A., Asaah, E., Tsobeng, A., Facheux, C., Foundjem, D., Mbosso, C., Degrande, A., Sado, T., Kanmegne, J., Mbile, P., Tabuna, H., Anegbeh, P., Useni, M. 2008a. Domestication, Utilization and Marketing of Indigenous Fruit Trees in West and Central Africa. Dans: Akinnifesi *et al.* (Eds.), *Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization:* 171-183. CAB International.

Tchoundjeu, Z., Facheux, C., Degrande, A. 2008b. L'entreprenariat paysan contre la pauvreté au Cameroun. *Dimension*, 3.

Termote, C. 2012. *Wild edible plant use in Tshopo district, Democratic Republic of Congo.* PhD study. Université de Gand, Belgique.

Tessmann, G. 1913. *Die Pangwe* (2 vol.). Berlin (s.n.).

Tchibozo, S., Theeten, F., Mergen, P., Dounias, E., Aberlenc, H., Le Gall, P. 2011. Les insectes comestibles d'Afrique francophone de l'Ouest et du Centre. Livret de vulgarisation. LINCAOCNET.

Ticktin, T. 2004. The ecological implications of harvesting non-timber forest products. *Journal of Applied Ecology*, 41: 11-21.

Ticktin, T., Shackleton, C. 2011. Harvesting Non-timber Forest Products Sustainably: Opportunities and Challenges. Dans: Shackleton, S., Shackleton, C., Shanley, P. (Eds.), *Non-Timber Forest Products in the Global Context*, Tropical Forestry 7.

Tieguhong, J.C. 2009. Field report on bushmeat socio-economics along the Zoulabot-Medoum road axis. Zological Society of London. Wood Wildlife Project, Cameroon Final report.

Tieguhong, J.C., Ndoye, O. 2006. Transforming Subsistence Products to Propellers of Sustainable Rural Development: Non-Timber Forest Products (NTFPs) Production and Trade in Cameroon. African Development Perspectives Yearbook. Dans: Wohlmuth, K., Burger, P., Gutowski, A., Hussain, M.N., Kneduk, T., Meyn, M. (Eds.), *Africa – escaping the primary commodities dilemma:* 107-138. Berlin, Germany, Lit Verlag.

Tieguhong, J.C., Zwolinski, J. 2009. Supplies of bushmeat for livelihoods in logging towns in the Congo Basin. *Journal of Horticulture and Forestry*, 1(5): 065-080.

Tieguhong, J.C., Ndoye, O., Vantomme, P., Zwolinski, J., Masuch, J. 2009. Coping with crisis in Central Africa: enhanced role for non-wood forest products. *Unasylva*, 233(60): 49-54. Disponible en ligne: http://www.fao.org/3/a-i1025e/i1025e10.pdf

Tieguhong, J.C., Mala, W.A., Ndoye, O., Grouwels, S., Useni, K.M., Lagarde Betti, J. 2012. Rural Enterprise Development for Poverty Alleviation Based on Non-wood Forest Products in Central Africa. *International Forestry Review*, 14(3): 363-379.

Tiki-Manga, T., Facheux, C., Mbosso, C., Foundjem Tita, D., Mbile, P., Kuh, E., Mbah, G., Olinga Nkodo, C. 2003. *OUPUT III: Harvest & Post Harvest Technologies*. Annual report Farmer Enterprise Development. Yaoundé, Cameroun.

Timko, J.A., Waeber, P.O., Kozak, R.A. 2010. The socio-economic contribution of non-timber forest products to rural livelihoods in Sub-Saharan Africa: knowledge gaps and new directions. *International Forestry Review*, 12(3): 284-294.

Toirambe, B.B. 2007. *Analyse de l'état des lieux du secteur des produits forestiers non ligneux et évaluation de leur contribution de la sécurité alimentaire en République démocratique du Congo*. Projet FAO GCP/RAF/398/GER, « Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux». Kinshasa, FAO, UICN. Disponible en ligne: ftp://ftp.fao.org/docrep/fao/012/ak325f/ak325f00.pdf

Tonye, J., Duguma, B., Tiki-Manga, T. 1994. Stepwise approach to alley cropping technology development and transfer in the forest zone of Cameroon. *Agroforestry systems*, 28(3): 269-278.

Tovey, H. 2009. Sustainability: a platform for debate. *Sustainability*, 1(1): 14-18. Disponible en ligne: http://www.mdpi.com/2071-1050/1/1/14

Townsend, W. 2000. The sustainability of subsistence hunting by the Siriono Indians of Bolivia. Dans: Robison, J.G., Bennett, E.L. (Eds.), *Hunting for Sustainability in Tropical Forests*. 267-281. Columbia University Press, New York, USA.

TRAFFIC. 2010. TRAFFIC Bulletin Seizures and Prosecutions. March 1997-March 2010. Disponible en ligne: http://www.traffic.org/seizures-archive. Accessed 31 December, 2010.

Trèche, S., Muchnik, J. 1993. Changement technique et alimentation urbaine: identification et diagnostic des systèmes techniques des systèmes techniques de transformation du manioc en chikwangue à Brazzaville. Dans: Muchnik J., *Alimentation, techniques et innovations dans les régions tropicales:* 339-369. L'Harmattan, Paris, France.

Trefon, T. 1994. *City Dwellers and the Central African Tropical Forest: resource use and perceptions.* Commission européenne DG XI, Bruxelles. Disponible en ligne: http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4106/City_Dwellers_and_the_Central_African_Tropical_Forest.pdf?sequence=1

Treillon, R. 1992. *L'innovation technologique dans les pays du Sud: le cas de l'agroalimentaire.* Karthala, Paris, France.

Treillon, R. 1993. Le goût des innovations. Dans: *Alimentation, techniques et innovations dans les régions tropicales:* 497-513. L'Harmattan, Paris, France.

Trilles. 1909. Les légendes de Bene Kanika et le folklore bantou. *Anthropos*, 4.

Tsobeng, A., Asaah, E., Tchoundjeu, Z., Degrande, A., Nkeumoe, F., Takoutsing, B., Tanly, L. Ngaunkam, P. 2012. Domestication of *Pentaclethra macrophylla* Benth.: Phenotypic variation in tree and seed traits in 49 trees from two populations in the humid lowlands of Cameroon. Book of abstracts AFTP International Symposium, 26-28 November 2012, Yaoundé.

U

UN-HABITAT. 2012. *State of the World's Cities 2012/2013: Prosperity of Cities*. Programme des Nations Unies pour les établissements humains. Nairobi.

V

Van Dijk, J.F.W. 1999. *Non-timber forest products in the Bipindi-Akom II Region, Cameroon, Issues for co-management.* Tropenbos-Cameroon Series 4, Tropenbos-Cameroon Programme. Kribi, Cameroun.

Van Dijk, J.F.W., Wiersum, K.F. 1999. Non-timber forest product resources: abundance, distribution, and the impact of timber exploitation. *Sustainable management of African rainforest:* 210-220. Tropenbos. Yaoundé.

Van Eijnatten, J. 2010. *An analysis of the Gnetum spp. value chain from a gender perspective.* SNV, Yaoundé.

Van Germeden, B.S., Olff, H., Parren, P.E., Brongers, F. 2003. The pristine rainforest? Remnants of historical impacts of current tree species composition and diversity. *Journal of Biogeography*, 30: 1381-1390.

Van Noordwijk, M., Hairiah, K., Weise, S. 2001. *Sustainability of Tropical Land-Use Systems Following Forest Conversion*. ICRAF-SEA, Bogor.

Van Parys, J. 2012. *Impact van geleide njangsang-commercialisering op de extractie en het voorkomen van Ricinodendron heudelotii (Baill.) Pierre ex Pax.* Thèse MSc. Faculty of BioScience Engineering, Université de Gand, Belgique.

Van Vliet, N., Nasi, R. 2008. Hunting for livelihood in Northeast Gabon: patterns, evolution and sustainability. *Ecology and Society*, 13(2): 33.

Van Vliet, N., Nebesse, C., Nasi, R. 2010. *The Dynamics of Bushmeat trade in the market of Kisangani, DRC.* XXIII IUFRO Congress, 23 -28 August 2010, Seoul, South Korea.

Van Vliet, N., Nasi, R., Taber, A. 2011. From the Forest to the Stomach: Bushmeat Consumption from Rural to Urban Settings in Central Africa. Dans: Shackleton, S., Mitchell, D., Shackleton, C., Campbell, B., Shanley, P. (Eds.), *Non-timber Forest Products in the Global Context.* Springer, Berlin.

Vasisht, K., Kumar, V. 2004. *Compendium of Medicinal and Aromatic Plants. Volume 1 Africa.* ICS. Trieste, Italie.

Vedeld, P., Angelsen, A., Bojö, J., Sjaastad, E., Kobugabe Berg, G. 2007. Forest environmental incomes and the rural poor. *Forest Policy and Economics*, 9(7): 869-879.

Vermeulen, C., Schippers, C., Ndouna, A.A., Bracke, C., Doucet, J.L. 2009. De nouveaux enjeux sur l'espace: la délimitation des premières forêts communautaires au Gabon. *Revue internationale des sciences biologiques et chimiques*, 3(5): 1171-1181.

Vermeulen, C., Carrière, S. 2001. Stratégies de gestion des ressources naturelles fondées sur les maîtrises foncières coutumières. Dans: Delvingt, W (Ed.), *La forêt des hommes: Terroirs villageois en forêt tropicale Africaine:* 109-144. Presses agronomiques de Gembloux, Gembloux, Belgique.

Vivien, J., Faure, J.J. 1995. *Fruitiers sauvages d'Afrique: Espèces du Cameroun.* Ministère français de la coopération, CTA, Paris, France.

Von Grebmer, K., Ringler, C., Rosegrant, M.W., Olofinbiyi, T., Wiesmann, D., Fritschel, H., Badiane, O., Torero, M., Yohannes, Y., Thompson, J., von Oppeln, C., Rahall, J. 2012. *Indice de la faim dans le monde 2012.* Deutsche Welthungerhilfe, Institut international de recherche sur les politiques alimentaires (IFPRI), Concern Worldwide et ACTED/Convergences 2015 (Eds.), Bonn/Washington, D.C./Dublin/Paris/Milan. Disponible en ligne: http://dx.doi.org/10.2499/9780896299450

W

Walsh, P.D., Abernethy, K.A., Bermejo, M., Beyers, R., De Wachter, P., Ella Akou, M., Huijbregts, B., Idiata Mambounga, D., Kamdem Toham, A., Kilbourn, A.M., Lahm, S.A., Latour, S., Maisels, F., Mbina, C., Mihindou, Y., Ndong Obiang, S., Ntsame Effa, E., Starkey, M.P., Telfer, P., Thibault, M., Tutin, C.E.G., White, L.J.T., Wilkie, D.S. 2003. Catastrophic ape decline in western equatorial Africa. *Nature*, 422: 611-614.

Walter, S. 2001. *Non-Wood Forest Products in Africa: A Regional and National Overview / Les produits forestiers non ligneux en Afrique: un aperçu régional et national.* Working paper/ Document de travail FOPW/01/1. Rome, Commission européenne et FAO. Disponible en ligne: http://www.fao.org/docrep/019/y1515b/y1515b.pdf

Walter, S., Mbala, S.M. 2006. *État des lieux du secteur «Produits Forestiers Non Ligneux» en Afrique centrale et analyse des priorités politiques.* Commission européenne (CE). Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), COMIFAC, Malabo, Guinée équatoriale.

Waruhiu, A.N., Kengue, J., Atangana, A.R., Tchoundjeu, Z., Leakey, R.B. 2004. Domestication of *Dacryodes edulis*. 2. Phenotypic variation of fruit traits in 200 trees from four populations in the humid lowlands of Cameroon. *Foods, Agricultural & Environment*, 2: 340-346.

Wilkie, D.S., Carpenter, J.R. 1999. Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. *Biodiversity and Conservation*, 8: 927-955.

Wilkie, D.S., Hakizumwami, E., Gami, N., Difara, B. 2001. *Beyond Boundaries: Regional Overview of Transboundary Natural Resource Management in Central Africa*. Programme d'appui à la biodiversité. WWF, Washington, D.C.

Willis, K.J., Gillson, L., Brnic, T.M. 2004. How "Virgin" is Virgin Rainforest? *Science*, 304: 402-403.

Wiersum, K.F. 1997a. From natural forest to tree crops, co-domestication of forest and tree species, an overview. *Nethetlands Journal of Agricultural Science*, 45:425-438.

Wiersum, K.F. 1997b. Indigenous exploitation and management of tropical forest resources: An evolutionary continuum in forest-people interactions. *Agriculture Ecosystems & Environment*, 63(1):1-16.

Wong, J.L.G. 2003. *Biometrics and NTFP Inventory.* Bangor School of Agricultural and Forest Sciences, University of Wales. Disponible en ligne: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.527.840&rep=rep1&type=pdf

Wong, J.L.G., Thornber, K., Baker, N. 2001. *Resource Assessment of Non-wood Forest Products: Experience and Biometric Principles.* NWFP Series 13, FAO, Rome.

Y

Yanggen, D. 2010. Role of Alternative Livelihoods in a People-Centred Approach to Conservation. Dans: Yanggen, D., Angu, K., Tchamou, N. (Eds.), *Landscape-Scale Conservation in the Congo Basin. Lessons learned from the Central African Regional Program for the Environment (CARPE):* 127-135. IUCN, Gland, Suisse.

Z

Zapfack, L., Nkongo, M.N. 1999. *A paticipatory survey and inventory of timber and non timber forest products of the Tikar Plain.* Report for LR1/Carpe. Université de Yaoundé et IITA Cameroun, Yaoundé, Cameroun.

Zenker, G. 1893. *Die Umgebung der Yaunde-Station (1890-1892).* Dans: Laburthe Tolra (Ph.), 1970.

Zenker, G. 1895. Yaunde. M.D.S. vol VIII. Dans: Laburthe-Tolra (Ph.), 1970.

Zhang, X., PiKun, H. 1995. Advantages and limitations of slash-and-burn system of agriculture and its countermeasures. Dans: LiYu, X., YuangZhang, Y., JinHui, Q. (Eds.), *Alternatives to Slash-and-Burn Agriculture:* 50-51. Kunmimg: Chine.

Design and layout: Kate Ferrucci

Today, when the age-old balance between man and nature seems to have been disrupted, when food and nutritional security, poverty alleviation and biodiversity and forest resource conservation have become global issues, and when uncontrolled population growth is leading to conflicts over living space and jeopardizing the continued existence of forest ecosystems, the phenomenon of climate change is yet another challenge to the creative genius of forest peoples to preserve and sustainably manage forests and the non-wood forest products (NWFPs) found there. This book pays tribute to the unflagging strength and intelligence of the Bantu, Baka-Bandjeli and Bororo-Wodaabe peoples and, by extension, to all the "lords of the forest" of Central Africa. Over the generations, these peoples have developed a body of knowledge that has enabled them to live and from the forests and their biodiversity, while preserving and enhancing them, even before the introduction of classic food and export crops.

Ministère fédéral
de l'Alimentation, de l'Agriculture et
de la Protection des Consommateurs

ISBN 978-92-5-109489-1 ISSN 1020-3370

I6399EN/1/03.17